ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

1021 North Grand Avenue East, P.O. Box 19276, Springfield, Illinois 62794-9276 • (217)782-3397
JB Pritzker, Governor John J. Kim, Director

MEMORANDUM

DATE: February 21, 2024

TO: Maureen Wozniak, Minesh Patel, Kent Mohr, Ron Robeen and Bill Marr

FROM: Yasmine Keppner-Bauman, Compliance Unit

RE: Proposed Compliance Commitment Agreement from
Koppers Inc
Violation Notice A-2023-00162
I.D. 031300AAJ

COMMENTS DUE TO Compliance Unit BY February 28, 2024

Please find attached a proposed Compliance Commitment Agreement (CCA) received from the facility in response to the above-referenced Violation Notice dated October 4, 2023.

Please provide your recommendations on whether we should send a proposed CCA or reject the proposed terms and send a Notice of Non-Issuance of a CCA.

NOTE: In your response to the Compliance Unit analyst, please indicate the following:

- **If your recommendation is to send a proposed CCA, include whether you believe the company's proposed terms are acceptable and if you have any suggested conditions for the proposed CCA.**

- **If your recommendation is to send a Notice of Non-Issuance of a CCA, include a recommendation for the next action (e.g., NITPL/refer, drop, track, etc.). This information will be discussed at the next CDG meeting.**

Once a decision is reached on the response, the Compliance Unit will either send a proposed CCA or Notice of Non-Issuance of a CCA.

February 12, 2024

Via E-mail and Certified U.S. Mail

Yasmine Keppner-Bauman
Illinois Environmental Protection Agency
Bureau of Air, Compliance Section
1021 North Grand Ave. East
P.O. Box 19276
Springfield, IL 62794-9276
Yasmine.Keppner-Bauman@Illinois.gov

RECEIVED
STATE OF ILLINOIS
FEB 1 5 2024
ENVIRONMENTAL PROTECTION AGENCY
BUREAU OF AIR

Re: Violation Notice A-2023-00162
ID: 031300AAJ

Dear Ms. Keppner-Bauman:

Koppers Inc. ("Koppers") thanks the Illinois Environmental Protection Agency ("IEPA") for virtually meeting on January 22, 2024 to discuss Violation Notice A-2023-00162 and for its consideration of this supplemental, post-meeting response to the Violation Notice.

During our meeting on January 22, 2024, IEPA requested certain, additional information with respect to Koppers' initial response to the Violation Notice. Below, Koppers provides its supplemental response, which should be read in connection with its December 4, 2023 initial response, incorporated herein by reference.

Update on Process Automation Project

Koppers, as discussed in its December 4, 2023 initial response, has recently invested in and commissioned several process control projects at the facility to address safety and air quality issues. These projects, referred to as the process automation project, have been fully commissioned and will result in minimizing many of the self-reported deviations cited in the violation notice.

Koppers, since commissioning the process automation project, has discovered a gap in the project that allows oil to continue to be produced to storage tanks for a short duration after the process has been shut down. This gap in the project resulted in a low-level emission during two events and the events were included in a deviation report to the agency (Attachment Y). Programming required to correct this issue is complete. Testing and full functionality is expected by the end of February.

Explanation of Calculations

IEPA, during our meeting on January 22, 2024, requested that Koppers provide further explanation regarding how the calculations provided in its initial response were performed. Generally, the calculations are performed using equations in USEPA's Emission Inventory Improvement

Program (EIIP) Volume II, Chapter 16 - Methods for Estimating Air Emissions from Chemical Manufacturing Facilities (August 2007) (Attachment U), or derived from the results of inlet control device volatile organic material (VOM) stack testing (Attachments V, W, X).[1] The calculations based on EIIP methodologies are rooted in the ideal gas law, volume displaced in a tank assuming 100% saturation of the headspace, the temperature of the organic liquid, and vapor pressure of the organic liquid. An organic liquid-specific vapor pressure is calculated using a two-point approximation of Antoine constants at the storage temperature. These vapor pressure approximations have been checked with laboratory analysis and compare well. The stack test results are for the inlet to a Thermal Oxidizer and are expressed in pounds of VOM per hour (lb/hr), and the results are multiplied by the duration of the event to arrive at the total VOM emission resulting from the event. In some cases, inlet emissions were not included in the stack testing and inlet emissions were estimated by assuming 98% control and back calculating the inlet emission rate. Using 98% control to estimate the inlet emission rates is an overestimate because the actual control efficiency is greater than 99%.

The following is a more detailed explanation for how emissions resulting from each event were quantified.

Emissions Derived from Stack Test Results

- The emissions reported in response to VN #11 are based on a 2009 stack test. The 2009 Pitch TO stack test shows uncontrolled emissions rate of 3.8 lb/hr from the pitch blending operation. Attachment V.
- The emissions reported in response to VN #13 are based on a 2012 stack test of Tube Heater #2. The 2012 Tube Heater stack test shows uncontrolled emission rate of 65.2 lb/hr from the distillation column. Attachment W.
- The emission reported in response to VN #18 are based on a 2020 stack test. The 2020 stack test of the Naphthalene Plant TO is 2.1 lb/hr assuming 98% VOM control and 0% VOM control for the scrubber. Attachment X.

Emissions Calculated Using Equations in EIIP, Chapter 16

Equations 3-1 and 3-2 (below) are used to calculate displacement of vapor space in a given tank (headspace). The vapor pressure of the material is calculated based on the individual constituents at temperature. For example, in response to VN #1, the partial pressure of 44 compound in creosote, and 21 compounds in naphthalene still residue at temperature were determined and summed to calculate the overall vapor pressure of the material.

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[1] Koppers' December 4, 2023 initial response included Attachments A through Q. The attachments to this supplemental response start with a revised Attachment Q.

Ideal Gas Law: $$E_{n\text{-}i} = \frac{p_i V}{RT}$$ Eq. 3-1

Where $E_{n\text{-}i}$ are the moles of component i that are emitted due to vapor displacement
p_i is the saturated vapor pressure of component i.
V is the displacement volume that was caused by the filling operation.
R is the ideal gas constant in consistent units,
T is the temperature of the liquid being charged

and,

$$p_i = x_i \gamma_i P_i$$ Eq. 3-2

Where p_i = effective vapor pressure for component i
x_i = mole fraction of component i
γ_i = component activity coefficient (Becomes 1.0 when Raoult's Law applies)
P_i = pure component pressure i

Raoult's law is used to determine the vapor pressure of the gas mixture and the Ideal Gas Law is used to calculate the emissions. See Attachment U, Illustration 3-1: Charging a pure solvent to an empty vessel form the EIIP document for an example calculation.

Violation No. 4 – Closed Vent System Data

Koppers provided the closed vent continuous records as Attachment F to its December 4, 2023 initial response. The closed vent continuous records show a 0 or a 1. A value of "0" means that exhaust is aligned with the TO. A value of "1" means that the bypass valve is open and depending on if the process is running or not, emissions are going to the atmosphere. The data historian stores 15-minute average values from data pulled continuously results are a value between 0 and 1. If the process is running and it stores a non-zero value, then it is considered a bypass event.

Violation No. 8 – SO2 Emissions (conversion to lb/hour)

The system continuously measures the SO2 emission rate and the conversion from pounds per month to pounds per hour is based on the operating hours for that day. Daily and monthly averages were provided with Koppers' initial response to minimize the data. If one takes the daily average for a given day and divide by the operating hours for that day, the result is the hourly average. Hourly measured values are provided in Attachment Q.

Violation No. 19 – Process Shutdown Programming

The Naphthalene plant has tanks that are controlled by the Tar TO and everything else is controlled by the Naphthalene TO. The automatic shutdown for the distillation process and the tanks at the Naphthalene plant is active, ensuring compliance with the Startup Shutdown Malfunction (SSM) plan during malfunction events of the Tar TO and/or Naphthalene TO. The HON SSM provisions are still in the applicable rule.

Shutdown of the individual air emission units is done manually. The Naphthalene Distillation Shutdown Checklist and the Tar Acid Washer Column operation work instruction are included in, respectively, Attachments R and T to this letter.

Violation No. 23 – Truck Transfer Rack

As noted in Koppers initial response, the truck transfer rack did not operate during the January 3, and March 23, 2023 events and, therefore, the facility was in compliance with condition 2.3.2.(a)(i)(C) of Construction Permit 14100012. Attachment S includes the material transfer logs for the plant on January 3, 2023 and March 23, 2023 and shows that no truck transfers occurred that would utilize the Naphthalene oxidizer on those dates.

Koppers is hopeful that the foregoing, supplemental information requested by IEPA is helpful to the agency as it considers resolution of the alleged violations. As previously relayed, it remains Koppers's desire to cooperatively participate in the Section 31 enforcement process and, if determined to be necessary, to work with IEPA toward a mutually-acceptable Compliance Commitment Agreement.

Thank you for considering this supplemental response to the Violation Notice. Please contact me at 708-556-9984, or by e-mail HerringLS@koppers.com, if you would like to discuss Koppers response or require any additional information. We look forward to receiving IEPA's written response and working towards a satisfactory resolution of these matters.

Sincerely,

Seth Herring
Plant Manager

Attachments:

Attachment Q: SO2 Emission Data (revised)
Attachment R: Naphthalene Distillation Shutdown Checklist
Attachment S: Pump Sheets
Attachment T: Tar Acid Washer Work Instructions
Attachment U: EIIP Chapter 16 Emission Estimates
Attachment V: Pitch TO 2009 Stack Test
Attachment W: #2 Tube Heater 2012 Stack Test
Attachment X: Naphthalene Plant 2020 Stack Test
Attachment Y: Deviation Reports
Attachment Z: Plot Plan

Attachment Q

SO2 Emissions Data

Response to Violation Notice A-2023-00162

Koppers Inc.

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
01-Aug-22 00:00:00	17.49464692	15.45279365	32.91286235
01-Aug-22 01:00:00	17.51946608	15.21956638	32.74873945
01-Aug-22 02:00:00	17.5389807	15.17110341	32.66868051
01-Aug-22 03:00:00	17.51218605	15.26063995	32.77215788
01-Aug-22 04:00:00	16.53081857	15.32093186	31.83889167
01-Aug-22 05:00:00	16.34121863	15.34494617	31.6681579
01-Aug-22 06:00:00	15.93233199	15.13211937	31.14763122
01-Aug-22 07:00:00	15.93831841	15.63435872	31.54051707
01-Aug-22 08:00:00	15.9374565	16.0503503	31.94273281
01-Aug-22 09:00:00	16.5973418	16.16363373	32.74379116
01-Aug-22 10:00:00	17.11905988	16.14017461	33.239684
01-Aug-22 11:00:00	16.54449187	16.08739255	32.6810929
01-Aug-22 12:00:00	16.52708435	15.24594095	31.842922
01-Aug-22 13:00:00	16.51216253	14.97207664	31.50031492
01-Aug-22 14:00:00	16.45947636	15.05640978	31.52301093
01-Aug-22 15:00:00	16.60659101	15.04236452	31.65783374
01-Aug-22 16:00:00	16.97065904	15.09972783	32.06122197
01-Aug-22 17:00:00	17.15058267	14.9317921	32.13720911
01-Aug-22 18:00:00	17.16570971	15.38540888	32.55933952
01-Aug-22 19:00:00	17.15294329	15.15282962	32.27745713
01-Aug-22 20:00:00	16.99121655	15.12165633	32.14821455
01-Aug-22 21:00:00	16.6751194	15.16022304	31.82964844
01-Aug-22 22:00:00	17.14521662	15.23657046	32.41733805
01-Aug-22 23:00:00	17.19735495	16.10006597	33.32300939
02-Aug-22 00:00:00	17.17794651	15.56490151	32.74649896
02-Aug-22 01:00:00	17.19616403	15.43605912	32.6268567
02-Aug-22 02:00:00	17.15399668	15.39423747	32.53690932
02-Aug-22 03:00:00	17.44781335	15.43739605	32.88187726
02-Aug-22 04:00:00	17.43024572	15.29060904	32.70551092
02-Aug-22 05:00:00	17.43913025	15.11167169	32.58377944
02-Aug-22 06:00:00	17.37801192	15.41560883	32.82011498
02-Aug-22 07:00:00	16.66554578	15.46341313	32.104949
02-Aug-22 08:00:00	16.30276018	15.39905612	31.71968359
02-Aug-22 09:00:00	16.14035183	15.35712491	31.49621169
02-Aug-22 10:00:00	16.14227422	15.40491512	31.51317907
02-Aug-22 11:00:00	16.14258268	15.38251983	31.51823425
02-Aug-22 12:00:00	17.08821705	15.3341767	32.41001119
02-Aug-22 13:00:00	17.36008019	15.32252529	32.65745121
02-Aug-22 14:00:00	17.32787312	15.293368	32.63365364
02-Aug-22 15:00:00	17.25446457	15.55337456	32.79583438
02-Aug-22 16:00:00	17.23804103	15.16092422	32.44429525
02-Aug-22 17:00:00	16.94710604	14.7904466	31.72042327

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
02-Aug-22 18:00:00	16.47356849	14.76973693	31.27365637
02-Aug-22 19:00:00	17.37650797	14.84067726	32.1821573
02-Aug-22 20:00:00	17.62980069	15.11573519	32.63312848
02-Aug-22 21:00:00	17.63101673	15.44815527	33.13030349
02-Aug-22 22:00:00	17.61815951	15.06286828	32.64904234
02-Aug-22 23:00:00	17.17470137	15.06739235	32.21277311
03-Aug-22 00:00:00	17.00788646	15.04364834	32.07423306
03-Aug-22 01:00:00	16.66770448	15.11143037	31.73992787
03-Aug-22 02:00:00	16.67974663	15.73471498	32.40175607
03-Aug-22 03:00:00	16.68289354	16.07347091	32.7079863
03-Aug-22 04:00:00	17.02395746	16.04061571	33.0754618
03-Aug-22 05:00:00	17.44243823	16.04475437	33.49730923
03-Aug-22 06:00:00	17.43182956	16.02411543	33.47735808
03-Aug-22 07:00:00	17.51123799	15.28429906	32.83528427
03-Aug-22 08:00:00	17.52540398	15.34018392	32.87552897
03-Aug-22 09:00:00	17.35967152	15.15720306	32.52840413
03-Aug-22 10:00:00	17.03574573	15.18015297	32.2104223
03-Aug-22 11:00:00	16.48437881	15.17808533	31.61301782
03-Aug-22 12:00:00	16.50748369	15.24116317	31.7352758
03-Aug-22 13:00:00	16.51949925	15.69673787	32.22706106
03-Aug-22 14:00:00	16.51961454	15.06965987	31.64497291
03-Aug-22 15:00:00	17.59694343	15.02446644	32.70515548
03-Aug-22 16:00:00	17.48541005	15.06000264	32.52292024
03-Aug-22 17:00:00	17.6206255	15.33863979	32.9186501
03-Aug-22 18:00:00	17.62279797	16.38178359	34.02344223
03-Aug-22 19:00:00	17.66740322	15.82629686	33.54125807
03-Aug-22 20:00:00	17.13004091	15.7904369	32.92284436
03-Aug-22 21:00:00	16.58145512	15.75381618	32.35289341
03-Aug-22 22:00:00	17.26467917	15.78880013	33.03757456
03-Aug-22 23:00:00	17.24708547	15.47306522	32.74409209
04-Aug-22 00:00:00	17.26596144	15.42738385	32.67658117
04-Aug-22 01:00:00	17.34078047	15.13979836	32.47408773
04-Aug-22 02:00:00	17.27279451	15.18874309	32.45803784
04-Aug-22 03:00:00	17.073692	15.18214273	32.26071792
04-Aug-22 04:00:00	17.03551632	15.23863984	32.31057331
04-Aug-22 05:00:00	17.05843756	15.62763887	32.64938042
04-Aug-22 06:00:00	17.03704845	15.23799377	32.28691408
04-Aug-22 07:00:00	17.25832685	15.13132114	32.42167155
04-Aug-22 08:00:00	17.67491097	15.14069843	32.8166239
04-Aug-22 09:00:00	17.78884072	15.24951424	32.96881266
04-Aug-22 10:00:00	17.82385741	15.69208437	33.50311756
04-Aug-22 11:00:00	17.75690132	15.3575831	33.14653199
04-Aug-22 12:00:00	17.52687205	15.41526734	32.91933674

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
04-Aug-22 13:00:00	16.98875374	15.42028999	32.41178989
04-Aug-22 14:00:00	16.92949147	15.46088668	32.36302604
04-Aug-22 15:00:00	17.04255104	15.36060969	32.40395874
04-Aug-22 16:00:00	17.05160332	15.45988708	32.52955211
04-Aug-22 17:00:00	17.08666293	15.57461539	32.67855899
04-Aug-22 18:00:00	17.89225038	15.59798277	33.4844496
04-Aug-22 19:00:00	17.84441026	15.56348476	33.41450649
04-Aug-22 20:00:00	17.7721547	15.55832121	33.31628948
04-Aug-22 21:00:00	17.8279456	15.94009831	33.69622616
04-Aug-22 22:00:00	17.82572142	16.29673779	34.11567561
04-Aug-22 23:00:00	17.0487732	16.37858009	33.47155565
05-Aug-22 00:00:00	16.95515336	16.36682934	33.35081217
05-Aug-22 01:00:00	16.9414658	16.40837042	33.33952056
05-Aug-22 02:00:00	16.85455545	15.45787387	32.38380559
05-Aug-22 03:00:00	16.87549146	15.54358454	32.38693513
05-Aug-22 04:00:00	17.07262463	15.42284937	32.48964988
05-Aug-22 05:00:00	17.55166043	15.43355589	32.9663673
05-Aug-22 06:00:00	17.33815808	15.43934299	32.70555433
05-Aug-22 07:00:00	17.50059075	15.5066303	33.00481245
05-Aug-22 08:00:00	17.53957854	15.6886404	33.26779931
05-Aug-22 09:00:00	17.52917194	15.68512985	33.19390466
05-Aug-22 10:00:00	17.68962457	15.652938	33.35529168
05-Aug-22 11:00:00	17.75952922	15.66035213	33.43077893
05-Aug-22 12:00:00	17.90551959	15.9683022	33.85519007
05-Aug-22 13:00:00	17.89758594	16.42582427	34.33390872
05-Aug-22 14:00:00	17.91887612	15.92829037	33.8801473
05-Aug-22 15:00:00	17.64213498	15.80765737	33.41045083
05-Aug-22 16:00:00	16.88302983	15.78714664	32.6395891
05-Aug-22 17:00:00	17.00231828	15.79119585	32.78979662
05-Aug-22 18:00:00	17.04339949	15.55019792	32.57811236
05-Aug-22 19:00:00	17.04139021	15.75357109	32.7710459
05-Aug-22 20:00:00	17.30672805	15.4041258	32.70562394
05-Aug-22 21:00:00	17.88137775	15.40398146	33.31093036
05-Aug-22 22:00:00	17.80519772	15.41183924	33.25326029
05-Aug-22 23:00:00	17.64609316	15.65168492	33.36117388
06-Aug-22 00:00:00	17.65032634	15.71250884	33.34077305
06-Aug-22 01:00:00	17.64790895	15.61475976	33.26285595
06-Aug-22 02:00:00	16.87504461	15.5898951	32.41888179
06-Aug-22 03:00:00	16.94511392	15.57610743	32.49622564
06-Aug-22 04:00:00	17.04981316	15.65634438	32.65878338
06-Aug-22 05:00:00	17.05545966	15.80549934	32.87145568
06-Aug-22 06:00:00	17.0942493	15.67493735	32.78370878
06-Aug-22 07:00:00	17.33954006	15.78260083	33.11080495

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
06-Aug-22 08:00:00	17.56540044	15.80540454	33.3190993
06-Aug-22 09:00:00	17.34227753	15.772462	33.11502647
06-Aug-22 10:00:00	17.3915702	15.83165582	33.17827596
06-Aug-22 11:00:00	17.40408696	15.7008442	33.12244299
06-Aug-22 12:00:00	17.42261484	15.93709218	33.36252297
06-Aug-22 13:00:00	17.54611778	15.96773614	33.49885538
06-Aug-22 14:00:00	17.8724042	15.95700034	33.82215788
06-Aug-22 15:00:00	18.26288266	15.75488748	34.02530488
06-Aug-22 16:00:00	18.24395567	16.12726071	34.38979128
06-Aug-22 17:00:00	18.26669619	16.5677021	34.84936714
06-Aug-22 18:00:00	17.76691479	16.50998767	34.30862502
06-Aug-22 19:00:00	17.36024666	16.52431764	33.88833688
06-Aug-22 20:00:00	17.16133086	16.52288453	33.69770495
06-Aug-22 21:00:00	17.17485518	15.5195952	32.69784504
06-Aug-22 22:00:00	17.12461079	15.48563968	32.62803872
06-Aug-22 23:00:00	17.40796365	15.18169657	32.58500523
07-Aug-22 00:00:00	17.91992791	15.17934563	33.076501
07-Aug-22 01:00:00	17.66858302	15.16246255	32.84001435
07-Aug-22 02:00:00	17.60242187	15.58108727	33.21714931
07-Aug-22 03:00:00	17.64436748	15.77728515	33.41463767
07-Aug-22 04:00:00	17.62706969	15.94155709	33.57224486
07-Aug-22 05:00:00	17.2141001	15.96143485	33.14976947
07-Aug-22 06:00:00	16.58402507	15.93153275	32.51819823
07-Aug-22 07:00:00	16.40735213	16.28746457	32.607472
07-Aug-22 08:00:00	16.40380976	16.27598286	32.69594341
07-Aug-22 09:00:00	16.41335106	15.95323451	32.39041154
07-Aug-22 10:00:00	17.36698299	15.95458587	33.30833366
07-Aug-22 11:00:00	17.69562605	15.97502367	33.62091382
07-Aug-22 12:00:00	17.73452176	15.96654377	33.69355795
07-Aug-22 13:00:00	17.78951889	15.51909754	33.32486972
07-Aug-22 14:00:00	17.76722738	15.72991345	33.45264668
07-Aug-22 15:00:00	17.5424348	15.31939793	32.88315092
07-Aug-22 16:00:00	16.73048475	15.33547274	32.02850766
07-Aug-22 17:00:00	17.1041069	15.29354453	32.42312283
07-Aug-22 18:00:00	17.05165577	15.64163526	32.66401613
07-Aug-22 19:00:00	17.04569605	15.69238949	32.74530008
07-Aug-22 20:00:00	17.03927591	15.60904551	32.61129782
07-Aug-22 21:00:00	17.63474719	15.66537417	33.32333099
07-Aug-22 22:00:00	17.478819	15.68517036	33.14831183
07-Aug-22 23:00:00	17.04498068	15.73960028	32.78933737
08-Aug-22 00:00:00	17.04597176	15.36095061	32.42092938
08-Aug-22 01:00:00	17.04069021	15.44706357	32.48658124
08-Aug-22 02:00:00	16.90547911	15.03760176	31.89839264

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
08-Aug-22 03:00:00	17.42999787	15.09146952	32.49751027
08-Aug-22 04:00:00	17.88056829	15.01397146	32.92301899
08-Aug-22 05:00:00	17.99648168	15.59751166	33.6110026
08-Aug-22 06:00:00	17.98901537	15.45593005	33.4618081
08-Aug-22 07:00:00	17.88884396	15.30948321	33.22270881
08-Aug-22 08:00:00	17.44166268	15.27537369	32.76013109
08-Aug-22 09:00:00	17.19389407	15.31662413	32.50304604
08-Aug-22 10:00:00	17.15679063	15.74835144	32.85013735
08-Aug-22 11:00:00	17.15635236	16.34981177	33.50474103
08-Aug-22 12:00:00	17.14127064	16.27374501	33.47014999
08-Aug-22 13:00:00	17.56127856	16.01062997	33.59764456
08-Aug-22 14:00:00	17.68786706	16.01985435	33.72429042
08-Aug-22 15:00:00	17.52500206	16.01076116	33.52931439
08-Aug-22 16:00:00	17.53270647	15.40878235	32.94984101
08-Aug-22 17:00:00	17.5697945	15.5866979	33.13563217
08-Aug-22 18:00:00	17.42052364	15.56950045	32.97304282
08-Aug-22 19:00:00	17.09107018	15.57271068	32.68934197
08-Aug-22 20:00:00	16.53178003	15.56449836	32.11341604
08-Aug-22 21:00:00	16.40446536	15.66166492	32.05120076
08-Aug-22 22:00:00	16.41374535	15.66222005	32.0772935
08-Aug-22 23:00:00	16.51128642	15.58626533	32.07791996
09-Aug-22 00:00:00	17.89672947	15.57335448	33.50917011
09-Aug-22 01:00:00	17.77784443	15.5631965	33.33193843
09-Aug-22 02:00:00	17.79767577	15.96619235	33.72106941
09-Aug-22 03:00:00	17.7930016	16.00519542	33.79684046
09-Aug-22 04:00:00	17.80155192	15.56208081	33.36835273
09-Aug-22 05:00:00	17.10003228	15.2928324	32.42176882
09-Aug-22 06:00:00	16.57963652	15.31666465	31.89694076
09-Aug-22 07:00:00	16.71740384	15.32538843	32.0393024
09-Aug-22 08:00:00	16.69743231	15.546103	32.26656384
09-Aug-22 09:00:00	16.62200133	15.80628082	32.4109088
09-Aug-22 10:00:00	17.06932078	15.66972685	32.72882801
09-Aug-22 11:00:00	17.73338922	15.66464496	33.40002759
09-Aug-22 12:00:00	17.64744547	15.70826956	33.34149869
09-Aug-22 13:00:00	17.64473279	15.86904689	33.45263676
09-Aug-22 14:00:00	17.62977837	15.62929967	33.25483237
09-Aug-22 15:00:00	17.63467725	16.13158692	33.80110847
09-Aug-22 16:00:00	16.77470069	16.12337341	32.90231599
09-Aug-22 17:00:00	17.31387266	16.13458409	33.43544685
09-Aug-22 18:00:00	17.04184543	16.04484902	33.0961789
09-Aug-22 19:00:00	17.05015034	15.4633541	32.54394446
09-Aug-22 20:00:00	17.05313502	15.58439644	32.69886193
09-Aug-22 21:00:00	17.23381138	15.39909423	32.61153633

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
09-Aug-22 22:00:00	17.34082614	15.42822533	32.78391414
09-Aug-22 23:00:00	16.89749029	15.39968804	32.33383645
10-Aug-22 00:00:00	16.87323157	15.87980615	32.77801387
10-Aug-22 01:00:00	16.86123392	15.80361938	32.64610587
10-Aug-22 02:00:00	16.89303518	15.70864677	32.5999195
10-Aug-22 03:00:00	17.54631869	15.67022597	33.25343895
10-Aug-22 04:00:00	17.60808182	15.70089409	33.2958302
10-Aug-22 05:00:00	17.78368674	16.1478352	33.90817127
10-Aug-22 06:00:00	17.79719957	16.49728706	34.33574729
10-Aug-22 07:00:00	17.79303046	16.59062237	34.37936242
10-Aug-22 08:00:00	17.53763199	16.49192167	34.04337417
10-Aug-22 09:00:00	17.11373054	16.47725854	33.59748099
10-Aug-22 10:00:00	17.79385302	16.43699581	34.21970071
10-Aug-22 11:00:00	17.7978896	15.46044558	33.24886894
10-Aug-22 12:00:00	17.81507497	15.72693226	33.55118285
10-Aug-22 13:00:00	17.79769601	15.41638565	33.21718746
10-Aug-22 14:00:00	17.6718341	15.42974597	33.10041046
10-Aug-22 15:00:00	17.88987901	15.38020593	33.31369739
10-Aug-22 16:00:00	17.90474606	15.7717434	33.67489771
10-Aug-22 17:00:00	17.8946921	15.76211452	33.66582595
10-Aug-22 18:00:00	17.85452186	15.77635034	33.62240664
10-Aug-22 19:00:00	17.02248542	15.80434261	32.81947772
10-Aug-22 20:00:00	16.73459816	15.78524719	32.52843751
10-Aug-22 21:00:00	16.51829758	15.8176245	32.38210035
10-Aug-22 22:00:00	16.51266718	15.5719755	32.12545119
10-Aug-22 23:00:00	16.50427659	15.6131101	32.0817158
11-Aug-22 00:00:00	17.43902546	15.54265998	32.99975904
11-Aug-22 01:00:00	17.73133098	15.59485917	33.31288147
11-Aug-22 02:00:00	18.14424917	15.56776046	33.7190272
11-Aug-22 03:00:00	18.20010259	15.65445466	33.85371399
11-Aug-22 04:00:00	18.16570971	15.71967464	33.86537933
11-Aug-22 05:00:00	17.7162572	15.91318719	33.64444796
11-Aug-22 06:00:00	16.70455064	15.95581255	32.64356853
11-Aug-22 07:00:00	16.83768066	15.93324041	32.76279174
11-Aug-22 08:00:00	17.03340483	15.95047287	33.01568858
11-Aug-22 09:00:00	17.05561998	16.33613904	33.34655094
11-Aug-22 10:00:00	17.08866045	16.66156838	33.78018061
11-Aug-22 11:00:00	17.77281655	16.65609516	34.44013596
11-Aug-22 12:00:00	17.68883144	16.64601771	34.35993958
11-Aug-22 13:00:00	17.62142234	16.25360037	33.91900656
11-Aug-22 14:00:00	17.6220648	15.5876361	33.21154658
11-Aug-22 15:00:00	17.61984401	15.75261259	33.39393149
11-Aug-22 16:00:00	16.85715532	15.93428755	32.80539555

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
11-Aug-22 17:00:00	16.98164897	15.9034103	32.91418429
11-Aug-22 18:00:00	17.20216073	15.94846668	33.12185987
11-Aug-22 19:00:00	17.2345846	15.80206701	33.04557631
11-Aug-22 20:00:00	17.23369821	15.57475374	32.78446741
11-Aug-22 21:00:00	17.32221307	15.69816783	33.00961266
11-Aug-22 22:00:00	17.54771932	15.69825033	33.26342392
11-Aug-22 23:00:00	17.34896172	15.65811838	33.00110563
12-Aug-22 00:00:00	17.61775716	16.20001296	33.77428695
12-Aug-22 01:00:00	17.63839149	15.92005237	33.5825439
12-Aug-22 02:00:00	17.64076784	15.72545687	33.37954267
12-Aug-22 03:00:00	17.41282982	15.63524223	33.08893373
12-Aug-22 04:00:00	17.6127793	15.68094902	33.29649353
12-Aug-22 05:00:00	17.9238135	15.62441688	33.52368779
12-Aug-22 06:00:00	17.92675961	15.49046077	33.43375058
12-Aug-22 07:00:00	17.93645498	15.47663111	33.40326087
12-Aug-22 08:00:00	17.64918751	15.60078987	33.25028377
12-Aug-22 09:00:00	17.00008848	15.58150067	32.56257545
12-Aug-22 10:00:00	17.23407544	15.55770508	32.81996165
12-Aug-22 11:00:00	17.24626255	15.69402099	32.9442304
12-Aug-22 12:00:00	17.26052199	15.72599008	32.96293916
12-Aug-22 13:00:00	17.38158809	16.29628736	33.66813374
12-Aug-22 14:00:00	17.69219102	16.28657722	33.98238076
12-Aug-22 15:00:00	17.79632653	16.27226759	34.10179944
12-Aug-22 16:00:00	17.63612493	15.91955047	33.53035436
12-Aug-22 17:00:00	17.67798646	15.50459184	33.19170079
12-Aug-22 18:00:00	17.63526784	15.75756529	33.39851591
12-Aug-22 19:00:00	17.22434001	15.68261375	32.84831708
12-Aug-22 20:00:00	16.8444447	15.67562834	32.51828501
12-Aug-22 21:00:00	16.41526551	15.61343988	32.08714097
12-Aug-22 22:00:00	16.39037153	15.84529174	32.25512653
12-Aug-22 23:00:00	16.42658011	15.80912569	32.19569344
13-Aug-22 00:00:00	16.99446275	16.06632857	33.04496944
13-Aug-22 01:00:00	17.83880499	16.06109513	33.87414106
13-Aug-22 02:00:00	17.62439537	16.01187146	33.662894
13-Aug-22 03:00:00	17.49497837	16.57708739	34.00666089
13-Aug-22 04:00:00	17.51162455	16.58308174	34.11196073
13-Aug-22 05:00:00	17.48814297	16.83876228	34.35453508
13-Aug-22 06:00:00	16.92160161	16.89791701	33.79108514
13-Aug-22 07:00:00	16.69855107	16.88178186	33.55470551
13-Aug-22 08:00:00	16.78237968	16.35886033	33.12822109
13-Aug-22 09:00:00	16.76216539	15.7044966	32.50347159
13-Aug-22 10:00:00	16.77546755	15.59934156	32.3656708
13-Aug-22 11:00:00	17.51560243	15.63369093	33.18479178

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
13-Aug-22 12:00:00	17.62990485	15.68452794	33.30620547
13-Aug-22 13:00:00	17.07040755	15.73264583	32.71710851
13-Aug-22 14:00:00	17.09736347	16.09289159	33.19583278
13-Aug-22 15:00:00	17.04965835	15.92475658	32.94749599
13-Aug-22 16:00:00	16.85175027	16.02712154	32.90379345
13-Aug-22 17:00:00	16.58962631	16.01128419	32.58393584
13-Aug-22 18:00:00	16.78772248	16.06546709	32.8405535
13-Aug-22 19:00:00	16.77189816	15.96581784	32.72923296
13-Aug-22 20:00:00	16.78266896	15.64726713	32.42251555
13-Aug-22 21:00:00	16.78775978	15.88067118	32.69312159
13-Aug-22 22:00:00	17.54965348	15.8468882	33.43790372
13-Aug-22 23:00:00	17.26452181	15.91738033	33.17739508
14-Aug-22 00:00:00	17.26583841	15.6921615	32.99985059
14-Aug-22 01:00:00	17.26187303	15.75774389	32.99059465
14-Aug-22 02:00:00	17.27764681	15.61691549	32.89232593
14-Aug-22 03:00:00	17.09659894	15.77406732	32.88299942
14-Aug-22 04:00:00	17.4006069	15.78231024	33.16133409
14-Aug-22 05:00:00	17.78305626	15.73782836	33.52444119
14-Aug-22 06:00:00	17.78892973	15.98707722	33.77232636
14-Aug-22 07:00:00	17.76454936	16.61697049	34.37164836
14-Aug-22 08:00:00	17.69252544	16.85951609	34.5654655
14-Aug-22 09:00:00	17.36272505	16.84609198	34.21380234
14-Aug-22 10:00:00	17.26185724	16.83941912	34.0804757
14-Aug-22 11:00:00	17.05224546	16.15119057	33.18814331
14-Aug-22 12:00:00	17.04241085	15.68496762	32.73837217
14-Aug-22 13:00:00	17.04575994	15.57946645	32.61650446
14-Aug-22 14:00:00	17.53543875	15.65628877	33.18618711
14-Aug-22 15:00:00	17.76536475	15.66224317	33.41619756
14-Aug-22 16:00:00	17.64115636	15.68055787	33.31731139
14-Aug-22 17:00:00	17.61365859	15.72863022	33.33184581
14-Aug-22 18:00:00	17.62760374	15.88177808	33.50473722
14-Aug-22 19:00:00	17.34559303	16.00984195	33.38030222
14-Aug-22 20:00:00	16.99288644	16.03955348	33.02532154
14-Aug-22 21:00:00	16.71699969	16.00087837	32.72776858
14-Aug-22 22:00:00	16.75694678	16.34723165	33.13420063
14-Aug-22 23:00:00	16.77474181	16.0392438	32.81148783
15-Aug-22 00:00:00	16.95649878	16.10664792	33.07275299
15-Aug-22 01:00:00	17.94404009	16.13355846	34.06338353
15-Aug-22 02:00:00	17.69944975	16.15224902	33.83313031
15-Aug-22 03:00:00	17.80052662	15.73704511	33.58082199
15-Aug-22 04:00:00	17.78437244	15.68827173	33.46490521
15-Aug-22 05:00:00	17.78465554	15.63750034	33.43718903
15-Aug-22 06:00:00	17.13726881	15.76852911	32.91836887

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
15-Aug-22 07:00:00	16.78648037	15.74452759	32.54546769
15-Aug-22 08:00:00	17.07479615	15.73233986	32.78594992
15-Aug-22 09:00:00	17.03548453	15.63618314	32.70900281
15-Aug-22 10:00:00	17.08567047	15.97419373	33.01895354
15-Aug-22 11:00:00	17.51359855	16.61480967	34.14439256
15-Aug-22 12:00:00	17.64929655	16.67151978	34.2702268
15-Aug-22 13:00:00	17.31900989	16.63117171	33.93442684
15-Aug-22 14:00:00	17.26111857	15.7815884	33.06890572
15-Aug-22 15:00:00	17.26711633	15.57477077	32.89096557
15-Aug-22 16:00:00	17.23870065	15.54066859	32.81303109
15-Aug-22 17:00:00	17.03916105	15.58840465	32.60349666
15-Aug-22 18:00:00	17.6276438	15.58453149	33.19876374
15-Aug-22 19:00:00	17.63176335	15.53584604	33.17507553
15-Aug-22 20:00:00	17.64757601	15.79201831	33.42780707
15-Aug-22 21:00:00	17.64494769	15.90251901	33.58554607
15-Aug-22 22:00:00	17.57726701	16.03581023	33.62528419
15-Aug-22 23:00:00	17.31821717	15.99631961	33.33429994
16-Aug-22 00:00:00	17.0858505	16.02172764	33.12132454
16-Aug-22 01:00:00	17.08972051	16.79988666	33.88585763
16-Aug-22 02:00:00	17.02914429	16.47284264	33.54367023
16-Aug-22 03:00:00	17.24752087	16.64799738	33.90666517
16-Aug-22 04:00:00	17.68892935	16.6328911	34.33600133
16-Aug-22 05:00:00	18.15340201	16.66727247	34.80350516
16-Aug-22 06:00:00	18.2692372	15.91320241	34.19123847
16-Aug-22 07:00:00	18.25846503	15.76432074	34.00032531
16-Aug-22 08:00:00	18.26635965	15.29764303	33.60442929
16-Aug-22 09:00:00	17.28738054	15.2732605	32.5599236
16-Aug-22 10:00:00	17.03334543	15.28327751	32.333646
16-Aug-22 11:00:00	16.50392214	15.44478447	31.92048518
16-Aug-22 12:00:00	16.52520646	15.87640275	32.4083483
16-Aug-22 13:00:00	16.52726597	15.88697502	32.3463192
16-Aug-22 14:00:00	17.22612303	15.88797433	33.15929837
16-Aug-22 15:00:00	17.82643456	15.89588376	33.73988472
16-Aug-22 16:00:00	17.26561716	15.86350022	33.17394903
16-Aug-22 17:00:00	17.22760815	15.84602012	33.10934173
16-Aug-22 18:00:00	17.25851557	15.79750013	33.03869671
16-Aug-22 19:00:00	17.09450227	15.39674121	32.50431658
16-Aug-22 20:00:00	16.49251885	15.40248957	31.87805229
16-Aug-22 21:00:00	16.25843101	15.4093792	31.65478918
16-Aug-22 22:00:00	16.40738614	15.50990831	32.0077116
16-Aug-22 23:00:00	16.37466883	15.65279201	32.01897545
17-Aug-22 00:00:00	16.40420299	15.42766327	31.87792619
17-Aug-22 01:00:00	17.44130622	15.4202441	32.83432833

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
17-Aug-22 02:00:00	17.26691628	15.40932366	32.67970445
17-Aug-22 03:00:00	17.26196914	15.46625929	32.72620413
17-Aug-22 04:00:00	17.27784326	16.46764688	33.71119351
17-Aug-22 05:00:00	17.28649235	16.50850883	33.82786984
17-Aug-22 06:00:00	17.29880757	16.6377814	33.86463441
17-Aug-22 07:00:00	17.24995444	16.74906858	33.96771674
17-Aug-22 08:00:00	17.23565536	16.77875424	33.9806669
17-Aug-22 09:00:00	17.27388509	16.7458939	33.99652163
17-Aug-22 10:00:00	17.27535412	17.37707802	34.49861957
17-Aug-22 11:00:00	17.92717118	18.8279527	36.75364155
17-Aug-22 12:00:00	17.8018376	18.85855415	36.64255987
17-Aug-22 13:00:00	17.80391026	18.82262527	36.64072369
17-Aug-22 14:00:00	17.81049644	18.8218547	36.64304959
17-Aug-22 15:00:00	17.79220083	18.77113959	36.58646562
17-Aug-22 16:00:00	17.84895828	18.74009154	36.60268392
17-Aug-22 17:00:00	17.87045246	16.71048737	34.59374852
17-Aug-22 18:00:00	17.90235625	17.13834685	35.03771803
17-Aug-22 19:00:00	17.89164607	17.21447957	35.11470538
17-Aug-22 20:00:00	17.92881616	17.23124213	35.15231069
17-Aug-22 21:00:00	17.31373586	17.25985702	34.54736858
17-Aug-22 22:00:00	17.146309	16.23137389	33.47591019
17-Aug-22 23:00:00	17.14115079	15.91993459	33.04475254
18-Aug-22 00:00:00	17.14706993	16.29044172	33.42058012
18-Aug-22 01:00:00	16.75787343	16.2689675	33.0542575
18-Aug-22 02:00:00	16.62738853	16.28893166	32.91594505
18-Aug-22 03:00:00	16.88400184	16.22355366	33.09980249
18-Aug-22 04:00:00	16.89261723	15.96060419	32.87193701
18-Aug-22 05:00:00	16.89131652	15.98220594	32.90197464
18-Aug-22 06:00:00	17.49307028	15.91820125	33.39946069
18-Aug-22 07:00:00	17.47476493	15.92312924	33.37310833
18-Aug-22 08:00:00	17.75215435	15.94972524	33.66429736
18-Aug-22 09:00:00	17.81370751	16.71574288	34.51874648
18-Aug-22 10:00:00	17.78839408	16.17250065	33.97141647
18-Aug-22 11:00:00	17.48609278	15.29796305	32.77650296
18-Aug-22 12:00:00	16.60104222	15.27937284	31.90572982
18-Aug-22 13:00:00	17.28380299	15.27916183	32.57272996
18-Aug-22 14:00:00	17.40353266	15.70883097	33.10148606
18-Aug-22 15:00:00	17.41642168	15.82472091	33.25390455
18-Aug-22 16:00:00	17.40614043	15.80574915	33.23910925
18-Aug-22 17:00:00	17.51844978	15.76602745	33.28471375
18-Aug-22 18:00:00	17.24318377	15.78757266	33.00730334
18-Aug-22 19:00:00	17.05707603	15.9291323	32.95931227
18-Aug-22 20:00:00	17.03189426	15.81359673	32.83277819

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
18-Aug-22 21:00:00	17.04149458	16.27902015	33.31185881
18-Aug-22 22:00:00	16.95622306	16.45502261	33.4022043
18-Aug-22 23:00:00	17.42141872	16.50204958	33.91498481
19-Aug-22 00:00:00	17.59658305	16.51405229	34.0943381
19-Aug-22 01:00:00	17.52482351	15.85445148	33.42975659
19-Aug-22 02:00:00	17.57366053	15.79142096	33.37665198
19-Aug-22 03:00:00	17.44899559	15.77454554	33.25864071
19-Aug-22 04:00:00	17.16283078	15.77335295	32.95310052
19-Aug-22 05:00:00	17.18277264	15.78268156	32.93766806
19-Aug-22 06:00:00	17.23958863	15.94145894	33.18506412
19-Aug-22 07:00:00	17.28610833	15.83470334	33.15444162
19-Aug-22 08:00:00	17.25230747	15.77084668	33.02892097
19-Aug-22 09:00:00	17.50074577	15.80716261	33.32785005
19-Aug-22 10:00:00	17.81885115	15.76781123	33.581842
19-Aug-22 11:00:00	17.60689121	15.85642889	33.44915136
19-Aug-22 12:00:00	17.62970236	16.69944827	34.38454882
19-Aug-22 13:00:00	17.63531457	16.43698921	34.1006948
19-Aug-22 14:00:00	17.44867484	16.0267334	33.4762552
19-Aug-22 15:00:00	17.13007885	16.03612315	33.17829959
19-Aug-22 16:00:00	16.7229609	16.0534083	32.74690225
19-Aug-22 17:00:00	16.70407613	15.94894465	32.66875154
19-Aug-22 18:00:00	16.60908222	15.87780568	32.44480038
19-Aug-22 19:00:00	16.7575869	16.03219096	32.77550422
19-Aug-22 20:00:00	17.76949925	16.02052556	33.82416322
19-Aug-22 21:00:00	17.6388997	16.05151783	33.68702793
19-Aug-22 22:00:00	17.63032246	16.14644581	33.77177014
19-Aug-22 23:00:00	17.64979013	15.79975637	33.48883099
20-Aug-22 00:00:00	17.6542253	15.954916	33.6231895
20-Aug-22 01:00:00	17.21877437	15.76756382	32.98982875
20-Aug-22 02:00:00	16.75266234	15.77183219	32.53519588
20-Aug-22 03:00:00	16.89440674	15.783804	32.65572527
20-Aug-22 04:00:00	16.89307965	15.88338592	32.8122779
20-Aug-22 05:00:00	16.89896329	15.8032008	32.6813274
20-Aug-22 06:00:00	17.19089423	15.79211146	32.97566499
20-Aug-22 07:00:00	17.60066128	15.75901201	33.37303755
20-Aug-22 08:00:00	17.50264125	15.75430756	33.26244121
20-Aug-22 09:00:00	17.3906054	16.03551128	33.42375387
20-Aug-22 10:00:00	17.4202262	15.91186746	33.29163784
20-Aug-22 11:00:00	17.39822833	16.18698223	33.6157127
20-Aug-22 12:00:00	16.67306349	16.12414988	32.79777972
20-Aug-22 13:00:00	16.84169557	16.12558772	32.98093181
20-Aug-22 14:00:00	16.89923781	16.32862261	33.25057581
20-Aug-22 15:00:00	16.88646184	16.7525668	33.59591844

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
20-Aug-22 16:00:00	16.87070285	16.85432226	33.74643241
20-Aug-22 17:00:00	17.29220025	17.00766068	34.31136054
20-Aug-22 18:00:00	17.34591187	17.02122498	34.37759378
20-Aug-22 19:00:00	17.28244803	17.01731555	34.30340174
20-Aug-22 20:00:00	17.26051712	15.90730045	33.31219037
20-Aug-22 21:00:00	17.25176303	15.95771683	33.16913654
20-Aug-22 22:00:00	17.27365303	16.32394727	33.59709295
20-Aug-22 23:00:00	17.43409432	16.30515104	33.75498226
21-Aug-22 00:00:00	17.93538666	16.29785513	34.22827254
21-Aug-22 01:00:00	18.25543255	16.27008509	34.5332506
21-Aug-22 02:00:00	18.27122243	15.97608854	34.20723597
21-Aug-22 03:00:00	18.27531023	16.0655236	34.37393591
21-Aug-22 04:00:00	17.3434844	16.04525855	33.39338366
21-Aug-22 05:00:00	17.17078389	16.03824923	33.21548573
21-Aug-22 06:00:00	17.16025872	16.20979572	33.34077517
21-Aug-22 07:00:00	17.15005493	16.04832655	33.23759185
21-Aug-22 08:00:00	17.14895937	16.05872062	33.20257971
21-Aug-22 09:00:00	17.49779733	16.15443071	33.65636741
21-Aug-22 10:00:00	17.88036013	16.16160951	34.01411445
21-Aug-22 11:00:00	17.59784646	16.17404532	33.71640799
21-Aug-22 12:00:00	17.6302886	16.12284728	33.77543054
21-Aug-22 13:00:00	17.66204177	16.04111799	33.68024105
21-Aug-22 14:00:00	17.48273472	16.55221195	33.99564383
21-Aug-22 15:00:00	16.85213852	16.48667805	33.3434177
21-Aug-22 16:00:00	16.71930493	16.48555478	33.20411873
21-Aug-22 17:00:00	17.03594515	16.30518277	33.29884248
21-Aug-22 18:00:00	17.05995878	16.47943105	33.57622994
21-Aug-22 19:00:00	17.05420929	17.17799579	34.24418753
21-Aug-22 20:00:00	17.67345743	17.22064999	34.88908005
21-Aug-22 21:00:00	17.42219586	17.23327404	34.65725093
21-Aug-22 22:00:00	17.96753152	17.06488021	35.11073897
21-Aug-22 23:00:00	18.0029601	15.81380101	33.8457222
22-Aug-22 00:00:00	18.01100406	15.73638484	33.76858314
22-Aug-22 01:00:00	17.62410047	15.80837088	33.41330253
22-Aug-22 02:00:00	17.22658337	15.79006185	33.00458188
22-Aug-22 03:00:00	17.64721595	15.78055296	33.44822333
22-Aug-22 04:00:00	17.62672202	15.9892727	33.62135866
22-Aug-22 05:00:00	17.63160589	15.91501718	33.55509652
22-Aug-22 06:00:00	17.60247453	16.26880905	33.86475733
22-Aug-22 07:00:00	17.26892376	16.32849535	33.56038599
22-Aug-22 08:00:00	17.14121511	16.2754129	33.41980913
22-Aug-22 09:00:00	17.05474959	16.56724633	33.63414531
22-Aug-22 10:00:00	17.0596714	16.23869514	33.32329877

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
22-Aug-22 11:00:00	17.04738405	16.33254652	33.35432074
22-Aug-22 12:00:00	17.43784036	16.37863979	33.82587157
22-Aug-22 13:00:00	17.81357596	16.41542196	34.20486503
22-Aug-22 14:00:00	17.97222233	16.39234977	34.38889567
22-Aug-22 15:00:00	18.01808728	15.85127624	33.93272569
22-Aug-22 16:00:00	18.00484297	16.03919649	34.00772773
22-Aug-22 17:00:00	17.67621009	16.41628848	34.07908242
22-Aug-22 18:00:00	16.78772004	16.42077351	33.18912224
22-Aug-22 19:00:00	17.01599418	16.39144492	33.41965527
22-Aug-22 20:00:00	17.39969985	16.16676802	33.54122755
22-Aug-22 21:00:00	17.42126846	16.07948226	33.51570935
22-Aug-22 22:00:00	17.40335263	17.01380041	34.40361214
22-Aug-22 23:00:00	17.81322426	17.01110219	34.83563932
23-Aug-22 00:00:00	17.73515458	17.02406313	34.75419935
23-Aug-22 01:00:00	17.63062053	16.75170256	34.45616327
23-Aug-22 02:00:00	17.63167042	15.67295841	33.25114886
23-Aug-22 03:00:00	17.62407499	16.0599716	33.64658462
23-Aug-22 04:00:00	17.35775185	16.16052506	33.46664988
23-Aug-22 05:00:00	17.70314333	16.14456688	33.83319431
23-Aug-22 06:00:00	17.48598311	16.17889883	33.63409593
23-Aug-22 07:00:00	17.52429072	15.92612404	33.46105676
23-Aug-22 08:00:00	17.5327673	15.94006591	33.45003107
23-Aug-22 09:00:00	17.45169332	15.95535019	33.40061675
23-Aug-22 10:00:00	17.21200307	15.95597412	33.15883965
23-Aug-22 11:00:00	16.96847513	15.93639514	32.90056319
23-Aug-22 12:00:00	16.88411215	16.46293441	33.25846926
23-Aug-22 13:00:00	16.88437557	16.47567209	33.41125707
23-Aug-22 14:00:00	16.89564122	16.37672647	33.27498648
23-Aug-22 15:00:00	17.81226815	16.39951897	34.22684542
23-Aug-22 16:00:00	17.8039252	16.43656858	34.25173632
23-Aug-22 17:00:00	18.26839606	16.25558403	34.58968735
23-Aug-22 18:00:00	18.27443006	15.92646371	34.20507488
23-Aug-22 19:00:00	18.26326413	16.0557068	34.27300368
23-Aug-22 20:00:00	17.64437787	16.2889534	33.94759878
23-Aug-22 21:00:00	16.66063351	16.3342918	32.97552617
23-Aug-22 22:00:00	17.08124352	16.233978	33.38311895
23-Aug-22 23:00:00	17.08751445	16.18223839	33.28271202
24-Aug-22 00:00:00	17.04711352	15.84815245	32.86249415
24-Aug-22 01:00:00	17.11832078	16.67601596	33.77549987
24-Aug-22 02:00:00	17.55845812	16.62748816	34.19349225
24-Aug-22 03:00:00	17.28536712	16.67198835	33.95449405
24-Aug-22 04:00:00	17.03137599	16.23294671	33.31277127
24-Aug-22 05:00:00	17.07849089	15.93559053	33.01811882

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
24-Aug-22 06:00:00	17.03287082	15.97206767	32.97752518
24-Aug-22 07:00:00	17.2929537	15.94326816	33.24416118
24-Aug-22 08:00:00	17.71617141	15.92746782	33.60771624
24-Aug-22 09:00:00	17.79667197	15.93795418	33.73262748
24-Aug-22 10:00:00	17.8059756	16.04817571	33.85372882
24-Aug-22 11:00:00	17.77974362	15.98142813	33.74057494
24-Aug-22 12:00:00	17.57204681	16.1521328	33.73192353
24-Aug-22 13:00:00	17.1361085	16.12854179	33.27874544
24-Aug-22 14:00:00	17.07310274	16.10049499	33.19933754
24-Aug-22 15:00:00	17.02182452	16.75995784	33.75812446
24-Aug-22 16:00:00	17.03673172	16.64259832	33.624387
24-Aug-22 17:00:00	17.04444175	16.76711538	33.84177272
24-Aug-22 18:00:00	17.90205786	16.7625138	34.67107815
24-Aug-22 19:00:00	18.03857422	16.7774056	34.8254528
24-Aug-22 20:00:00	17.77245564	16.36782111	34.18268416
24-Aug-22 21:00:00	17.80222321	15.81731367	33.64249886
24-Aug-22 22:00:00	17.78758897	15.66738388	33.46742333
24-Aug-22 23:00:00	17.18003146	15.77624285	32.96125319
25-Aug-22 00:00:00	16.97527366	15.76978249	32.73862818
25-Aug-22 01:00:00	16.86750285	15.78996658	32.62882106
25-Aug-22 02:00:00	16.89269617	15.8880241	32.81201358
25-Aug-22 03:00:00	16.89428849	15.79293961	32.67078506
25-Aug-22 04:00:00	17.09773498	16.05231171	33.12989807
25-Aug-22 05:00:00	17.53932031	16.06336212	33.55655458
25-Aug-22 06:00:00	17.23158285	16.04048732	33.25519618
25-Aug-22 07:00:00	17.40266101	15.95943772	33.35104741
25-Aug-22 08:00:00	17.43593407	15.63395283	33.09733823
25-Aug-22 09:00:00	17.40738233	15.74725186	33.15342458
25-Aug-22 10:00:00	17.5725352	15.78463236	33.34742567
25-Aug-22 11:00:00	17.70580525	15.73761837	33.48196559
25-Aug-22 12:00:00	17.79289892	15.81945605	33.55084031
25-Aug-22 13:00:00	17.79821841	15.85306623	33.67587676
25-Aug-22 14:00:00	17.78605556	15.73163388	33.47888364
25-Aug-22 15:00:00	17.52508301	16.05286293	33.60211829
25-Aug-22 16:00:00	17.5645398	16.01545934	33.60941113
25-Aug-22 17:00:00	25.71217219	16.00165685	41.72666338
25-Aug-22 18:00:00	25.95798344	16.41362576	42.37529411
25-Aug-22 19:00:00	25.9961977	16.56040107	42.54783185
25-Aug-22 20:00:00	26.86816904	16.77245712	43.64173491
25-Aug-22 21:00:00	30.85209613	16.74356547	47.61726888
25-Aug-22 22:00:00	29.94198842	16.73777321	46.706187
25-Aug-22 23:00:00	29.22067822	16.11146609	45.39999123
26-Aug-22 00:00:00	29.18078083	15.53732973	44.74857521

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
26-Aug-22 01:00:00	29.21311834	15.51752594	44.74961474
26-Aug-22 02:00:00	30.19072077	15.56904004	45.76876609
26-Aug-22 03:00:00	30.46202172	15.53859864	46.02587869
26-Aug-22 04:00:00	29.97479057	15.57864096	45.53690317
26-Aug-22 05:00:00	29.91649734	15.74419462	45.7098342
26-Aug-22 06:00:00	29.92698235	15.84563568	45.75267301
26-Aug-22 07:00:00	29.9696082	15.95970885	45.89537276
26-Aug-22 08:00:00	30.22730022	15.94280275	46.17289352
26-Aug-22 09:00:00	30.36277972	15.89746119	46.28156344
26-Aug-22 10:00:00	30.34828112	16.17877761	46.51739544
26-Aug-22 11:00:00	30.28684044	15.50736676	45.80653763
26-Aug-22 12:00:00	30.28453689	15.65562357	45.92098236
26-Aug-22 13:00:00	30.31111993	15.70664894	45.95876072
26-Aug-22 14:00:00	30.72008811	15.74625262	46.42015076
26-Aug-22 15:00:00	30.91246329	15.58117895	46.50402246
26-Aug-22 16:00:00	30.94279236	15.7438445	46.67561418
26-Aug-22 17:00:00	30.97307804	15.64011929	46.58387989
26-Aug-22 18:00:00	30.79103565	15.64734942	46.46659131
26-Aug-22 19:00:00	30.72322761	15.69562841	46.40622309
26-Aug-22 20:00:00	30.26867782	15.66750191	45.94349946
26-Aug-22 21:00:00	30.2355353	15.96859831	46.21057691
26-Aug-22 22:00:00	30.22855632	16.50493537	46.73051537
26-Aug-22 23:00:00	30.93851312	17.15554214	48.06926722
27-Aug-22 00:00:00	32.36106131	17.12230587	49.49404335
27-Aug-22 01:00:00	32.10979133	17.14257595	49.23034308
27-Aug-22 02:00:00	32.02676964	16.03644294	48.15600162
27-Aug-22 03:00:00	31.99325042	15.64508915	47.67093171
27-Aug-22 04:00:00	31.98887051	15.70617402	47.67445232
27-Aug-22 05:00:00	32.87993601	15.81303909	48.6570318
27-Aug-22 06:00:00	33.17836931	15.76227048	48.94538159
27-Aug-22 07:00:00	33.44567278	15.78644378	49.23444133
27-Aug-22 08:00:00	33.4384435	15.80428749	49.21939638
27-Aug-22 09:00:00	33.4561242	15.69449605	49.16304207
27-Aug-22 10:00:00	33.53830443	15.93801875	49.44320696
27-Aug-22 11:00:00	33.44275199	15.92861723	49.36292786
27-Aug-22 12:00:00	34.37456258	15.92227631	50.30227714
27-Aug-22 13:00:00	34.58480326	16.54832869	51.05675952
27-Aug-22 14:00:00	34.52323299	15.8802309	50.43669086
27-Aug-22 15:00:00	34.60265096	16.08417314	50.64775933
27-Aug-22 16:00:00	34.3651051	16.03407197	50.3943153
27-Aug-22 17:00:00	34.54621908	16.01556301	50.59930081
27-Aug-22 18:00:00	34.30470594	15.77806613	50.07993244
27-Aug-22 19:00:00	34.25326453	15.90582577	50.15304788

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
27-Aug-22 20:00:00	34.27627966	15.59277264	49.84754986
27-Aug-22 21:00:00	34.49256304	15.67139764	50.1709991
27-Aug-22 22:00:00	34.64051056	15.70196769	50.34506416
27-Aug-22 23:00:00	34.31914096	15.81996524	50.07755284
28-Aug-22 00:00:00	34.2852921	15.72676415	50.00512928
28-Aug-22 01:00:00	34.30632676	16.09477764	50.38847415
28-Aug-22 02:00:00	34.29928377	16.0488413	50.34084702
28-Aug-22 03:00:00	34.5560538	16.02909955	50.58246655
28-Aug-22 04:00:00	34.41735903	16.02293855	50.44581095
28-Aug-22 05:00:00	34.58998828	15.88657986	50.48018985
28-Aug-22 06:00:00	34.67186991	15.65585687	50.32102606
28-Aug-22 07:00:00	34.6023638	15.5483853	50.18746863
28-Aug-22 08:00:00	34.72449303	15.56756956	50.29253536
28-Aug-22 09:00:00	34.17245695	15.55660915	49.72758505
28-Aug-22 10:00:00	34.20663918	15.62222841	49.84267055
28-Aug-22 11:00:00	34.20741102	15.75411265	49.9457158
28-Aug-22 12:00:00	34.21698316	15.76687108	49.98293379
28-Aug-22 13:00:00	34.64742343	15.78965934	50.42343924
28-Aug-22 14:00:00	34.39676476	15.78060558	50.17872535
28-Aug-22 15:00:00	35.02120802	15.82891	50.81143803
28-Aug-22 16:00:00	35.06290181	16.60421658	51.67244839
28-Aug-22 17:00:00	35.06709184	16.10906039	51.19174639
28-Aug-22 18:00:00	34.96503067	16.03054301	51.01332647
28-Aug-22 19:00:00	34.18269433	16.06436058	50.20219951
28-Aug-22 20:00:00	34.5977798	16.03347905	50.62544314
28-Aug-22 21:00:00	34.62035264	15.69777527	50.38100327
28-Aug-22 22:00:00	34.62216526	15.73566129	50.40834999
28-Aug-22 23:00:00	34.51999071	15.40884389	49.89440812
29-Aug-22 00:00:00	34.27692159	15.40163677	49.7036745
29-Aug-22 01:00:00	34.32167519	15.43412712	49.736843
29-Aug-22 02:00:00	34.10048485	15.57027329	49.64874882
29-Aug-22 03:00:00	34.10532665	15.80970139	49.91884825
29-Aug-22 04:00:00	34.06570307	15.32403692	49.36737251
29-Aug-22 05:00:00	34.18318473	15.17191919	49.31847297
29-Aug-22 06:00:00	34.29296112	15.16585241	49.41785134
29-Aug-22 07:00:00	34.51134364	15.10635016	49.67749023
29-Aug-22 08:00:00	34.56894811	15.536922	50.09861035
29-Aug-22 09:00:00	34.5348214	15.25879823	49.82725923
29-Aug-22 10:00:00	34.45558357	14.93961003	49.38005839
29-Aug-22 11:00:00	34.33224466	14.94583349	49.26749081
29-Aug-22 12:00:00	34.41432063	14.95560353	49.37881872
29-Aug-22 13:00:00	34.28086344	15.25665331	49.51469803
29-Aug-22 14:00:00	34.29280684	15.77854305	50.06190198

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
29-Aug-22 15:00:00	34.28142463	15.46391875	49.76229435
29-Aug-22 16:00:00	34.33138487	15.47074322	49.76339912
29-Aug-22 17:00:00	34.40977796	15.44178365	49.82771195
29-Aug-22 18:00:00	34.30940098	15.6146846	49.93721347
29-Aug-22 19:00:00	34.27144517	16.31127887	50.56978925
29-Aug-22 20:00:00	34.31717957	15.87491311	50.21165403
29-Aug-22 21:00:00	34.36539459	15.55269448	49.97007882
29-Aug-22 22:00:00	34.43102837	15.57712716	49.98826811
29-Aug-22 23:00:00	33.92973603	15.58013093	49.48781204
30-Aug-22 00:00:00	33.82188013	15.56143575	49.35021642
30-Aug-22 01:00:00	33.82360289	15.49945969	49.36331325
30-Aug-22 02:00:00	33.95825916	15.04816761	49.01118845
30-Aug-22 03:00:00	34.22496838	15.0280802	49.26334
30-Aug-22 04:00:00	33.9770546	15.08079872	49.04804929
30-Aug-22 05:00:00	33.77175713	15.27393913	49.01970122
30-Aug-22 06:00:00	33.8347577	15.6813932	49.49647734
30-Aug-22 07:00:00	33.80640115	15.61099195	49.45814938
30-Aug-22 08:00:00	34.23514112	15.6808386	49.88722194
30-Aug-22 09:00:00	34.42661116	15.70870378	50.12195905
30-Aug-22 10:00:00	34.58867349	15.62689825	50.24584468
30-Aug-22 11:00:00	34.59388256	15.61151017	50.15948847
30-Aug-22 12:00:00	34.5247008	15.10033099	49.60850313
30-Aug-22 13:00:00	34.47801738	15.13870885	49.62353609
30-Aug-22 14:00:00	34.31339455	15.16189437	49.46833483
30-Aug-22 15:00:00	34.72747061	15.20343097	49.89221085
30-Aug-22 16:00:00	34.89647505	15.47182446	50.30641588
30-Aug-22 17:00:00	34.923268	15.49285682	50.46641567
30-Aug-22 18:00:00	34.72943793	15.42127154	50.14849811
30-Aug-22 19:00:00	34.20239449	15.38140639	49.6198491
30-Aug-22 20:00:00	34.40515539	15.41677062	49.82590548
30-Aug-22 21:00:00	34.17015118	15.41547478	49.60793375
30-Aug-22 22:00:00	34.17752859	16.15835972	50.30967098
30-Aug-22 23:00:00	34.14657731	16.134245	50.28555128
31-Aug-22 00:00:00	34.21173816	16.16021241	50.37088394
31-Aug-22 01:00:00	34.50595559	16.11493259	50.61861017
31-Aug-22 02:00:00	34.0734414	16.12547193	50.20342573
31-Aug-22 03:00:00	34.07654741	15.24660789	49.35003874
31-Aug-22 04:00:00	34.11908129	15.2493159	49.37580631
31-Aug-22 05:00:00	33.96065627	15.0239673	48.9617744
31-Aug-22 06:00:00	34.38441976	15.05396883	49.4367947
31-Aug-22 07:00:00	34.52790621	15.06842264	49.56811432
31-Aug-22 08:00:00	34.99769062	15.5030356	50.52536096
31-Aug-22 09:00:00	34.94520463	15.61680227	50.53297113

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
31-Aug-22 10:00:00	34.90806834	15.57449878	50.52383953
31-Aug-22 11:00:00	34.23285315	15.60585588	49.79719035
31-Aug-22 12:00:00	33.96892569	15.59677986	49.53513612
31-Aug-22 13:00:00	34.28218545	15.84973641	50.09251828
31-Aug-22 14:00:00	34.30975681	15.76752663	50.10023117
31-Aug-22 15:00:00	34.29749044	15.26480876	49.57234934
31-Aug-22 16:00:00	34.28665945	15.05719717	49.33488048
31-Aug-22 17:00:00	33.8772689	15.02593893	48.90952089
31-Aug-22 18:00:00	34.38165686	15.06641827	49.43207486
31-Aug-22 19:00:00	34.35035112	15.33770095	49.64056651
31-Aug-22 20:00:00	34.34683673	15.47838103	49.81747246
31-Aug-22 21:00:00	34.33170827	15.5850953	49.89294073
31-Aug-22 22:00:00	33.88295831	15.59463503	49.47183885
31-Aug-22 23:00:00	33.90927188	15.55384631	49.48027399
01-Sep-22 00:00:00	33.82352426	15.38695834	49.29401949
01-Sep-22 01:00:00	33.82593685	15.80721974	49.61583349
01-Sep-22 02:00:00	33.82406129	16.02093641	49.85023499
01-Sep-22 03:00:00	34.0571857	15.9164188	49.98119884
01-Sep-22 04:00:00	34.02451664	15.9758448	49.94784482
01-Sep-22 05:00:00	34.45552169	15.8051058	50.29841354
01-Sep-22 06:00:00	34.4770103	15.02027037	49.50324027
01-Sep-22 07:00:00	34.43042798	15.34032011	49.75249856
01-Sep-22 08:00:00	34.22019704	15.43391235	49.64208794
01-Sep-22 09:00:00	33.95955382	15.38359575	49.35130246
01-Sep-22 10:00:00	34.1126158	15.4395166	49.53164991
01-Sep-22 11:00:00	34.07602946	15.22602562	49.3199358
01-Sep-22 12:00:00	34.11437077	15.60674832	49.67721748
01-Sep-22 13:00:00	34.20599408	15.75363575	49.97894266
01-Sep-22 14:00:00	33.98757362	15.80641274	49.77522532
01-Sep-22 15:00:00	34.37340991	15.78356584	50.16366853
01-Sep-22 16:00:00	34.78982544	15.89090799	50.58810986
01-Sep-22 17:00:00	34.83985477	15.69289966	50.59795083
01-Sep-22 18:00:00	34.8510312	15.11857014	50.00208537
01-Sep-22 19:00:00	34.15910149	15.15493097	49.33536593
01-Sep-22 20:00:00	34.1076942	15.19196991	49.28021834
01-Sep-22 21:00:00	34.20497958	15.22252497	49.37774372
01-Sep-22 22:00:00	34.16152	15.16677062	49.29330932
01-Sep-22 23:00:00	34.21075715	15.18794163	49.41962518
02-Sep-22 00:00:00	34.03070132	14.93338029	48.95020955
02-Sep-22 01:00:00	33.90444628	14.97103695	48.86731508
02-Sep-22 02:00:00	33.67006811	14.9578386	48.61431016
02-Sep-22 03:00:00	33.88003752	15.26143232	49.17481321
02-Sep-22 04:00:00	33.84803708	15.87969769	49.71553697

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
02-Sep-22 05:00:00	33.81226667	16.03161916	49.86744139
02-Sep-22 06:00:00	33.95515156	16.0049148	50.0031414
02-Sep-22 07:00:00	33.83369382	16.07731104	49.87260352
02-Sep-22 08:00:00	34.45760134	15.70642369	50.23510267
02-Sep-22 09:00:00	34.44229115	15.05979003	49.44785394
02-Sep-22 10:00:00	34.44972017	15.15543029	49.63458492
02-Sep-22 11:00:00	34.32386759	15.03112083	49.37570238
02-Sep-22 12:00:00	33.87483279	15.00087819	48.89960416
02-Sep-22 13:00:00	34.13730134	15.0843912	49.19438489
02-Sep-22 14:00:00	34.2145763	15.1564028	49.37935638
02-Sep-22 15:00:00	34.17130937	15.48525879	49.70113309
02-Sep-22 16:00:00	34.16056527	15.5501421	49.69892748
02-Sep-22 17:00:00	33.93551021	15.57298275	49.51613002
02-Sep-22 18:00:00	34.1606049	15.56311284	49.72614988
02-Sep-22 19:00:00	34.0756552	15.70894379	49.85519808
02-Sep-22 20:00:00	34.00918282	15.44866588	49.45295016
02-Sep-22 21:00:00	34.0589678	14.8503352	48.9355615
02-Sep-22 22:00:00	33.9658592	14.80542932	48.76286305
02-Sep-22 23:00:00	34.11218219	14.80484184	48.91830126
03-Sep-22 00:00:00	33.44739829	14.95789395	48.39449268
03-Sep-22 01:00:00	33.41603449	15.03666904	48.45443005
03-Sep-22 02:00:00	33.44036007	15.24343708	48.67464892
03-Sep-22 03:00:00	33.70311101	15.0175957	48.73815409
03-Sep-22 04:00:00	34.15283797	15.06569927	49.19511202
03-Sep-22 05:00:00	33.61090406	15.05330425	48.6381352
03-Sep-22 06:00:00	33.60871379	15.43205606	49.0363138
03-Sep-22 07:00:00	33.57321792	16.00894086	49.61720043
03-Sep-22 08:00:00	33.65690083	16.14003081	49.79540708
03-Sep-22 09:00:00	34.05921957	16.15582275	50.18927553
03-Sep-22 10:00:00	33.73031595	16.13216419	49.85779953
03-Sep-22 11:00:00	33.69015291	15.55323069	49.31479899
03-Sep-22 12:00:00	33.72697873	15.06887269	48.78704262
03-Sep-22 13:00:00	33.70118014	15.42709949	49.09787602
03-Sep-22 14:00:00	34.21297603	15.41084448	49.62845569
03-Sep-22 15:00:00	33.86864132	15.42727227	49.24126932
03-Sep-22 16:00:00	34.55220646	15.46001356	49.98565958
03-Sep-22 17:00:00	34.61884181	15.22401778	49.81033113
03-Sep-22 18:00:00	34.55355432	15.36497026	49.94780774
03-Sep-22 19:00:00	34.40481673	15.12891131	49.54104588
03-Sep-22 20:00:00	33.86742867	15.12891381	49.01990106
03-Sep-22 21:00:00	33.98080932	15.15720827	49.13962852
03-Sep-22 22:00:00	33.85190911	15.40852319	49.3069487
03-Sep-22 23:00:00	33.93074396	15.40958495	49.36901516

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
04-Sep-22 00:00:00	33.94723278	15.06727946	49.03961987
04-Sep-22 01:00:00	33.83454111	15.03030094	48.87864558
04-Sep-22 02:00:00	33.70032438	15.07784468	48.73380364
04-Sep-22 03:00:00	33.47319518	15.34816959	48.80081262
04-Sep-22 04:00:00	33.46439362	15.31564771	48.70483907
04-Sep-22 05:00:00	33.43197208	15.24763611	48.7244143
04-Sep-22 06:00:00	33.63093525	15.07258644	48.68521129
04-Sep-22 07:00:00	33.94675297	15.06911488	48.98750888
04-Sep-22 08:00:00	33.82795864	15.09898341	48.91731474
04-Sep-22 09:00:00	33.81543944	15.69107358	49.46185811
04-Sep-22 10:00:00	33.84844589	16.25290049	50.12259473
04-Sep-22 11:00:00	33.88896963	16.02421681	49.92557674
04-Sep-22 12:00:00	33.82340029	16.06884868	49.86346351
04-Sep-22 13:00:00	33.64552752	16.00258064	49.71452951
04-Sep-22 14:00:00	33.44318814	15.52827671	49.00519074
04-Sep-22 15:00:00	33.35097377	15.22181064	48.58775732
04-Sep-22 16:00:00	33.35835425	15.31089889	48.69610956
04-Sep-22 17:00:00	33.91516643	15.3189184	49.23344294
04-Sep-22 18:00:00	34.03547796	15.36202659	49.369563
04-Sep-22 19:00:00	34.18724844	15.39497556	49.54505384
04-Sep-22 20:00:00	34.20250575	15.26000653	49.46856308
04-Sep-22 21:00:00	34.19249535	15.17873054	49.39715174
04-Sep-22 22:00:00	34.01944669	15.02792174	49.06831402
04-Sep-22 23:00:00	33.99250391	15.050721	49.05474748
05-Sep-22 00:00:00	32.96210819	15.06017362	48.01120843
05-Sep-22 01:00:00	32.67723041	15.60850366	48.26672024
05-Sep-22 02:00:00	32.75862736	15.36083481	48.12491057
05-Sep-22 03:00:00	33.00811937	15.42882721	48.45635011
05-Sep-22 04:00:00	33.84570927	15.45415741	49.26327536
05-Sep-22 05:00:00	33.45484373	15.39582572	48.8568787
05-Sep-22 06:00:00	33.34450065	15.3806119	48.74632136
05-Sep-22 07:00:00	33.35462782	15.32802391	48.65304587
05-Sep-22 08:00:00	33.3294824	15.4372743	48.78176541
05-Sep-22 09:00:00	33.78998597	15.38756424	49.17459228
05-Sep-22 10:00:00	33.79380968	15.413967	49.21412701
05-Sep-22 11:00:00	34.10532082	15.43798856	49.5360046
05-Sep-22 12:00:00	34.12843302	15.65078317	49.71946971
05-Sep-22 13:00:00	34.0856692	16.00780106	50.08610323
05-Sep-22 14:00:00	33.89217165	15.93017788	49.80013704
05-Sep-22 15:00:00	33.64652655	15.91672059	49.60940207
05-Sep-22 16:00:00	34.03290494	15.94893087	49.97327126
05-Sep-22 17:00:00	34.11032952	15.32293717	49.43598387
05-Sep-22 18:00:00	34.02229055	15.16987753	49.2704543

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
05-Sep-22 19:00:00	33.95034048	15.07579846	49.00853369
05-Sep-22 20:00:00	33.68030018	15.0515773	48.74493217
05-Sep-22 21:00:00	33.87192302	15.03433278	48.91411654
05-Sep-22 22:00:00	33.69406213	15.18972866	48.87536337
05-Sep-22 23:00:00	33.68532223	15.10332002	48.7573346
06-Sep-22 00:00:00	33.68801456	15.52472734	49.23374134
06-Sep-22 01:00:00	33.77773084	15.59482891	49.35200833
06-Sep-22 02:00:00	33.99083074	15.56561654	49.5708953
06-Sep-22 03:00:00	33.83584298	15.62350736	49.44830139
06-Sep-22 04:00:00	33.81022178	15.51834813	49.32841598
06-Sep-22 05:00:00	33.84154744	15.16022423	49.00561655
06-Sep-22 06:00:00	33.83440124	15.42625825	49.22748608
06-Sep-22 07:00:00	33.84975688	15.6703259	49.5286253
06-Sep-22 08:00:00	33.80901803	15.64271575	49.48213492
06-Sep-22 09:00:00	33.83376842	15.67691164	49.49495104
06-Sep-22 10:00:00	33.8948627	19.80557769	53.71685621
06-Sep-22 11:00:00	34.76956961	34.24704997	69.01713308
06-Sep-22 12:00:00	33.91009988	34.24830246	68.14242525
06-Sep-22 13:00:00	33.90375688	34.25697009	68.14391825
06-Sep-22 14:00:00	33.94534281	34.3357101	68.25651268
06-Sep-22 15:00:00	33.95279312	34.26815266	68.20093409
06-Sep-22 16:00:00	36.48942682	33.31087001	70.74727207
06-Sep-22 17:00:00	36.70149146	16.4424812	53.23304982
06-Sep-22 18:00:00	36.76148542	15.47308491	52.23850695
06-Sep-22 19:00:00	35.94098303	15.25606527	51.2526154
06-Sep-22 20:00:00	34.10463354	15.33546637	49.41738849
06-Sep-22 21:00:00	34.52185716	15.29843113	49.80796221
06-Sep-22 22:00:00	34.61892573	15.36135886	49.97849217
06-Sep-22 23:00:00	34.6518578	15.40108305	50.08614858
07-Sep-22 00:00:00	34.63715596	15.43749115	50.05944061
07-Sep-22 01:00:00	33.96968397	15.42384375	49.38231701
07-Sep-22 02:00:00	34.07858043	15.47058353	49.50599056
07-Sep-22 03:00:00	33.70700815	15.42993073	49.13205147
07-Sep-22 04:00:00	33.66405699	15.91359165	49.56394817
07-Sep-22 05:00:00	33.66498036	16.26925578	49.92610486
07-Sep-22 06:00:00	33.87211143	16.4146499	50.29077159
07-Sep-22 07:00:00	34.18702825	16.44503152	50.59085994
07-Sep-22 08:00:00	33.51467853	16.43313438	49.94382095
07-Sep-22 09:00:00	33.54137739	15.34651319	48.97388331
07-Sep-22 10:00:00	33.57102606	15.35679155	48.89969699
07-Sep-22 11:00:00	33.60606066	15.41643575	49.04784987
07-Sep-22 12:00:00	34.16718292	15.4078042	49.59824212
07-Sep-22 13:00:00	34.2588412	15.44612018	49.67951308

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
07-Sep-22 14:00:00	34.62689124	15.48174247	50.09506692
07-Sep-22 15:00:00	34.76200761	15.60391156	50.42812411
07-Sep-22 16:00:00	34.72079616	15.69946702	50.41155158
07-Sep-22 17:00:00	34.27757475	15.66799007	49.95294529
07-Sep-22 18:00:00	33.94305865	15.74687924	49.62535901
07-Sep-22 19:00:00	33.92406231	15.82086368	49.71783074
07-Sep-22 20:00:00	33.93248099	15.74405983	49.67460518
07-Sep-22 21:00:00	33.94600444	15.60535749	49.5617182
07-Sep-22 22:00:00	34.13387998	15.81134731	49.95247449
07-Sep-22 23:00:00	34.06544283	15.7898851	49.86249373
08-Sep-22 00:00:00	34.20255152	15.76265963	49.9688359
08-Sep-22 01:00:00	34.19332557	15.6282229	49.88766423
08-Sep-22 02:00:00	34.17388047	15.48607937	49.67763074
08-Sep-22 03:00:00	34.31702465	15.71612708	50.01793791
08-Sep-22 04:00:00	34.0724731	15.66066661	49.75419458
08-Sep-22 05:00:00	34.08703952	15.69741154	49.7849671
08-Sep-22 06:00:00	33.96132151	15.89570204	49.88505463
08-Sep-22 07:00:00	33.85627047	16.44441197	50.26789178
08-Sep-22 08:00:00	33.8185694	16.19892855	49.99230014
08-Sep-22 09:00:00	33.88838853	16.348008	50.22784699
08-Sep-22 10:00:00	34.08093241	16.37361426	50.42090193
08-Sep-22 11:00:00	34.22251235	16.22266614	50.49990887
08-Sep-22 12:00:00	34.14111222	15.59516101	49.72393396
08-Sep-22 13:00:00	34.23881425	15.53517056	49.75952191
08-Sep-22 14:00:00	34.20838843	15.78725656	49.99515745
08-Sep-22 15:00:00	34.15217294	15.7806293	49.92963409
08-Sep-22 16:00:00	33.96896489	15.77803822	49.74260881
08-Sep-22 17:00:00	33.77327389	15.70406362	49.48225837
08-Sep-22 18:00:00	33.88414023	15.65331788	49.54483407
08-Sep-22 19:00:00	33.83349186	16.01658863	49.84434234
08-Sep-22 20:00:00	34.16847335	16.04401984	50.21793895
08-Sep-22 21:00:00	34.31844669	16.04437726	50.36093224
08-Sep-22 22:00:00	34.46093114	15.9002808	50.35404095
08-Sep-22 23:00:00	34.45158725	15.71933766	50.1286833
09-Sep-22 00:00:00	34.4510337	15.52069187	49.98788961
09-Sep-22 01:00:00	34.27011638	15.63213583	49.86228638
09-Sep-22 02:00:00	34.24579175	15.57856014	49.8406122
09-Sep-22 03:00:00	33.7065239	15.61694162	49.27172025
09-Sep-22 04:00:00	33.7203598	15.41164552	49.15400115
09-Sep-22 05:00:00	33.74207369	15.5626448	49.30645964
09-Sep-22 06:00:00	33.84292475	15.70877389	49.53452698
09-Sep-22 07:00:00	34.25005892	15.6714766	49.93127512
09-Sep-22 08:00:00	34.05601035	15.67184019	49.76504686

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
09-Sep-22 09:00:00	34.17655945	16.11842632	50.30100992
09-Sep-22 10:00:00	34.19859017	16.11319819	50.3241972
09-Sep-22 11:00:00	34.27326563	16.13921669	50.39249682
09-Sep-22 12:00:00	34.20726215	16.12648373	50.40156513
09-Sep-22 13:00:00	33.94886928	16.11220732	50.09814623
09-Sep-22 14:00:00	34.08405579	16.00847956	50.1070474
09-Sep-22 15:00:00	34.06628566	15.5318346	49.61650827
09-Sep-22 16:00:00	34.10565609	15.22497755	49.33926548
09-Sep-22 17:00:00	34.24863646	15.19278679	49.43172412
09-Sep-22 18:00:00	34.00873905	15.18359552	49.17884975
09-Sep-22 19:00:00	34.62121964	15.17374039	49.82919576
09-Sep-22 20:00:00	34.68664402	15.43479669	50.11569277
09-Sep-22 21:00:00	34.69183201	15.51237159	50.25804922
09-Sep-22 22:00:00	34.64904065	15.56910397	50.22805383
09-Sep-22 23:00:00	34.10312462	15.59431771	49.663876
10-Sep-22 00:00:00	33.93023046	15.59717585	49.53074434
10-Sep-22 01:00:00	33.57134766	15.40487053	49.01780849
10-Sep-22 02:00:00	33.57700581	15.50674481	49.06823052
10-Sep-22 03:00:00	33.51197359	15.03303207	48.60402171
10-Sep-22 04:00:00	33.92216682	15.04186295	48.99801047
10-Sep-22 05:00:00	34.09897486	15.07186259	49.17883004
10-Sep-22 06:00:00	34.23363283	15.1837794	49.37978935
10-Sep-22 07:00:00	34.16108386	15.33683019	49.56821209
10-Sep-22 08:00:00	34.18999841	15.41052601	49.61707057
10-Sep-22 09:00:00	34.26374351	15.47855221	49.73822827
10-Sep-22 10:00:00	34.39137967	15.40992022	49.83175337
10-Sep-22 11:00:00	34.26911312	15.41604579	49.70215691
10-Sep-22 12:00:00	34.03869311	15.82398882	49.91466395
10-Sep-22 13:00:00	34.15804778	15.68510628	49.85756964
10-Sep-22 14:00:00	34.17872916	15.35527802	49.50474273
10-Sep-22 15:00:00	34.22385979	15.31024948	49.56117694
10-Sep-22 16:00:00	34.32805083	15.32868571	49.64815521
10-Sep-22 17:00:00	34.12851969	15.36073743	49.52287728
10-Sep-22 18:00:00	34.11903509	15.61493974	49.69868113
10-Sep-22 19:00:00	34.02703879	15.24305023	49.28903262
10-Sep-22 20:00:00	34.23970095	15.18168492	49.40535265
10-Sep-22 21:00:00	34.40806283	15.18795103	49.5716576
10-Sep-22 22:00:00	33.7271027	15.17317635	48.8612531
10-Sep-22 23:00:00	33.84856881	15.71459574	49.538286
11-Sep-22 00:00:00	33.82228152	16.06110891	49.85776972
11-Sep-22 01:00:00	33.94743835	16.02712523	49.99978966
11-Sep-22 02:00:00	34.36995082	16.00581501	50.41481569
11-Sep-22 03:00:00	34.14238845	16.05467747	50.20128059

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
11-Sep-22 04:00:00	34.30187395	15.64863249	49.9370327
11-Sep-22 05:00:00	34.32597097	15.46898429	49.83080228
11-Sep-22 06:00:00	34.31143294	15.18035709	49.48562566
11-Sep-22 07:00:00	34.25955836	15.17386395	49.4356433
11-Sep-22 08:00:00	34.09649298	15.18037719	49.26427417
11-Sep-22 09:00:00	33.87500191	15.30973768	49.19065009
11-Sep-22 10:00:00	33.78629112	15.76078809	49.61780532
11-Sep-22 11:00:00	33.83605936	15.4375849	49.28415315
11-Sep-22 12:00:00	34.2168915	15.32488991	49.55146758
11-Sep-22 13:00:00	34.14845848	15.35905228	49.47419188
11-Sep-22 14:00:00	34.54595976	15.34761236	49.88236668
11-Sep-22 15:00:00	34.67951902	15.78850917	50.46741401
11-Sep-22 16:00:00	34.63031769	15.57533325	50.20838081
11-Sep-22 17:00:00	34.47574806	14.95433349	49.42455546
11-Sep-22 18:00:00	34.06046168	14.95615773	49.0160728
11-Sep-22 19:00:00	34.05457624	14.97825841	49.01047982
11-Sep-22 20:00:00	33.56097921	15.40773114	48.92947875
11-Sep-22 21:00:00	33.54778141	15.62886653	49.17558592
11-Sep-22 22:00:00	33.63669247	15.42449605	49.03439649
11-Sep-22 23:00:00	34.08270115	15.42426258	49.54130279
12-Sep-22 00:00:00	34.14291361	15.44740998	49.60027032
12-Sep-22 01:00:00	34.06068865	15.57458977	49.60562918
12-Sep-22 02:00:00	34.09694333	16.34575367	50.42794079
12-Sep-22 03:00:00	34.08097903	16.06144916	50.1467236
12-Sep-22 04:00:00	34.04947344	15.97100544	50.03071375
12-Sep-22 05:00:00	34.24695545	15.92454343	50.17992189
12-Sep-22 06:00:00	34.33328289	15.96994058	50.2644666
12-Sep-22 07:00:00	34.2895476	15.36943499	49.64046648
12-Sep-22 08:00:00	34.30222024	15.47511562	49.76925589
12-Sep-22 09:00:00	34.21340052	15.28245001	49.52448188
12-Sep-22 10:00:00	34.29663722	15.32541877	49.63168928
12-Sep-22 11:00:00	34.39440431	15.33583562	49.69113322
12-Sep-22 12:00:00	34.89502398	15.48335324	50.29367256
12-Sep-22 13:00:00	34.9027551	15.61314042	50.53912357
12-Sep-22 14:00:00	34.82449298	15.36335772	50.18115934
12-Sep-22 15:00:00	34.13566462	15.297208	49.45480495
12-Sep-22 16:00:00	34.07896169	15.27953311	49.39985212
12-Sep-22 17:00:00	33.78275977	15.3614882	49.1271676
12-Sep-22 18:00:00	33.80261252	15.26674346	49.10317675
12-Sep-22 19:00:00	33.81917275	15.19263395	49.06109269
12-Sep-22 20:00:00	34.0050034	15.13784332	49.16310268
12-Sep-22 21:00:00	33.96691301	15.12803816	49.10652436
12-Sep-22 22:00:00	33.63952425	15.18863343	48.79111912

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
12-Sep-22 23:00:00	33.55501111	15.2132999	48.72322167
13-Sep-22 00:00:00	33.60211033	15.54368321	49.11838722
13-Sep-22 01:00:00	33.62473657	15.07177785	48.68551275
13-Sep-22 02:00:00	33.94445864	15.08207922	48.98391427
13-Sep-22 03:00:00	33.8052667	15.05440212	48.8648421
13-Sep-22 04:00:00	33.97547425	15.51045439	49.40804241
13-Sep-22 05:00:00	33.93067784	15.93693309	49.92361376
13-Sep-22 06:00:00	33.89512189	15.33429003	49.28643015
13-Sep-22 07:00:00	33.92856767	15.04434236	49.0075389
13-Sep-22 08:00:00	33.79376835	15.04838663	48.86051623
13-Sep-22 09:00:00	33.95777109	15.07452701	49.03724289
13-Sep-22 10:00:00	33.95093791	15.33469597	49.27284333
13-Sep-22 11:00:00	33.89736048	15.25559724	49.18466808
13-Sep-22 12:00:00	33.91424772	15.14447765	49.06980218
13-Sep-22 13:00:00	33.82276132	15.14820635	48.97997644
13-Sep-22 14:00:00	34.23284022	15.16667779	49.38702774
13-Sep-22 15:00:00	34.32741038	15.32877706	49.60756916
13-Sep-22 16:00:00	34.29649078	15.45503309	49.74748749
13-Sep-22 17:00:00	34.27066775	15.80353005	50.03698603
13-Sep-22 18:00:00	33.76250108	15.77856731	49.52139671
13-Sep-22 19:00:00	33.84320153	15.78581071	49.61806594
13-Sep-22 20:00:00	33.63541434	15.65486973	49.28441556
13-Sep-22 21:00:00	33.72757806	15.17910613	48.90785472
13-Sep-22 22:00:00	33.7002057	15.27889894	48.96375275
13-Sep-22 23:00:00	33.71497133	15.35361195	49.02681026
14-Sep-22 00:00:00	34.04493671	15.30328321	49.37168492
14-Sep-22 01:00:00	33.70509126	15.35764085	49.08481312
14-Sep-22 02:00:00	33.78265593	15.22878665	49.02231534
14-Sep-22 03:00:00	33.77487331	15.30098245	49.03110144
14-Sep-22 04:00:00	33.76054001	15.3014874	49.0720075
14-Sep-22 05:00:00	34.11462763	15.36235238	49.46381103
14-Sep-22 06:00:00	33.94510057	15.34449655	49.27153291
14-Sep-22 07:00:00	34.2637647	15.61515566	49.87617048
14-Sep-22 08:00:00	34.31650437	15.5547328	49.88500553
14-Sep-22 09:00:00	34.35738118	15.04927384	49.42641288
14-Sep-22 10:00:00	34.10513666	15.04548498	49.15184805
14-Sep-22 11:00:00	33.75637499	15.03102269	48.81477186
14-Sep-22 12:00:00	34.78584756	15.12812157	49.98009597
14-Sep-22 13:00:00	34.84146076	15.16388517	49.99216546
14-Sep-22 14:00:00	34.86594454	15.35947527	50.21953837
14-Sep-22 15:00:00	34.5147828	15.33397764	49.85284826
14-Sep-22 16:00:00	34.01297993	15.33998162	49.32766512
14-Sep-22 17:00:00	34.37656021	15.2832525	49.66965061

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
14-Sep-22 18:00:00	34.34013473	15.44731453	49.79062504
14-Sep-22 19:00:00	34.30948702	16.12070306	50.38885795
14-Sep-22 20:00:00	34.3666545	16.13367297	50.52461539
14-Sep-22 21:00:00	33.66092724	16.15931864	49.80579419
14-Sep-22 22:00:00	33.65277884	16.11749477	49.7879467
14-Sep-22 23:00:00	33.5326909	15.87083716	49.45909721
15-Sep-22 00:00:00	33.41326989	15.17709949	48.59250662
15-Sep-22 01:00:00	33.37211821	15.33132103	48.72773276
15-Sep-22 02:00:00	33.4593135	15.31404018	48.77697749
15-Sep-22 03:00:00	33.63651615	15.34583642	48.96448072
15-Sep-22 04:00:00	34.38554064	15.40273161	49.7492165
15-Sep-22 05:00:00	34.3209894	15.46940684	49.79064242
15-Sep-22 06:00:00	34.33732224	15.28083274	49.62263314
15-Sep-22 07:00:00	34.17446525	14.95665787	49.13249645
15-Sep-22 08:00:00	33.72944811	14.92635568	48.67928823
15-Sep-22 09:00:00	33.81411277	14.99906713	48.77292548
15-Sep-22 10:00:00	33.79391607	15.19257869	48.94775709
15-Sep-22 11:00:00	33.81680425	15.25818954	49.07369804
15-Sep-22 12:00:00	33.81152111	15.35125552	49.12293731
15-Sep-22 13:00:00	33.66650973	15.34177783	48.97614091
15-Sep-22 14:00:00	33.59426732	15.32217517	48.92262035
15-Sep-22 15:00:00	33.32491854	15.32859307	48.66537582
15-Sep-22 16:00:00	33.32766257	15.23587455	48.506965
15-Sep-22 17:00:00	33.32196691	15.58620082	48.92191929
15-Sep-22 18:00:00	33.63655504	15.60609061	49.25248303
15-Sep-22 19:00:00	33.88162422	15.59354273	49.46340561
15-Sep-22 20:00:00	33.140156	15.61239247	48.71111721
15-Sep-22 21:00:00	33.15956582	16.02301778	49.20094623
15-Sep-22 22:00:00	33.18577152	15.93226233	49.12319077
15-Sep-22 23:00:00	33.24283515	15.67736835	48.90431192
16-Sep-22 00:00:00	33.73526361	15.69249976	49.44762819
16-Sep-22 01:00:00	33.31474474	15.64752088	48.9822979
16-Sep-22 02:00:00	33.32722855	15.39079856	48.7989148
16-Sep-22 03:00:00	33.37199656	15.02882581	48.40829955
16-Sep-22 04:00:00	33.343814	15.21429896	48.51806725
16-Sep-22 05:00:00	33.62704277	15.16212214	48.79987568
16-Sep-22 06:00:00	33.42559475	15.14345417	48.57155863
16-Sep-22 07:00:00	33.3054587	15.25878855	48.56209861
16-Sep-22 08:00:00	33.35129038	15.40172874	48.70783552
16-Sep-22 09:00:00	33.33995353	15.81020424	49.14199087
16-Sep-22 10:00:00	33.6020796	15.6560768	49.28642019
16-Sep-22 11:00:00	33.45938322	15.71240238	49.15342935
16-Sep-22 12:00:00	33.76495107	15.69157693	49.46235063

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
16-Sep-22 13:00:00	33.7083185	15.15816175	48.90889629
16-Sep-22 14:00:00	33.70123863	14.80225232	48.53285509
16-Sep-22 15:00:00	33.66216871	14.59964335	48.25848452
16-Sep-22 16:00:00	33.39972454	14.62790682	48.00022909
16-Sep-22 17:00:00	33.25006527	14.60116927	47.83674897
16-Sep-22 18:00:00	32.46329477	14.91594899	47.36436632
16-Sep-22 19:00:00	32.46782366	15.23502249	47.6986618
16-Sep-22 20:00:00	32.47572623	15.15683344	47.64026006
16-Sep-22 21:00:00	33.35224957	15.0506067	48.40969679
16-Sep-22 22:00:00	33.5597371	15.06275764	48.60237651
16-Sep-22 23:00:00	33.08827951	15.16151704	48.2217155
17-Sep-22 00:00:00	33.05529149	15.48302571	48.57532459
17-Sep-22 01:00:00	33.07101292	14.99034201	48.08389537
17-Sep-22 02:00:00	33.09273423	14.97394772	48.05724631
17-Sep-22 03:00:00	33.50902918	14.93635775	48.48421817
17-Sep-22 04:00:00	33.37330776	14.93577328	48.31525167
17-Sep-22 05:00:00	33.32652007	15.1595814	48.47818142
17-Sep-22 06:00:00	33.35932096	14.99503385	48.34876654
17-Sep-22 07:00:00	33.35136922	15.03297615	48.41123178
17-Sep-22 08:00:00	33.75687748	15.07063802	48.82358742
17-Sep-22 09:00:00	33.76851209	15.03654687	48.82016754
17-Sep-22 10:00:00	34.14557012	15.37664703	49.50778036
17-Sep-22 11:00:00	34.0393664	15.61537814	49.62192006
17-Sep-22 12:00:00	34.06130579	15.53622474	49.60548846
17-Sep-22 13:00:00	33.65289921	15.14246793	48.80278047
17-Sep-22 14:00:00	33.58303812	15.16576803	48.75880771
17-Sep-22 15:00:00	33.42463324	15.15004528	48.58263736
17-Sep-22 16:00:00	33.40132099	14.99271229	48.34368049
17-Sep-22 17:00:00	33.43940078	14.93535662	48.38312001
17-Sep-22 18:00:00	33.68126106	14.95483704	48.62592019
17-Sep-22 19:00:00	33.8028876	14.98080152	48.74356037
17-Sep-22 20:00:00	33.40577592	14.92224951	48.34182739
17-Sep-22 21:00:00	33.41737366	15.12591203	48.53923713
17-Sep-22 22:00:00	33.40600522	15.09235931	48.48946614
17-Sep-22 23:00:00	33.39052306	14.73599349	48.07875464
18-Sep-22 00:00:00	33.48168161	14.70085155	48.14250851
18-Sep-22 01:00:00	33.29309336	14.65740879	47.97168244
18-Sep-22 02:00:00	33.73460515	14.82391471	48.50699446
18-Sep-22 03:00:00	33.71149127	14.88901159	48.5931547
18-Sep-22 04:00:00	33.71654744	14.88883915	48.62821261
18-Sep-22 05:00:00	33.62144513	14.79272054	48.41722128
18-Sep-22 06:00:00	33.49483278	14.7777501	48.30072339
18-Sep-22 07:00:00	33.55922678	14.77936739	48.35878309

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
18-Sep-22 08:00:00	33.59004868	14.97647618	48.53467125
18-Sep-22 09:00:00	33.52268367	14.92877497	48.43503973
18-Sep-22 10:00:00	33.50250604	14.99222298	48.45387755
18-Sep-22 11:00:00	33.52864689	14.96346924	48.48696094
18-Sep-22 12:00:00	33.68158425	14.9319818	48.63078541
18-Sep-22 13:00:00	33.57491642	15.46256395	49.06300721
18-Sep-22 14:00:00	33.56240527	15.43591401	48.98920547
18-Sep-22 15:00:00	33.64163695	15.06748856	48.72604752
18-Sep-22 16:00:00	33.27962939	15.08147555	48.31890982
18-Sep-22 17:00:00	33.41993862	15.05963937	48.4862335
18-Sep-22 18:00:00	32.94786814	15.10697704	48.04330395
18-Sep-22 19:00:00	32.97842556	14.91996288	47.90631337
18-Sep-22 20:00:00	32.9372548	15.15690486	48.10182805
18-Sep-22 21:00:00	33.03842884	15.0542142	48.06821244
18-Sep-22 22:00:00	33.6897405	15.03801605	48.77660624
18-Sep-22 23:00:00	33.64968851	15.06529442	48.72764672
19-Sep-22 00:00:00	33.84434085	15.1549197	48.96953307
19-Sep-22 01:00:00	33.7890483	15.5912118	49.41869174
19-Sep-22 02:00:00	33.67435731	15.75988274	49.461778
19-Sep-22 03:00:00	33.37059826	15.83261267	49.16739612
19-Sep-22 04:00:00	33.09379302	15.74258396	48.86880981
19-Sep-22 05:00:00	33.10186683	15.50410991	48.64303426
19-Sep-22 06:00:00	33.28916423	14.77721741	48.07868604
19-Sep-22 07:00:00	33.16806051	15.38354667	48.52272881
19-Sep-22 08:00:00	33.19016743	15.55262993	48.75978644
19-Sep-22 09:00:00	32.9507885	15.5831999	48.51878569
19-Sep-22 10:00:00	33.68373214	15.54579692	49.25172424
19-Sep-22 11:00:00	33.70952098	15.03772397	48.72887293
19-Sep-22 12:00:00	33.72894711	15.10963175	48.85897217
19-Sep-22 13:00:00	33.58674381	15.04816061	48.65379588
19-Sep-22 14:00:00	33.30360942	15.06203985	48.35209952
19-Sep-22 15:00:00	32.71387863	15.0056884	47.74572372
19-Sep-22 16:00:00	32.42741055	15.14719825	47.58352195
19-Sep-22 17:00:00	32.47148429	14.8687778	47.30896881
19-Sep-22 18:00:00	32.43417676	15.05591783	47.48497486
19-Sep-22 19:00:00	32.8575662	14.9899969	47.87332386
19-Sep-22 20:00:00	33.09940529	15.04221467	48.14342372
19-Sep-22 21:00:00	33.20475854	15.02442159	48.23620139
19-Sep-22 22:00:00	33.18112225	15.06590488	48.20337062
19-Sep-22 23:00:00	33.14584711	15.10633945	48.2804167
20-Sep-22 00:00:00	33.03900613	15.15513162	48.19474824
20-Sep-22 01:00:00	33.2120035	15.13540677	48.3532505
20-Sep-22 02:00:00	33.67500051	15.14969173	48.81194284

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
20-Sep-22 03:00:00	33.66081164	15.20830139	48.85803689
20-Sep-22 04:00:00	33.67785517	14.86936295	48.53658902
20-Sep-22 05:00:00	33.63224453	15.02992392	48.65127754
20-Sep-22 06:00:00	33.53727955	15.06418586	48.57980135
20-Sep-22 07:00:00	33.66542795	15.01339581	48.69422065
20-Sep-22 08:00:00	33.83131387	14.91256356	48.78798156
20-Sep-22 09:00:00	33.80779902	14.74102645	48.55615658
20-Sep-22 10:00:00	33.82142152	14.80875386	48.62807814
20-Sep-22 11:00:00	33.2439821	14.76324987	48.01236894
20-Sep-22 12:00:00	33.1892164	14.78005743	47.97977299
20-Sep-22 13:00:00	32.67825169	15.10532761	47.73939641
20-Sep-22 14:00:00	32.68190299	15.84896082	48.53875542
20-Sep-22 15:00:00	32.74387593	15.41316131	48.14771038
20-Sep-22 16:00:00	32.64016639	15.46382232	48.07858163
20-Sep-22 17:00:00	32.5148663	15.44360779	47.96061028
20-Sep-22 18:00:00	32.19658067	15.42141097	47.62257152
20-Sep-22 19:00:00	32.08084149	15.70127188	47.77284643
20-Sep-22 20:00:00	32.11835024	15.63150667	47.75614887
20-Sep-22 21:00:00	32.26439126	15.69011394	47.95107015
20-Sep-22 22:00:00	32.87964948	15.67490721	48.56959301
20-Sep-22 23:00:00	32.66067886	15.66461364	48.33687147
21-Sep-22 00:00:00	32.5564927	15.54875204	48.09439652
21-Sep-22 01:00:00	32.61541642	15.4983876	48.13988241
21-Sep-22 02:00:00	32.69076284	15.4297088	48.14375093
21-Sep-22 03:00:00	32.89880668	15.54185913	48.43195576
21-Sep-22 04:00:00	32.84286012	15.52653654	48.35286225
21-Sep-22 05:00:00	32.70414776	15.59272105	48.24601396
21-Sep-22 06:00:00	32.69192357	15.8089838	48.49423154
21-Sep-22 07:00:00	32.68752755	15.5691722	48.2671352
21-Sep-22 08:00:00	33.00885158	15.8684557	48.89101262
21-Sep-22 09:00:00	33.25279405	15.91942958	49.16337077
21-Sep-22 10:00:00	33.81443172	15.88925991	49.7119734
21-Sep-22 11:00:00	34.05812899	15.51915375	49.56641399
21-Sep-22 12:00:00	33.97288513	15.2496304	49.2456273
21-Sep-22 13:00:00	33.84751892	15.42444746	49.25849964
21-Sep-22 14:00:00	33.0613274	15.43457909	48.48417261
21-Sep-22 15:00:00	33.39027129	15.38944867	48.81381925
21-Sep-22 16:00:00	33.35564189	15.42852548	48.76396502
21-Sep-22 17:00:00	33.29349073	15.6346231	48.96143892
21-Sep-22 18:00:00	33.10312907	15.3215649	48.44292747
21-Sep-22 19:00:00	33.0082976	15.38837337	48.43616952
21-Sep-22 20:00:00	33.25906711	15.43000719	48.70135964
21-Sep-22 21:00:00	32.71959644	15.4438813	48.13965713

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
21-Sep-22 22:00:00	32.75976223	15.33538029	48.09774886
21-Sep-22 23:00:00	32.89298672	15.25408189	48.17850664
22-Sep-22 00:00:00	32.99904972	15.46976916	48.47490692
22-Sep-22 01:00:00	33.77548896	15.42132931	49.20792325
22-Sep-22 02:00:00	33.78687774	15.40516923	49.20471679
22-Sep-22 03:00:00	34.12286017	15.42109418	49.54451524
22-Sep-22 04:00:00	34.24660524	15.43751399	49.68290202
22-Sep-22 05:00:00	34.17701424	15.2650067	49.4654346
22-Sep-22 06:00:00	33.5651012	15.29170714	48.86252107
22-Sep-22 07:00:00	33.25582186	15.33170589	48.57095952
22-Sep-22 08:00:00	32.72203424	15.27715093	48.03636318
22-Sep-22 09:00:00	32.57253965	15.25023731	47.82226071
22-Sep-22 10:00:00	32.57873493	15.30118587	47.84689903
22-Sep-22 11:00:00	33.28914282	15.42538438	48.71229829
22-Sep-22 12:00:00	33.31983672	15.44037483	48.71269306
22-Sep-22 13:00:00	33.37266244	15.38636971	48.73051156
22-Sep-22 14:00:00	33.36209212	15.32206106	48.5991141
22-Sep-22 15:00:00	33.36459414	15.20658689	48.60513104
22-Sep-22 16:00:00	33.4949095	15.13879423	48.62365278
22-Sep-22 17:00:00	33.42306773	15.16757827	48.56579314
22-Sep-22 18:00:00	33.62744522	15.12533226	48.76168166
22-Sep-22 19:00:00	33.61700461	15.2022076	48.75046131
22-Sep-22 20:00:00	33.60461235	15.30792938	48.91284794
22-Sep-22 21:00:00	33.53877195	14.77031664	48.30141025
22-Sep-22 22:00:00	33.06502936	14.80134042	47.86703788
22-Sep-22 23:00:00	33.13441107	14.80409982	47.92884191
23-Sep-22 00:00:00	33.45359301	14.90048039	48.35819534
23-Sep-22 01:00:00	33.43139945	15.45000785	48.88580057
23-Sep-22 02:00:00	33.40126864	15.21253061	48.61189363
23-Sep-22 03:00:00	33.27656336	15.14475079	48.43537267
23-Sep-22 04:00:00	33.10207134	15.12854992	48.24626859
23-Sep-22 05:00:00	33.46606827	15.13068829	48.61178907
23-Sep-22 06:00:00	33.33568954	15.38495339	48.69070244
23-Sep-22 07:00:00	33.39448039	15.30200628	48.71235996
23-Sep-22 08:00:00	33.40527895	14.91186177	48.32427936
23-Sep-22 09:00:00	33.23370722	14.94365066	48.16918839
23-Sep-22 10:00:00	33.3914157	14.90936516	48.3629375
23-Sep-22 11:00:00	33.5673275	14.99271275	48.59253989
23-Sep-22 12:00:00	33.62242677	15.16731843	48.77553996
23-Sep-22 13:00:00	33.6261461	15.03424633	48.6719318
23-Sep-22 14:00:00	33.10945914	14.94304829	48.04447206
23-Sep-22 15:00:00	33.05133798	14.92672137	47.99765714
23-Sep-22 16:00:00	32.24225171	14.99489074	47.2139704

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
23-Sep-22 17:00:00	32.33647092	15.809587	48.15485626
23-Sep-22 18:00:00	32.28423119	15.53540154	47.8003966
23-Sep-22 19:00:00	32.34291903	15.28010807	47.67395208
23-Sep-22 20:00:00	32.48131879	15.29278959	47.78803529
23-Sep-22 21:00:00	32.14134524	15.2942261	47.43381479
23-Sep-22 22:00:00	31.94417402	15.1371911	47.08361393
23-Sep-22 23:00:00	31.94974931	15.33756783	47.30024507
24-Sep-22 00:00:00	32.0347218	15.11037244	47.13137648
24-Sep-22 01:00:00	32.6180705	15.17596134	47.77521797
24-Sep-22 02:00:00	32.27462037	15.12919444	47.41937213
24-Sep-22 03:00:00	32.37636969	15.22746216	47.58552996
24-Sep-22 04:00:00	32.31097137	15.53471086	47.86270519
24-Sep-22 05:00:00	32.31106355	15.45475419	47.73304028
24-Sep-22 06:00:00	32.37355836	15.42582699	47.77738248
24-Sep-22 07:00:00	32.24559795	15.4138326	47.66001299
24-Sep-22 08:00:00	32.67221896	15.36262638	48.07929675
24-Sep-22 09:00:00	32.73417664	15.10650783	47.84231822
24-Sep-22 10:00:00	32.74941063	15.1183829	47.90358692
24-Sep-22 11:00:00	32.71950489	14.9421032	47.66752582
24-Sep-22 12:00:00	32.52376535	14.91467355	47.44905769
24-Sep-22 13:00:00	32.59951252	14.9488959	47.53690635
24-Sep-22 14:00:00	32.63036156	15.28632577	47.87884894
24-Sep-22 15:00:00	32.59352557	15.34277391	47.8877964
24-Sep-22 16:00:00	32.65235647	15.64075947	48.3028811
24-Sep-22 17:00:00	32.19111019	15.68004006	47.83668306
24-Sep-22 18:00:00	32.00874159	15.68099332	47.68697696
24-Sep-22 19:00:00	31.45724752	15.48024065	47.03499292
24-Sep-22 20:00:00	31.43739425	15.11337386	46.57993338
24-Sep-22 21:00:00	31.51838112	15.15920798	46.64691989
24-Sep-22 22:00:00	32.07545174	15.12672514	47.15550253
24-Sep-22 23:00:00	32.63894717	15.04702721	47.6956891
25-Sep-22 00:00:00	32.8960531	15.06932036	47.97319433
25-Sep-22 01:00:00	33.05082173	15.21153723	48.20959144
25-Sep-22 02:00:00	33.04395379	15.23769373	48.26844554
25-Sep-22 03:00:00	32.92068185	15.14083768	48.04998422
25-Sep-22 04:00:00	32.69882499	15.13838252	47.84907002
25-Sep-22 05:00:00	32.9246504	15.16794085	48.07780181
25-Sep-22 06:00:00	33.12479909	15.2089842	48.31815169
25-Sep-22 07:00:00	33.14164713	15.15869467	48.29404598
25-Sep-22 08:00:00	33.13066249	15.00903251	48.15273603
25-Sep-22 09:00:00	32.83496634	15.07089776	47.90022108
25-Sep-22 10:00:00	32.80933465	15.04737136	47.85701398
25-Sep-22 11:00:00	33.16039424	15.18903473	48.28781456

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
25-Sep-22 12:00:00	33.16995557	15.401403	48.55209531
25-Sep-22 13:00:00	33.16552586	16.28597915	49.43635135
25-Sep-22 14:00:00	32.98162015	17.14565811	50.10048725
25-Sep-22 15:00:00	32.78505707	17.07797346	49.89516173
25-Sep-22 16:00:00	32.58826966	17.21029028	49.76254135
25-Sep-22 17:00:00	32.60689778	23.4515242	55.59043046
25-Sep-22 18:00:00	32.60370964	25.5353295	58.11242061
25-Sep-22 19:00:00	32.68361791	25.8846159	58.55268825
25-Sep-22 20:00:00	32.88425806	25.87335945	58.76595857
25-Sep-22 21:00:00	32.85354042	25.89867666	58.75930553
25-Sep-22 22:00:00	33.21503491	26.20291392	59.45152028
25-Sep-22 23:00:00	33.28076808	26.55578062	59.82346471
26-Sep-22 00:00:00	33.26135169	26.30146885	59.57539876
26-Sep-22 01:00:00	33.06098747	26.26711559	59.32734511
26-Sep-22 02:00:00	32.72356775	26.22713457	58.9682134
26-Sep-22 03:00:00	32.7295581	26.3494834	59.0393947
26-Sep-22 04:00:00	32.71971109	26.77823194	59.49401198
26-Sep-22 05:00:00	32.7057902	26.83948824	59.54543855
26-Sep-22 06:00:00	32.69863192	26.72785799	59.46578598
26-Sep-22 07:00:00	32.71045706	26.74443304	59.44591628
26-Sep-22 08:00:00	32.73000654	26.67940818	59.4125671
26-Sep-22 09:00:00	32.68849436	26.71467177	59.40523665
26-Sep-22 10:00:00	32.68325276	28.37372185	60.63241892
26-Sep-22 11:00:00	33.35249774	34.40000863	67.74858517
26-Sep-22 12:00:00	33.37567054	34.39218924	67.78285005
26-Sep-22 13:00:00	33.37056499	34.38646995	67.76778221
26-Sep-22 14:00:00	33.49720764	34.38859961	67.8933826
26-Sep-22 15:00:00	33.37601111	34.43536917	67.790399
26-Sep-22 16:00:00	34.67313364	34.41417779	69.10450151
26-Sep-22 17:00:00	34.95027902	27.93701882	63.1988377
26-Sep-22 18:00:00	34.91518762	27.48833021	62.37653044
26-Sep-22 19:00:00	34.47665215	27.7633795	62.23756387
26-Sep-22 20:00:00	33.04947005	27.72483363	60.79627927
26-Sep-22 21:00:00	32.89416864	27.66786886	60.57753584
26-Sep-22 22:00:00	32.9918766	27.30569532	60.32306904
26-Sep-22 23:00:00	32.95772955	26.91355069	59.84330474
27-Sep-22 00:00:00	32.99304178	27.28897682	60.29555846
27-Sep-22 01:00:00	32.80646218	27.22706432	60.02569509
27-Sep-22 02:00:00	33.5684469	27.23527813	60.80424584
27-Sep-22 03:00:00	34.46660678	27.20503373	61.71226586
27-Sep-22 04:00:00	34.47207875	27.03491508	61.52905443
27-Sep-22 05:00:00	34.50840081	27.25172181	61.73535241
27-Sep-22 06:00:00	35.46650208	27.35295677	62.82652862

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
27-Sep-22 07:00:00	36.10146035	27.31099521	63.41254828
27-Sep-22 08:00:00	36.39412202	27.37961084	63.75662062
27-Sep-22 09:00:00	36.63211081	27.24729659	63.92206298
27-Sep-22 10:00:00	36.54730182	27.18299574	63.72398716
27-Sep-22 11:00:00	36.61734009	27.46184148	64.08558004
27-Sep-22 12:00:00	37.21041976	27.49648285	64.69109578
27-Sep-22 13:00:00	37.5325773	27.42817423	64.95932388
27-Sep-22 14:00:00	37.64652231	27.4444313	65.08768633
27-Sep-22 15:00:00	37.55173514	27.04867098	64.60881042
27-Sep-22 16:00:00	37.58869076	27.46502919	65.03372353
27-Sep-22 17:00:00	37.4645906	27.61086633	65.0579461
27-Sep-22 18:00:00	37.53482946	27.65511948	65.17170122
27-Sep-22 19:00:00	37.03309822	27.46869294	64.54762459
27-Sep-22 20:00:00	36.95825005	27.17102602	64.14420531
27-Sep-22 21:00:00	36.91782252	27.2493941	64.17928441
27-Sep-22 22:00:00	37.0889225	27.44631201	64.51090664
27-Sep-22 23:00:00	37.68872748	27.47832108	65.17044237
28-Sep-22 00:00:00	37.48896747	27.46742333	64.97826979
28-Sep-22 01:00:00	37.42617777	27.3009896	64.74464827
28-Sep-22 02:00:00	37.46431499	26.8542721	64.3405785
28-Sep-22 03:00:00	37.51286337	26.82327652	64.35110813
28-Sep-22 04:00:00	37.64624723	26.8148436	64.44164636
28-Sep-22 05:00:00	37.33524513	26.82016322	64.13929558
28-Sep-22 06:00:00	37.42063204	26.94765462	64.35659334
28-Sep-22 07:00:00	37.43863381	27.09383276	64.52002939
28-Sep-22 08:00:00	37.3969468	27.3058247	64.65573615
28-Sep-22 09:00:00	37.74123383	27.2355673	64.95554013
28-Sep-22 10:00:00	37.50668589	27.26959702	64.76879671
28-Sep-22 11:00:00	37.01461728	27.20645428	64.25901328
28-Sep-22 12:00:00	36.91265721	27.07619254	63.98859766
28-Sep-22 13:00:00	36.91294734	27.06816451	63.97290421
28-Sep-22 14:00:00	37.31131278	27.48511872	64.77393383
28-Sep-22 15:00:00	37.63875686	27.46274355	65.08821636
28-Sep-22 16:00:00	37.40820864	27.42866424	64.84053718
28-Sep-22 17:00:00	37.39500152	27.15560585	64.55423228
28-Sep-22 18:00:00	37.48534775	26.79232237	64.28063477
28-Sep-22 19:00:00	37.46891509	27.05211263	64.53152254
28-Sep-22 20:00:00	37.39494091	27.07700575	64.46562449
28-Sep-22 21:00:00	37.56942452	27.10421774	64.69398393
28-Sep-22 22:00:00	37.50453652	27.0004264	64.49344529
28-Sep-22 23:00:00	37.42764303	27.04848427	64.49107212
29-Sep-22 00:00:00	37.52146869	27.2376185	64.74569829
29-Sep-22 01:00:00	38.67897839	27.25502107	65.93465042

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
29-Sep-22 02:00:00	40.08984672	27.21406884	67.32624054
29-Sep-22 03:00:00	40.4606959	27.25518013	67.71132406
29-Sep-22 04:00:00	40.55031374	27.04597717	67.65403938
29-Sep-22 05:00:00	40.50558917	27.02596283	67.53036965
29-Sep-22 06:00:00	40.65870264	27.34433831	68.02109104
29-Sep-22 07:00:00	41.87162018	27.34899344	69.22743861
29-Sep-22 08:00:00	41.98700778	27.42479038	69.39073902
29-Sep-22 09:00:00	41.51053153	27.3566991	68.8670973
29-Sep-22 10:00:00	41.55844159	26.92234617	68.51396679
29-Sep-22 11:00:00	41.48228561	27.14284632	68.60968272
29-Sep-22 12:00:00	43.5932596	27.07561843	70.67158466
29-Sep-22 13:00:00	44.63663038	27.10073196	71.74089644
29-Sep-22 14:00:00	44.78171645	27.11311221	71.86454069
29-Sep-22 15:00:00	44.80532095	27.30234316	72.1172443
29-Sep-22 16:00:00	44.71426455	27.29696963	71.97264989
29-Sep-22 17:00:00	45.43460041	27.47450839	72.89130486
29-Sep-22 18:00:00	46.55197801	27.5115348	74.04886542
29-Sep-22 19:00:00	45.64256689	27.44976976	73.11943224
29-Sep-22 20:00:00	45.46489504	27.30753696	72.79206255
29-Sep-22 21:00:00	45.42281257	27.00538651	72.41717996
29-Sep-22 22:00:00	45.38126024	27.40648015	72.80510924
29-Sep-22 23:00:00	44.64791446	27.34902045	72.02177585
30-Sep-22 00:00:00	45.0271829	27.3367068	72.35896132
30-Sep-22 01:00:00	44.68025398	27.25917859	71.92083995
30-Sep-22 02:00:00	44.78130892	27.05403074	71.81642871
30-Sep-22 03:00:00	44.64630296	27.20030944	71.83401871
30-Sep-22 04:00:00	45.23336665	27.35416557	72.60084407
30-Sep-22 05:00:00	45.95097987	27.36890835	73.32321803
30-Sep-22 06:00:00	45.2710779	27.29745699	72.57359356
30-Sep-22 07:00:00	45.19009018	27.20553727	72.32871585
30-Sep-22 08:00:00	45.0992491	27.00609896	72.11617745
30-Sep-22 09:00:00	45.26113065	27.1058818	72.36393102
30-Sep-22 10:00:00	46.12635824	27.14124542	73.25388993
30-Sep-22 11:00:00	45.9789452	27.12227864	73.10181724
30-Sep-22 12:00:00	46.19217152	27.1284345	73.32234319
30-Sep-22 13:00:00	46.13497077	26.82925881	72.93088383
30-Sep-22 14:00:00	46.12658649	26.83354293	72.9873369
30-Sep-22 15:00:00	45.99190966	26.86089868	72.83561325
30-Sep-22 16:00:00	45.66840511	26.86289719	72.5278901
30-Sep-22 17:00:00	45.83934869	26.83820605	72.64773384
30-Sep-22 18:00:00	45.74017949	27.12442727	72.82127762
30-Sep-22 19:00:00	45.80752987	27.11890899	72.89007738
30-Sep-22 20:00:00	46.09064399	27.4056325	73.47750092

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
30-Sep-22 21:00:00	45.82303386	27.37568431	73.20113373
30-Sep-22 22:00:00	46.09663518	27.36284913	73.46360313
30-Sep-22 23:00:00	46.03763305	26.97346189	73.04231856
01-Oct-22 00:00:00	46.02573734	27.02188492	73.03935793
01-Oct-22 01:00:00	46.02614615	27.36742884	73.39676521
01-Oct-22 02:00:00	45.76413388	27.38161988	73.12771225
01-Oct-22 03:00:00	45.59434446	27.35282686	72.94872114
01-Oct-22 04:00:00	45.49451277	26.9825884	72.5451995
01-Oct-22 05:00:00	45.51657147	26.90642463	72.38883675
01-Oct-22 06:00:00	45.45436859	26.83426295	72.27831862
01-Oct-22 07:00:00	45.75252194	26.82925038	72.57564841
01-Oct-22 08:00:00	45.74384393	26.82416503	72.5681004
01-Oct-22 09:00:00	46.28142463	26.83657773	73.127054
01-Oct-22 10:00:00	46.25671811	27.00705454	73.29015011
01-Oct-22 11:00:00	46.34982554	26.96502384	73.31502745
01-Oct-22 12:00:00	46.1559124	27.28844024	73.41227341
01-Oct-22 13:00:00	45.86758063	27.2615799	73.11881298
01-Oct-22 14:00:00	46.06553523	27.22676463	73.29723867
01-Oct-22 15:00:00	46.29825444	27.10160104	73.37636312
01-Oct-22 16:00:00	46.16571384	26.81796932	73.00074217
01-Oct-22 17:00:00	46.1640358	27.28872327	73.43613646
01-Oct-22 18:00:00	45.86914274	27.26609581	73.13658947
01-Oct-22 19:00:00	46.35037931	27.27433181	73.65170415
01-Oct-22 20:00:00	46.24800703	26.99889054	73.218225
01-Oct-22 21:00:00	46.17535506	26.91723347	73.14640681
01-Oct-22 22:00:00	46.2750651	27.25132147	73.50916841
01-Oct-22 23:00:00	45.79123794	27.47272743	73.26962789
02-Oct-22 00:00:00	45.8312344	27.46197102	73.28699493
02-Oct-22 01:00:00	45.24044927	27.37371971	72.61249394
02-Oct-22 02:00:00	45.35889816	26.97782177	72.37217924
02-Oct-22 03:00:00	45.20847978	26.75969452	71.9317966
02-Oct-22 04:00:00	45.52287738	26.83121088	72.35198021
02-Oct-22 05:00:00	45.9515188	26.84040483	72.8064732
02-Oct-22 06:00:00	46.13411607	26.83818949	73.01462951
02-Oct-22 07:00:00	46.46951548	26.70734731	73.20867496
02-Oct-22 08:00:00	46.48144383	26.68564235	73.210687
02-Oct-22 09:00:00	46.37910355	27.14648268	73.50673421
02-Oct-22 10:00:00	46.31475576	27.08735406	73.42276722
02-Oct-22 11:00:00	46.0731305	27.08075481	73.17298126
02-Oct-22 12:00:00	46.52085241	26.84050309	73.397892
02-Oct-22 13:00:00	46.54939164	26.75730144	73.3105668
02-Oct-22 14:00:00	46.57800039	26.81785181	73.36551822
02-Oct-22 15:00:00	46.17658848	27.00872188	73.16900296

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
02-Oct-22 16:00:00	45.78750398	27.03288725	72.82671271
02-Oct-22 17:00:00	45.64512147	26.98189742	72.63762961
02-Oct-22 18:00:00	45.53444587	26.75047493	72.29517492
02-Oct-22 19:00:00	45.50548977	26.75731224	72.19911236
02-Oct-22 20:00:00	45.87001355	27.00332271	72.88892322
02-Oct-22 21:00:00	45.70044306	27.00028723	72.70972061
02-Oct-22 22:00:00	45.53460948	26.980822	72.53385544
02-Oct-22 23:00:00	45.29603269	26.80968793	72.13624032
03-Oct-22 00:00:00	45.33583026	26.61489656	71.98736013
03-Oct-22 01:00:00	45.32684665	26.71970177	72.05667174
03-Oct-22 02:00:00	45.76427502	26.7323513	72.48564614
03-Oct-22 03:00:00	45.85795275	26.74459627	72.57757844
03-Oct-22 04:00:00	46.22824287	26.72039834	72.95094215
03-Oct-22 05:00:00	46.18186887	26.92105929	73.07687717
03-Oct-22 06:00:00	46.14537832	26.62208716	72.77336756
03-Oct-22 07:00:00	45.7355476	26.62943755	72.36619144
03-Oct-22 08:00:00	45.39881049	26.61448345	72.05677923
03-Oct-22 09:00:00	45.72951317	26.60981682	72.35276434
03-Oct-22 10:00:00	45.72902785	26.99297857	72.69165322
03-Oct-22 11:00:00	45.60060416	26.67223189	72.2954322
03-Oct-22 12:00:00	45.55015458	26.76389535	72.32608145
03-Oct-22 13:00:00	45.30184301	26.7148725	72.02000088
03-Oct-22 14:00:00	45.917664	26.80995108	72.7340865
03-Oct-22 15:00:00	46.00981045	26.58262306	72.61454815
03-Oct-22 16:00:00	46.02930302	26.56702833	72.63318973
03-Oct-22 17:00:00	45.97200733	26.25206375	72.24606917
03-Oct-22 18:00:00	45.59407785	26.27539751	71.87159899
03-Oct-22 19:00:00	45.7532035	26.28570268	72.03842545
03-Oct-22 20:00:00	45.00535287	26.32055071	71.32999547
03-Oct-22 21:00:00	45.07323647	26.65100444	71.67894604
03-Oct-22 22:00:00	45.16285261	26.46023899	71.62465159
03-Oct-22 23:00:00	45.11675368	26.37556722	71.53038915
04-Oct-22 00:00:00	45.3851596	26.37887845	71.77418137
04-Oct-22 01:00:00	44.99648348	26.34253137	71.35601298
04-Oct-22 02:00:00	45.10403697	26.62562169	71.67139732
04-Oct-22 03:00:00	45.01623344	26.51714883	71.5130427
04-Oct-22 04:00:00	45.07338969	26.64340235	71.70905919
04-Oct-22 05:00:00	45.73814498	26.619667	72.38039292
04-Oct-22 06:00:00	45.3970161	26.63399071	72.02366426
04-Oct-22 07:00:00	45.47258398	26.54019642	72.0174302
04-Oct-22 08:00:00	45.39479807	26.6044071	71.98357561
04-Oct-22 09:00:00	45.59189839	26.39123132	72.01372401
04-Oct-22 10:00:00	45.96370888	26.48122233	72.43981001

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
04-Oct-22 11:00:00	45.62659963	26.45885372	72.09864383
04-Oct-22 12:00:00	46.55579143	26.48841321	73.02727657
04-Oct-22 13:00:00	46.54742919	26.86010257	73.4019928
04-Oct-22 14:00:00	46.42762184	26.51239272	72.94489458
04-Oct-22 15:00:00	46.27215619	26.49177138	72.76791679
04-Oct-22 16:00:00	45.53670396	26.44032793	72.00009749
04-Oct-22 17:00:00	45.13191795	26.47562451	71.63334507
04-Oct-22 18:00:00	44.46332338	26.66712019	71.11046134
04-Oct-22 19:00:00	44.51951514	26.75585789	71.31269836
04-Oct-22 20:00:00	44.61046982	26.63969686	71.25648244
04-Oct-22 21:00:00	45.8667149	26.59796118	72.50864029
04-Oct-22 22:00:00	45.86641481	26.60372159	72.45458391
04-Oct-22 23:00:00	45.51064852	26.73494363	72.22943921
05-Oct-22 00:00:00	45.49598164	27.00274658	72.47940572
05-Oct-22 01:00:00	45.38988919	26.72550339	72.13456684
05-Oct-22 02:00:00	46.05197038	26.71179447	72.77378209
05-Oct-22 03:00:00	46.22279909	26.74841277	72.96852917
05-Oct-22 04:00:00	46.21536679	26.73437197	72.9407391
05-Oct-22 05:00:00	46.17685488	27.26582421	73.43326102
05-Oct-22 06:00:00	46.05448723	27.1190069	73.22884793
05-Oct-22 07:00:00	46.33768315	26.99814814	73.35017861
05-Oct-22 08:00:00	46.48884413	26.98468187	73.48279741
05-Oct-22 09:00:00	47.05922042	27.04349634	74.08767149
05-Oct-22 10:00:00	47.35174243	27.25572999	74.58619817
05-Oct-22 11:00:00	47.36428536	27.41512892	74.80138355
05-Oct-22 12:00:00	47.26610184	27.1878234	74.45428679
05-Oct-22 13:00:00	46.9586686	27.25995196	74.20835283
05-Oct-22 14:00:00	47.1764111	27.25352828	74.44063059
05-Oct-22 15:00:00	46.54612308	27.32186649	73.85409631
05-Oct-22 16:00:00	46.62459649	27.48215877	74.09273741
05-Oct-22 17:00:00	46.58172565	27.22515618	73.8067415
05-Oct-22 18:00:00	46.81593683	27.10920111	73.92617586
05-Oct-22 19:00:00	47.39739863	27.06124823	74.4737943
05-Oct-22 20:00:00	46.38040331	27.07078826	73.47113461
05-Oct-22 21:00:00	46.31021309	27.50773817	73.80897988
05-Oct-22 22:00:00	46.37722249	27.52980328	73.93223868
05-Oct-22 23:00:00	46.39833683	27.10465622	73.48173269
06-Oct-22 00:00:00	47.53610844	27.09059111	74.65514374
06-Oct-22 01:00:00	47.52266736	27.13079953	74.60948831
06-Oct-22 02:00:00	47.87815921	27.43332715	75.33352195
06-Oct-22 03:00:00	47.86531639	27.84476354	75.67978951
06-Oct-22 04:00:00	47.8452833	27.50838651	75.34272752
06-Oct-22 05:00:00	47.71044689	27.47517837	75.15835529

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
06-Oct-22 06:00:00	47.30664211	27.48073514	74.77728738
06-Oct-22 07:00:00	47.02035438	27.49106141	74.50521808
06-Oct-22 08:00:00	47.07284906	27.9001485	74.95045726
06-Oct-22 09:00:00	47.17413118	27.90470759	75.0512174
06-Oct-22 10:00:00	47.51357121	27.99106548	75.5042021
06-Oct-22 11:00:00	47.63550631	27.94149632	75.57123099
06-Oct-22 12:00:00	48.22035111	27.98330688	76.21467732
06-Oct-22 13:00:00	48.26634725	27.92008064	76.22504425
06-Oct-22 14:00:00	48.18435521	27.90397496	76.1145295
06-Oct-22 15:00:00	48.08656629	27.43904262	75.54625744
06-Oct-22 16:00:00	48.01696396	27.49388091	75.50858943
06-Oct-22 17:00:00	47.80969662	27.43557972	75.23921839
06-Oct-22 18:00:00	46.75338434	27.68522827	74.45158509
06-Oct-22 19:00:00	46.65324953	28.15037869	74.81753837
06-Oct-22 20:00:00	46.94977718	28.03322185	75.02155685
06-Oct-22 21:00:00	47.63143794	28.05458429	75.67501195
06-Oct-22 22:00:00	48.04332097	28.01478232	76.10678143
06-Oct-22 23:00:00	47.7709287	28.06650358	75.83616787
07-Oct-22 00:00:00	47.61446317	28.13806311	75.70532735
07-Oct-22 01:00:00	47.58394708	28.12892045	75.74597804
07-Oct-22 02:00:00	47.40093634	28.07539039	75.46162863
07-Oct-22 03:00:00	47.84943877	28.03737401	75.89553346
07-Oct-22 04:00:00	48.10552385	28.06598706	76.177909
07-Oct-22 05:00:00	48.3441516	28.08207417	76.41133118
07-Oct-22 06:00:00	48.31806755	28.13126967	76.46225131
07-Oct-22 07:00:00	48.34393374	27.58290545	75.9358601
07-Oct-22 08:00:00	48.18499586	27.59627904	75.76612769
07-Oct-22 09:00:00	47.96071095	27.5970451	75.54591921
07-Oct-22 10:00:00	48.66035546	27.85188992	76.3805596
07-Oct-22 11:00:00	48.59640249	27.95939747	76.60259671
07-Oct-22 12:00:00	48.64872678	27.70668941	76.37918515
07-Oct-22 13:00:00	48.18734656	27.7324952	75.90266588
07-Oct-22 14:00:00	47.42718527	27.71031589	75.12666109
07-Oct-22 15:00:00	47.56353548	27.71758641	75.27103276
07-Oct-22 16:00:00	47.44462331	28.04564497	75.46193271
07-Oct-22 17:00:00	47.47802014	28.11544517	75.59272936
07-Oct-22 18:00:00	47.60301632	28.10513821	75.72166485
07-Oct-22 19:00:00	47.40811327	28.08915986	75.49151103
07-Oct-22 20:00:00	46.98852264	28.07899869	75.04988013
07-Oct-22 21:00:00	46.895035	27.72898271	74.62626998
07-Oct-22 22:00:00	46.91009903	27.61683808	74.49871784
07-Oct-22 23:00:00	46.80826886	27.25332483	74.0750139
08-Oct-22 00:00:00	46.99958801	27.26046742	74.26923328

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
08-Oct-22 01:00:00	47.07334328	27.21832636	74.27548218
08-Oct-22 02:00:00	47.4893909	27.38287525	74.83282291
08-Oct-22 03:00:00	47.5340307	27.74805933	75.24958392
08-Oct-22 04:00:00	47.55556679	27.57785765	75.19158639
08-Oct-22 05:00:00	47.09689967	27.45998785	74.53249825
08-Oct-22 06:00:00	46.67346446	27.41453954	74.1015341
08-Oct-22 07:00:00	46.95218531	27.43375484	74.39598974
08-Oct-22 08:00:00	47.00376595	27.41233238	74.44780519
08-Oct-22 09:00:00	46.96299002	27.53727436	74.47728984
08-Oct-22 10:00:00	47.03656578	27.44862022	74.48199972
08-Oct-22 11:00:00	46.78418011	27.4493244	74.24289068
08-Oct-22 12:00:00	47.3510365	27.46880033	74.82125176
08-Oct-22 13:00:00	47.7355743	27.37475109	75.11480247
08-Oct-22 14:00:00	47.83746465	27.33458222	75.11573368
08-Oct-22 15:00:00	47.75762346	27.01417849	74.73655828
08-Oct-22 16:00:00	46.59168667	26.97778592	73.58159616
08-Oct-22 17:00:00	46.61543316	26.95982026	73.58622191
08-Oct-22 18:00:00	46.84929636	27.09495737	73.90466732
08-Oct-22 19:00:00	47.02488804	27.36197344	74.39849006
08-Oct-22 20:00:00	46.90665881	27.46064138	74.36141502
08-Oct-22 21:00:00	46.60591729	27.32240707	73.9282274
08-Oct-22 22:00:00	46.52973429	27.31523005	73.82400979
08-Oct-22 23:00:00	46.02707693	27.34558007	73.35041173
09-Oct-22 00:00:00	46.11720869	27.19522264	73.33613417
09-Oct-22 01:00:00	46.14649094	27.29800913	73.46553209
09-Oct-22 02:00:00	46.06855032	26.84691048	72.91842185
09-Oct-22 03:00:00	46.31244596	26.8328127	73.13683616
09-Oct-22 04:00:00	45.98859215	26.76071013	72.76603995
09-Oct-22 05:00:00	46.50971646	27.06249301	73.51451167
09-Oct-22 06:00:00	46.42968771	27.28629054	73.72111596
09-Oct-22 07:00:00	46.44776387	27.00299443	73.45581139
09-Oct-22 08:00:00	46.26175944	26.79860825	73.03339513
09-Oct-22 09:00:00	45.85771222	26.78388907	72.65531286
09-Oct-22 10:00:00	46.24192323	26.89311585	73.1566746
09-Oct-22 11:00:00	46.18727684	27.0699571	73.25957722
09-Oct-22 12:00:00	46.14879757	27.09907489	73.2220086
09-Oct-22 13:00:00	46.24715636	27.03932718	73.28963499
09-Oct-22 14:00:00	46.10375002	27.12420495	73.21411853
09-Oct-22 15:00:00	46.3333149	27.06363757	73.41932297
09-Oct-22 16:00:00	46.38629172	27.16276095	73.48925442
09-Oct-22 17:00:00	46.34198168	26.99035549	73.32790022
09-Oct-22 18:00:00	46.46578407	26.67037243	73.13175371
09-Oct-22 19:00:00	46.38518969	26.6923098	73.12383087

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
09-Oct-22 20:00:00	46.2523649	26.70699047	72.92767249
09-Oct-22 21:00:00	45.57466549	26.96709336	72.48625692
09-Oct-22 22:00:00	45.50894928	27.2115625	72.77006884
09-Oct-22 23:00:00	45.48696645	27.10933791	72.60803969
10-Oct-22 00:00:00	45.37582228	27.06308941	72.42084567
10-Oct-22 01:00:00	45.81546063	27.05908878	72.8772672
10-Oct-22 02:00:00	46.05966017	27.08513218	73.15536838
10-Oct-22 03:00:00	46.03801854	27.44083818	73.50808673
10-Oct-22 04:00:00	46.03524717	27.23200745	73.2789739
10-Oct-22 05:00:00	45.81475343	26.70096406	72.52140935
10-Oct-22 06:00:00	45.97001839	26.72728175	72.66099803
10-Oct-22 07:00:00	45.42773755	26.72361755	72.14255736
10-Oct-22 08:00:00	45.28010941	27.03268795	72.32249472
10-Oct-22 09:00:00	45.29046737	26.91829967	72.19022115
10-Oct-22 10:00:00	45.27352799	26.58027252	71.85545264
10-Oct-22 11:00:00	46.04088614	26.4715491	72.49511125
10-Oct-22 12:00:00	45.77097532	26.41655584	72.2265625
10-Oct-22 13:00:00	45.99571186	26.67447818	72.64999008
10-Oct-22 14:00:00	46.02466202	26.93019337	72.93592792
10-Oct-22 15:00:00	46.11743779	27.0458398	73.1612748
10-Oct-22 16:00:00	46.1262739	26.70818899	72.82471
10-Oct-22 17:00:00	45.6204692	26.70009571	72.32534705
10-Oct-22 18:00:00	45.81327184	26.68405148	72.51453781
10-Oct-22 19:00:00	45.73807335	26.95951197	72.7031535
10-Oct-22 20:00:00	45.71303262	27.01983706	72.7531609
10-Oct-22 21:00:00	45.7203935	26.9551573	72.65993415
10-Oct-22 22:00:00	45.65618409	27.00521459	72.68330171
10-Oct-22 23:00:00	45.61204826	26.96131516	72.59476937
11-Oct-22 00:00:00	45.37562667	27.11588273	72.49644131
11-Oct-22 01:00:00	45.42051654	26.91810848	72.31791501
11-Oct-22 02:00:00	45.3653486	26.86194807	72.24854088
11-Oct-22 03:00:00	45.49750625	26.69849096	72.18698374
11-Oct-22 04:00:00	45.44121382	26.68434391	72.12885581
11-Oct-22 05:00:00	46.3390433	26.77466498	73.11160405
11-Oct-22 06:00:00	46.50104226	27.09248186	73.61256917
11-Oct-22 07:00:00	46.42005603	27.25938447	73.66815228
11-Oct-22 08:00:00	46.06005054	27.04146936	73.11367077
11-Oct-22 09:00:00	45.45142025	27.05968066	72.51536857
11-Oct-22 10:00:00	45.76201566	27.13073942	72.93013509
11-Oct-22 11:00:00	45.57608541	26.87543117	72.4566495
11-Oct-22 12:00:00	45.6594073	26.76917166	72.37983576
11-Oct-22 13:00:00	45.6157199	26.95655526	72.58812332
11-Oct-22 14:00:00	45.55543857	26.9958258	72.53596581

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
11-Oct-22 15:00:00	45.77665096	26.92268064	72.71932305
11-Oct-22 16:00:00	45.73425632	26.9499087	72.72101381
11-Oct-22 17:00:00	45.85682784	26.53082381	72.43748728
11-Oct-22 18:00:00	45.78388151	26.58632268	72.37211651
11-Oct-22 19:00:00	45.5191288	26.30027305	71.82516191
11-Oct-22 20:00:00	45.54481845	26.373172	71.93604759
11-Oct-22 21:00:00	44.74952698	26.3723828	71.07199309
11-Oct-22 22:00:00	44.61521954	26.85395336	71.48254055
11-Oct-22 23:00:00	44.59076987	26.82663525	71.40797763
12-Oct-22 00:00:00	44.72474734	26.71018507	71.45809894
12-Oct-22 01:00:00	45.70580864	26.72057187	72.42247221
12-Oct-22 02:00:00	45.17885145	26.69658979	71.85643895
12-Oct-22 03:00:00	45.44555706	26.99655596	72.46711477
12-Oct-22 04:00:00	45.63034609	26.74477779	72.41799588
12-Oct-22 05:00:00	45.72149319	27.08298641	72.79470359
12-Oct-22 06:00:00	45.71776687	27.070202	72.80088764
12-Oct-22 07:00:00	45.39538108	27.04272676	72.42192713
12-Oct-22 08:00:00	45.83534304	27.02899564	72.86252891
12-Oct-22 09:00:00	45.90517115	26.67093111	72.57662808
12-Oct-22 10:00:00	45.85723644	26.96127563	72.8228747
12-Oct-22 11:00:00	45.72227372	26.964077	72.69160292
12-Oct-22 12:00:00	45.10020065	27.00083417	72.06908417
12-Oct-22 13:00:00	46.56580204	26.9715645	73.53820419
12-Oct-22 14:00:00	46.78910552	26.77975731	73.62042053
12-Oct-22 15:00:00	46.74167972	26.71727986	73.47279655
12-Oct-22 16:00:00	46.51672575	26.84051492	73.30981212
12-Oct-22 17:00:00	45.38095135	26.81221792	72.18708165
12-Oct-22 18:00:00	45.77303823	26.82429748	72.5894911
12-Oct-22 19:00:00	45.91961924	26.96819422	72.88731893
12-Oct-22 20:00:00	45.81496323	26.6732004	72.4795723
12-Oct-22 21:00:00	45.84800614	27.33465046	73.12910292
12-Oct-22 22:00:00	45.46538268	27.39717863	72.89781147
12-Oct-22 23:00:00	45.61313989	27.41894195	73.04487186
13-Oct-22 00:00:00	45.37530306	27.35037168	72.72679477
13-Oct-22 01:00:00	45.4782753	26.9530107	72.3953576
13-Oct-22 02:00:00	45.52077972	26.9852901	72.5124961
13-Oct-22 03:00:00	45.18873554	27.09807269	72.28194343
13-Oct-22 04:00:00	45.70656035	27.07357188	72.7748252
13-Oct-22 05:00:00	45.842524	27.05575398	72.89485338
13-Oct-22 06:00:00	46.13751348	27.04347605	73.17391417
13-Oct-22 07:00:00	46.08590868	26.75431824	72.84858322
13-Oct-22 08:00:00	45.96998978	27.34594345	73.31967248
13-Oct-22 09:00:00	46.01488135	27.36765109	73.39162085

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
13-Oct-22 10:00:00	45.42409325	27.27131945	72.7294888
13-Oct-22 11:00:00	45.3110218	27.11063332	72.43140793
13-Oct-22 12:00:00	45.20560582	26.64094151	71.84212042
13-Oct-22 13:00:00	45.44457097	27.02259032	72.45743179
13-Oct-22 14:00:00	46.02913984	27.04725214	73.07624859
13-Oct-22 15:00:00	45.6388588	27.08517946	72.70108965
13-Oct-22 16:00:00	45.76355722	27.09660365	72.87050502
13-Oct-22 17:00:00	45.84102588	26.99581051	72.81907611
13-Oct-22 18:00:00	45.68992551	26.91450257	72.62743039
13-Oct-22 19:00:00	45.75937674	27.06617396	72.82474221
13-Oct-22 20:00:00	45.37642564	27.09201867	72.49189462
13-Oct-22 21:00:00	44.72187	27.05619076	71.7740576
13-Oct-22 22:00:00	43.88462766	27.03874294	71.01828384
13-Oct-22 23:00:00	43.92894808	26.85957485	70.75492986
14-Oct-22 00:00:00	44.0375061	27.05820402	71.09280607
14-Oct-22 01:00:00	45.86758804	26.97050423	72.83174854
14-Oct-22 02:00:00	45.65765042	26.95432201	72.61684036
14-Oct-22 03:00:00	45.12983237	26.95483239	72.08705012
14-Oct-22 04:00:00	45.26377826	26.86110073	72.11521573
14-Oct-22 05:00:00	45.14378526	27.05009339	72.17285453
14-Oct-22 06:00:00	45.504378	27.05247936	72.56868362
14-Oct-22 07:00:00	45.67911127	27.06130406	72.75104862
14-Oct-22 08:00:00	45.26534886	27.06878916	72.36314053
14-Oct-22 09:00:00	45.14735964	27.19028592	72.35136456
14-Oct-22 10:00:00	45.08728239	27.03807301	72.11197366
14-Oct-22 11:00:00	45.30259683	27.04983383	72.37043211
14-Oct-22 12:00:00	45.60386827	27.09657041	72.66028002
14-Oct-22 13:00:00	45.90650728	27.07403617	72.96326065
14-Oct-22 14:00:00	46.03399701	27.12943838	73.11897331
14-Oct-22 15:00:00	46.06198968	26.76349195	72.80712636
14-Oct-22 16:00:00	46.03428502	27.17658032	73.20759032
14-Oct-22 17:00:00	45.60379791	27.20969156	72.79912207
14-Oct-22 18:00:00	45.81008275	27.23663123	73.03988478
14-Oct-22 19:00:00	45.16945351	27.80976977	72.86181725
14-Oct-22 20:00:00	45.12170876	29.32124943	74.478508
14-Oct-22 21:00:00	45.15813086	29.46525457	74.58914291
14-Oct-22 22:00:00	45.53790283	29.67062234	75.17536926
14-Oct-22 23:00:00	45.7824173	29.61607827	75.4040273
15-Oct-22 00:00:00	45.3010629	29.59964759	74.90489112
15-Oct-22 01:00:00	45.24865023	31.07646218	76.21008216
15-Oct-22 02:00:00	45.27093061	30.94789717	76.19825759
15-Oct-22 03:00:00	45.32670699	30.87590031	76.18738884
15-Oct-22 04:00:00	45.69058206	30.8739824	76.56193882

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
15-Oct-22 05:00:00	45.43258328	30.8516895	76.26853138
15-Oct-22 06:00:00	45.53144815	30.99138398	76.47848045
15-Oct-22 07:00:00	45.52212726	30.9303425	76.43677606
15-Oct-22 08:00:00	45.49995083	31.78442944	77.23655362
15-Oct-22 09:00:00	45.63776398	31.81994413	77.45682314
15-Oct-22 10:00:00	45.44307688	31.83621354	77.29236518
15-Oct-22 11:00:00	45.00324906	31.7325644	76.78281021
15-Oct-22 12:00:00	45.09532293	31.68813886	76.81246185
15-Oct-22 13:00:00	45.13176907	31.55853219	76.68129052
15-Oct-22 14:00:00	45.40340487	31.7227034	77.09398976
15-Oct-22 15:00:00	45.47588232	31.68639485	77.15148184
15-Oct-22 16:00:00	45.79026794	31.68807986	77.46805021
15-Oct-22 17:00:00	45.77881368	31.88935767	77.63354429
15-Oct-22 18:00:00	45.73633236	31.52089967	77.24655151
15-Oct-22 19:00:00	45.79756165	31.59318468	77.38315328
15-Oct-22 20:00:00	45.72344377	31.62838191	77.30225415
15-Oct-22 21:00:00	45.4892754	31.58812018	77.07680681
15-Oct-22 22:00:00	44.04863803	31.53745853	75.52076314
15-Oct-22 23:00:00	43.94198163	31.63671472	75.60828908
16-Oct-22 00:00:00	44.0427102	31.21855121	75.26154285
16-Oct-22 01:00:00	45.04136976	31.33526927	76.39188088
16-Oct-22 02:00:00	45.83315192	31.31292434	77.14405568
16-Oct-22 03:00:00	45.40531709	31.33113978	76.71700732
16-Oct-22 04:00:00	45.27651299	31.83350998	77.14209408
16-Oct-22 05:00:00	45.22998386	31.49152088	76.74046495
16-Oct-22 06:00:00	45.31728787	31.82996231	77.15630722
16-Oct-22 07:00:00	45.30281321	31.82542695	77.14512507
16-Oct-22 08:00:00	45.25439411	31.84871062	77.1023585
16-Oct-22 09:00:00	45.28485976	31.87242095	77.16370943
16-Oct-22 10:00:00	45.2703584	34.32068797	78.75915188
16-Oct-22 11:00:00	46.49969525	46.4555405	92.97483826
16-Oct-22 12:00:00	45.69764646	46.31828456	92.01814397
16-Oct-22 13:00:00	45.60669327	46.41663092	91.99074851
16-Oct-22 14:00:00	45.67668406	46.40173626	92.0899548
16-Oct-22 15:00:00	45.64034292	46.38048269	92.02189382
16-Oct-22 16:00:00	47.21896998	46.39999824	93.61696243
16-Oct-22 17:00:00	47.6648852	32.82586839	81.71392038
16-Oct-22 18:00:00	47.69130452	32.17126497	79.90082592
16-Oct-22 19:00:00	47.28402371	31.94556096	79.24839772
16-Oct-22 20:00:00	46.46213426	31.95801857	78.3981336
16-Oct-22 21:00:00	46.63684612	31.90395832	78.53323873
16-Oct-22 22:00:00	46.7916122	31.89100516	78.70165507
16-Oct-22 23:00:00	46.78105036	31.65384568	78.39788409

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
17-Oct-22 00:00:00	46.7372108	31.39148479	78.14536073
17-Oct-22 01:00:00	46.32348442	31.37972747	77.69986894
17-Oct-22 02:00:00	46.52103424	31.31480471	77.88002057
17-Oct-22 03:00:00	46.40587955	31.40948264	77.78129684
17-Oct-22 04:00:00	46.35816299	31.92480522	78.19579654
17-Oct-22 05:00:00	46.55362935	31.93679969	78.54691315
17-Oct-22 06:00:00	46.24217129	32.06708501	78.30752161
17-Oct-22 07:00:00	46.1573569	32.03632588	78.19841046
17-Oct-22 08:00:00	45.73052682	32.04684575	77.76281781
17-Oct-22 09:00:00	46.13651594	32.00715478	78.18753348
17-Oct-22 10:00:00	45.99935744	32.34945573	78.33888753
17-Oct-22 11:00:00	46.01955901	31.9022279	77.91962673
17-Oct-22 12:00:00	46.50752195	31.97044508	78.47928916
17-Oct-22 13:00:00	46.05575604	31.97303924	78.01382828
17-Oct-22 14:00:00	46.62847434	32.11473577	78.69143762
17-Oct-22 15:00:00	46.58294445	32.24337758	78.86267259
17-Oct-22 16:00:00	46.54425706	31.97675535	78.51963594
17-Oct-22 17:00:00	46.34309705	31.8634705	78.20861407
17-Oct-22 18:00:00	45.6527284	31.84095745	77.48341031
17-Oct-22 19:00:00	46.65353945	31.87997431	78.46399477
17-Oct-22 20:00:00	46.61792458	32.2521286	78.84866842
17-Oct-22 21:00:00	46.6975121	32.46349419	79.18731986
17-Oct-22 22:00:00	46.38917202	32.38438462	78.77437422
17-Oct-22 23:00:00	45.69040977	32.40587739	78.10520893
18-Oct-22 00:00:00	45.85571077	32.39767723	78.23645867
18-Oct-22 01:00:00	45.79085498	32.45658345	78.25833087
18-Oct-22 02:00:00	45.80496131	32.66290983	78.51062542
18-Oct-22 03:00:00	45.86568324	32.69419363	78.53958554
18-Oct-22 04:00:00	45.66912566	32.66563267	78.34373601
18-Oct-22 05:00:00	45.82852279	32.68048668	78.50352464
18-Oct-22 06:00:00	45.73967277	32.64207416	78.36239243
18-Oct-22 07:00:00	45.63206651	32.5745572	78.20821381
18-Oct-22 08:00:00	45.65240902	32.15975338	77.81456418
18-Oct-22 09:00:00	45.73437436	32.06960299	77.77530458
18-Oct-22 10:00:00	45.75903447	32.02008618	77.79313999
18-Oct-22 11:00:00	46.31952371	32.07466694	78.38920805
18-Oct-22 12:00:00	46.34549713	32.86420038	79.2155287
18-Oct-22 13:00:00	46.46203709	32.56356663	78.9819302
18-Oct-22 14:00:00	46.20582559	32.27289687	78.48974991
18-Oct-22 15:00:00	45.79934692	32.31219694	78.15326479
18-Oct-22 16:00:00	46.01184061	32.26835442	78.29528851
18-Oct-22 17:00:00	46.10417853	32.80101686	78.85787752
18-Oct-22 18:00:00	46.13690461	32.66448551	78.81653553

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
18-Oct-22 19:00:00	46.17177391	32.66270659	78.82600911
18-Oct-22 20:00:00	46.00235367	32.67413938	78.68963581
18-Oct-22 21:00:00	44.66526794	32.6775518	77.33648894
18-Oct-22 22:00:00	45.10650783	32.73746752	77.84436629
18-Oct-22 23:00:00	45.15451876	33.01527723	78.10545858
19-Oct-22 00:00:00	45.16015604	33.99979189	79.23687532
19-Oct-22 01:00:00	44.93897057	33.62061649	78.55759277
19-Oct-22 02:00:00	44.39335505	33.61363575	78.01445346
19-Oct-22 03:00:00	43.78278054	33.64665	77.43538941
19-Oct-22 04:00:00	43.63272942	34.11364541	77.77991542
19-Oct-22 05:00:00	43.66828452	34.80137963	78.45761405
19-Oct-22 06:00:00	44.48743481	34.57585804	79.04693307
19-Oct-22 07:00:00	47.08953285	34.60397169	81.67216407
19-Oct-22 08:00:00	46.95934592	34.61131944	81.57531102
19-Oct-22 09:00:00	46.92045826	34.50582525	81.47327098
19-Oct-22 10:00:00	46.90732765	34.23165364	81.15727488
19-Oct-22 11:00:00	46.8812561	34.40543365	81.26813592
19-Oct-22 12:00:00	46.94359313	34.61650785	81.55226771
19-Oct-22 13:00:00	46.70548333	34.56147308	81.27303823
19-Oct-22 14:00:00	46.80914603	34.45099703	81.27069177
19-Oct-22 15:00:00	46.82139969	33.9588373	80.804643
19-Oct-22 16:00:00	46.76267306	34.29654037	81.09216309
19-Oct-22 17:00:00	46.82204882	34.08979978	80.90631782
19-Oct-22 18:00:00	46.76785448	34.13948218	80.90322113
19-Oct-22 19:00:00	47.18949996	34.09396574	81.29964786
19-Oct-22 20:00:00	47.28299501	34.12205484	81.3489702
19-Oct-22 21:00:00	47.21872563	34.4800379	81.73280038
19-Oct-22 22:00:00	47.12878121	34.60683229	81.724617
19-Oct-22 23:00:00	46.81433678	34.59881507	81.40096495
20-Oct-22 00:00:00	46.89523252	34.57041889	81.46981854
20-Oct-22 01:00:00	46.28436746	34.4711919	80.77567228
20-Oct-22 02:00:00	46.25161892	34.20552497	80.44755724
20-Oct-22 03:00:00	46.22935613	34.08468225	80.34955894
20-Oct-22 04:00:00	46.7503554	34.08731609	80.80761493
20-Oct-22 05:00:00	47.1400778	34.05854797	81.18834347
20-Oct-22 06:00:00	46.04413541	34.14359326	80.14964821
20-Oct-22 07:00:00	46.01857821	34.26085197	80.29954741
20-Oct-22 08:00:00	46.01680226	34.20874638	80.26494895
20-Oct-22 09:00:00	46.19892078	33.75946524	79.94019106
20-Oct-22 10:00:00	46.8040337	33.80690702	80.61380418
20-Oct-22 11:00:00	46.32816145	33.77141349	80.13206047
20-Oct-22 12:00:00	46.57787365	34.40286686	80.90949885
20-Oct-22 13:00:00	46.6200339	34.24618636	80.88040034

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
20-Oct-22 14:00:00	46.6127065	33.82637342	80.46361584
20-Oct-22 15:00:00	47.14000066	33.77968195	80.92199368
20-Oct-22 16:00:00	46.48582437	33.77062458	80.26023822
20-Oct-22 17:00:00	46.36164898	34.10923078	80.51220332
20-Oct-22 18:00:00	46.43447198	34.19684135	80.61709807
20-Oct-22 19:00:00	46.44093513	34.22505506	80.71829944
20-Oct-22 20:00:00	46.81806225	34.00420852	80.81714249
20-Oct-22 21:00:00	46.458967	34.01674652	80.46378496
20-Oct-22 22:00:00	46.92570262	33.99651146	80.89961624
20-Oct-22 23:00:00	46.70987553	34.34627914	81.02035268
21-Oct-22 00:00:00	46.92977079	34.30275536	81.20476998
21-Oct-22 01:00:00	46.95022647	34.21307299	81.16070175
21-Oct-22 02:00:00	46.71966404	34.21666463	80.92707189
21-Oct-22 03:00:00	46.1253944	34.22185368	80.31358168
21-Oct-22 04:00:00	45.40276612	34.32121703	79.73705004
21-Oct-22 05:00:00	45.409896	34.43435054	79.83674749
21-Oct-22 06:00:00	45.38805856	34.25421418	79.67886946
21-Oct-22 07:00:00	46.53774007	34.23069742	80.78522216
21-Oct-22 08:00:00	46.85944515	34.30148655	81.15771654
21-Oct-22 09:00:00	46.84008047	34.32595762	81.1576984
21-Oct-22 10:00:00	46.78748216	34.47152583	81.23206117
21-Oct-22 11:00:00	46.79890145	34.65564092	81.4834972
21-Oct-22 12:00:00	46.54313681	34.45421826	80.99270757
21-Oct-22 13:00:00	46.31104279	34.50974433	80.8185446
21-Oct-22 14:00:00	46.43549728	34.46635257	80.89876514
21-Oct-22 15:00:00	46.31413417	34.69097169	81.03303485
21-Oct-22 16:00:00	46.26095517	34.52551884	80.79762395
21-Oct-22 17:00:00	46.27909787	34.38972261	80.65910806
21-Oct-22 18:00:00	46.49180052	34.35123274	80.84978118
21-Oct-22 19:00:00	46.90275277	34.4043983	81.31042163
21-Oct-22 20:00:00	47.2651098	34.63672617	81.8934572
21-Oct-22 21:00:00	47.25315295	34.42804697	81.67742221
21-Oct-22 22:00:00	47.30812136	34.67256228	81.99209171
21-Oct-22 23:00:00	46.92106099	34.6211942	81.55915324
22-Oct-22 00:00:00	47.0027292	34.55196804	81.54391522
22-Oct-22 01:00:00	46.88450347	34.62719091	81.49647183
22-Oct-22 02:00:00	46.8526997	34.31457795	81.18061235
22-Oct-22 03:00:00	46.93106482	34.63147912	81.53115209
22-Oct-22 04:00:00	46.69863849	34.59786007	81.27364166
22-Oct-22 05:00:00	46.64370452	34.58901147	81.22056283
22-Oct-22 06:00:00	46.08707492	34.61050542	80.6869901
22-Oct-22 07:00:00	45.9477342	34.76167841	80.63105286
22-Oct-22 08:00:00	46.09560649	34.5126614	80.67124473

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
22-Oct-22 09:00:00	46.0594991	34.03147761	80.08310954
22-Oct-22 10:00:00	46.78900443	34.03153504	80.81636471
22-Oct-22 11:00:00	46.69851112	34.04494125	80.73568726
22-Oct-22 12:00:00	47.54892943	34.36698257	81.91187244
22-Oct-22 13:00:00	47.53539679	34.01352077	81.56601249
22-Oct-22 14:00:00	47.55120892	34.63300182	82.16985957
22-Oct-22 15:00:00	46.89927673	34.54278912	81.45531188
22-Oct-22 16:00:00	46.32642259	34.584519	80.88700485
22-Oct-22 17:00:00	47.01807488	34.62631819	81.62233437
22-Oct-22 18:00:00	47.05163108	34.48365367	81.55716112
22-Oct-22 19:00:00	46.98034562	34.55412218	81.50319735
22-Oct-22 20:00:00	46.81585036	34.62061691	81.42303085
22-Oct-22 21:00:00	46.29386075	34.60298051	80.89801831
22-Oct-22 22:00:00	46.97754542	34.60095081	81.55408647
22-Oct-22 23:00:00	47.28759681	34.47775731	81.80086242
23-Oct-22 00:00:00	47.20835347	33.92430666	81.12302717
23-Oct-22 01:00:00	47.33426857	34.96824201	82.24822405
23-Oct-22 02:00:00	46.60920228	34.98773306	81.59792921
23-Oct-22 03:00:00	46.44493061	34.98743064	81.42429182
23-Oct-22 04:00:00	46.48592313	34.92882792	81.38390605
23-Oct-22 05:00:00	46.39114126	34.18521818	80.58172819
23-Oct-22 06:00:00	46.40841569	34.12348394	80.54568609
23-Oct-22 07:00:00	46.43169806	34.00908568	80.43723989
23-Oct-22 08:00:00	46.51371405	34.00827238	80.49968536
23-Oct-22 09:00:00	46.66994921	34.0064791	80.68368488
23-Oct-22 10:00:00	46.73317655	34.0995103	80.81016837
23-Oct-22 11:00:00	46.89600605	33.90534698	80.78444121
23-Oct-22 12:00:00	46.63059722	34.38263123	81.020472
23-Oct-22 13:00:00	46.71036127	34.39681943	81.1047198
23-Oct-22 14:00:00	46.49251578	34.3431299	80.84919838
23-Oct-22 15:00:00	46.66531584	34.37409839	81.01694785
23-Oct-22 16:00:00	46.53143713	34.06356939	80.59559801
23-Oct-22 17:00:00	46.6540858	34.77333577	81.3962983
23-Oct-22 18:00:00	46.84127871	34.86174562	81.70494228
23-Oct-22 19:00:00	46.85927921	34.88588206	81.7276285
23-Oct-22 20:00:00	47.39315181	34.66298697	82.08630131
23-Oct-22 21:00:00	47.31566026	33.84548986	81.13553535
23-Oct-22 22:00:00	47.35021199	34.48911413	81.84007136
23-Oct-22 23:00:00	47.2696281	34.39440611	81.66156514
24-Oct-22 00:00:00	46.73230489	34.36028406	81.09825431
24-Oct-22 01:00:00	46.01938566	34.38780297	80.39421844
24-Oct-22 02:00:00	46.20517434	34.27701254	80.5296775
24-Oct-22 03:00:00	46.0003287	34.12394884	80.08389155

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
24-Oct-22 04:00:00	46.17884	34.45629975	80.62909783
24-Oct-22 05:00:00	46.46757274	34.48208533	80.93795353
24-Oct-22 06:00:00	46.45664618	34.50090041	80.94859907
24-Oct-22 07:00:00	46.64094586	34.70759975	81.3346494
24-Oct-22 08:00:00	46.65727509	33.97955894	80.6705958
24-Oct-22 09:00:00	46.62863922	34.49789487	81.1104855
24-Oct-22 10:00:00	46.71862793	34.75667752	81.46008555
24-Oct-22 11:00:00	46.57102988	34.75875431	81.31433148
24-Oct-22 12:00:00	46.27975146	34.67455143	80.99125968
24-Oct-22 13:00:00	46.34072346	34.76574241	81.08372201
24-Oct-22 14:00:00	46.2001614	34.3491336	80.51548583
24-Oct-22 15:00:00	46.44898224	35.02872785	81.47511376
24-Oct-22 16:00:00	46.71373325	35.01717631	81.72684521
24-Oct-22 17:00:00	46.74092356	34.9872582	81.72180133
24-Oct-22 18:00:00	46.81664255	34.60891045	81.42152108
24-Oct-22 19:00:00	46.8065904	34.0874638	80.89547729
24-Oct-22 20:00:00	46.68125576	34.38231821	81.05906381
24-Oct-22 21:00:00	46.31974729	34.36755869	80.71107398
24-Oct-22 22:00:00	46.76020495	34.3619117	81.13667636
24-Oct-22 23:00:00	46.21361838	34.35228206	80.60905181
25-Oct-22 00:00:00	46.2315695	34.12640233	80.34828907
25-Oct-22 01:00:00	46.2383959	34.46205881	80.68880293
25-Oct-22 02:00:00	46.3825442	34.60352813	80.95855225
25-Oct-22 03:00:00	46.92743725	34.55688646	81.47047975
25-Oct-22 04:00:00	46.10120943	34.6021701	80.71628994
25-Oct-22 05:00:00	46.18555302	34.57100126	80.79295603
25-Oct-22 06:00:00	46.17372767	34.0293524	80.19032881
25-Oct-22 07:00:00	46.15333557	34.22325622	80.35651652
25-Oct-22 08:00:00	46.5647441	34.05928787	80.60527717
25-Oct-22 09:00:00	46.7823658	34.08668271	80.82176675
25-Oct-22 10:00:00	47.4975942	34.46199792	81.96669091
25-Oct-22 11:00:00	47.55644459	34.75631375	82.27508545
25-Oct-22 12:00:00	47.52526665	34.30935415	81.86350335
25-Oct-22 13:00:00	46.95902612	34.21707217	81.17417102
25-Oct-22 14:00:00	46.4730036	34.31039365	80.77623664
25-Oct-22 15:00:00	46.70235549	34.2249332	80.90575494
25-Oct-22 16:00:00	46.82817629	34.18565581	81.04135132
25-Oct-22 17:00:00	46.76429462	34.28105672	81.02204641
25-Oct-22 18:00:00	46.71154934	34.39941268	81.08891381
25-Oct-22 19:00:00	46.45634672	34.39874395	80.86467319
25-Oct-22 20:00:00	46.21847534	34.39414824	80.61473846
25-Oct-22 21:00:00	46.06634691	34.34475093	80.46387072
25-Oct-22 22:00:00	46.18888749	34.19770983	80.34491475

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
25-Oct-22 23:00:00	46.23358854	34.51783053	80.72214042
26-Oct-22 00:00:00	46.18510056	34.4780674	80.63302337
26-Oct-22 01:00:00	46.02686289	34.45044273	80.48682573
26-Oct-22 02:00:00	45.44468541	34.21550115	79.68661753
26-Oct-22 03:00:00	45.45592011	34.28099802	79.73084513
26-Oct-22 04:00:00	45.34554354	34.14681212	79.47996733
26-Oct-22 05:00:00	46.43116718	34.03468365	80.45698124
26-Oct-22 06:00:00	46.67120637	34.01660093	80.67211024
26-Oct-22 07:00:00	46.5331724	33.96723705	80.49780782
26-Oct-22 08:00:00	46.48894649	34.30772697	80.7918023
26-Oct-22 09:00:00	46.50978237	33.80524339	80.29546526
26-Oct-22 10:00:00	46.42479134	34.02902511	80.44300207
26-Oct-22 11:00:00	46.5017431	34.00013585	80.49155172
26-Oct-22 12:00:00	46.54777654	34.03564898	80.59761132
26-Oct-22 13:00:00	46.23189439	34.23169934	80.44487042
26-Oct-22 14:00:00	46.18710052	33.98746639	80.1754392
26-Oct-22 15:00:00	46.29677497	34.48772261	80.74268723
26-Oct-22 16:00:00	46.51493454	34.45393577	80.96936735
26-Oct-22 17:00:00	46.70154995	34.54403146	81.24977069
26-Oct-22 18:00:00	47.00882085	34.18280873	81.22497643
26-Oct-22 19:00:00	46.9022079	34.07980813	81.02836439
26-Oct-22 20:00:00	47.04524867	33.94228787	80.98813756
26-Oct-22 21:00:00	46.79516835	33.87853156	80.65099292
26-Oct-22 22:00:00	46.75237444	33.85811848	80.58180957
26-Oct-22 23:00:00	46.58069314	33.86404525	80.41858843
27-Oct-22 00:00:00	46.62443415	33.77481206	80.3671129
27-Oct-22 01:00:00	46.64532216	34.06542481	80.6744211
27-Oct-22 02:00:00	46.75969866	34.50355381	81.27615547
27-Oct-22 03:00:00	46.54117627	34.47789849	81.01089266
27-Oct-22 04:00:00	46.33208338	34.47397168	80.82239956
27-Oct-22 05:00:00	46.35220464	34.13647758	80.45071891
27-Oct-22 06:00:00	46.4399058	33.80346044	80.25736237
27-Oct-22 07:00:00	46.42169317	33.48922963	79.93110233
27-Oct-22 08:00:00	46.39947891	33.47799776	79.89894316
27-Oct-22 09:00:00	46.27183342	33.53572469	79.79759132
27-Oct-22 10:00:00	47.0011745	33.51363987	80.52566401
27-Oct-22 11:00:00	47.05032116	33.77744887	80.81092156
27-Oct-22 12:00:00	46.92451986	34.25961759	81.11972512
27-Oct-22 13:00:00	46.80769793	34.56944529	81.39804628
27-Oct-22 14:00:00	46.49403233	34.5505494	81.0394037
27-Oct-22 15:00:00	46.48077965	34.57985309	81.08505503
27-Oct-22 16:00:00	46.43423208	33.52099588	79.96051746
27-Oct-22 17:00:00	46.3239691	33.69330067	80.02587933

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
27-Oct-22 18:00:00	46.71477381	34.40178808	81.11784193
27-Oct-22 19:00:00	46.34243329	34.37217267	80.72317547
27-Oct-22 20:00:00	46.62608295	34.38299495	81.01972919
27-Oct-22 21:00:00	46.52626504	33.93778642	80.53648271
27-Oct-22 22:00:00	46.52004623	33.68588151	80.18764793
27-Oct-22 23:00:00	46.48551114	34.22770564	80.67897966
28-Oct-22 00:00:00	46.39224879	34.3841646	80.7851766
28-Oct-22 01:00:00	46.72468291	34.46581883	81.18267441
28-Oct-22 02:00:00	45.6376862	34.30727111	79.94840325
28-Oct-22 03:00:00	45.63756286	33.75871298	79.3928176
28-Oct-22 04:00:00	45.66667557	34.28682794	79.88192919
28-Oct-22 05:00:00	46.06528473	34.51014031	80.55883408
28-Oct-22 06:00:00	46.6686289	34.44900273	81.13413535
28-Oct-22 07:00:00	45.89326943	34.45135356	80.35398314
28-Oct-22 08:00:00	45.89747408	34.04019695	79.8997612
28-Oct-22 09:00:00	45.96018918	34.01268111	79.95552784
28-Oct-22 10:00:00	45.94431856	34.19658018	80.14289135
28-Oct-22 11:00:00	46.55324894	34.22000715	80.76195662
28-Oct-22 12:00:00	46.00775846	34.24221437	80.24647903
28-Oct-22 13:00:00	46.2405707	33.92288208	80.21320407
28-Oct-22 14:00:00	46.29090712	34.08183946	80.32865291
28-Oct-22 15:00:00	46.29958619	33.88231405	80.17854436
28-Oct-22 16:00:00	46.894278	33.92773676	80.8321796
28-Oct-22 17:00:00	46.36106979	33.87891515	80.26313061
28-Oct-22 18:00:00	47.56957139	33.87269225	81.44409561
28-Oct-22 19:00:00	47.66064432	33.8476518	81.50286441
28-Oct-22 20:00:00	47.70155589	33.72824754	81.41776699
28-Oct-22 21:00:00	47.13043404	33.87220256	81.01291546
28-Oct-22 22:00:00	46.2172415	33.8468286	80.08151062
28-Oct-22 23:00:00	46.58898905	33.86747965	80.46401723
29-Oct-22 00:00:00	46.22258313	34.09937965	80.27414788
29-Oct-22 01:00:00	46.29349666	34.12412559	80.4364463
29-Oct-22 02:00:00	46.25696225	33.80216175	80.03639433
29-Oct-22 03:00:00	46.06269794	33.8997819	79.98103036
29-Oct-22 04:00:00	46.23392953	33.84752009	80.09623082
29-Oct-22 05:00:00	45.90671306	33.88600201	79.76711909
29-Oct-22 06:00:00	45.85238033	34.08734025	79.95925564
29-Oct-22 07:00:00	45.87356016	33.48652289	79.38205804
29-Oct-22 08:00:00	46.12052727	33.27162022	79.39850786
29-Oct-22 09:00:00	46.25201056	33.2738141	79.52080621
29-Oct-22 10:00:00	46.48413213	33.29061487	79.76942995
29-Oct-22 11:00:00	46.53249635	33.91898282	80.43964005
29-Oct-22 12:00:00	46.5126595	33.77753046	80.34762255

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
29-Oct-22 13:00:00	46.41322327	33.25672227	79.67225944
29-Oct-22 14:00:00	46.07674768	33.26695654	79.32928255
29-Oct-22 15:00:00	45.81283315	33.3549295	79.14892663
29-Oct-22 16:00:00	45.44561852	33.5703844	78.98534097
29-Oct-22 17:00:00	45.49474525	33.8916058	79.41617457
29-Oct-22 18:00:00	45.5690155	33.48432562	79.07350625
29-Oct-22 19:00:00	46.57863426	33.43590461	80.00641039
29-Oct-22 20:00:00	46.5303936	33.40687116	79.93196572
29-Oct-22 21:00:00	46.60518498	33.46061622	80.0777075
29-Oct-22 22:00:00	46.57622867	33.69785086	80.26007101
29-Oct-22 23:00:00	46.67263921	33.52039719	80.19475767
30-Oct-22 00:00:00	46.69356961	33.51364588	80.20405112
30-Oct-22 01:00:00	46.46903695	33.49277901	79.96461868
30-Oct-22 02:00:00	45.37669881	33.47937686	78.85508262
30-Oct-22 03:00:00	44.86564	33.79216173	78.65243954
30-Oct-22 04:00:00	44.99161805	33.74760267	78.77961977
30-Oct-22 05:00:00	45.19775433	33.26818106	78.46969138
30-Oct-22 06:00:00	46.06362025	33.26262686	79.33181
30-Oct-22 07:00:00	45.71807946	33.29396608	79.02669356
30-Oct-22 08:00:00	45.49167464	33.46084819	78.95774926
30-Oct-22 09:00:00	45.54076661	33.74548552	79.27997377
30-Oct-22 10:00:00	45.50062391	33.64938312	79.10709296
30-Oct-22 11:00:00	46.05263138	33.7625601	79.79818916
30-Oct-22 12:00:00	46.13243654	33.78196059	79.90836038
30-Oct-22 13:00:00	46.09939935	33.70765874	79.81188202
30-Oct-22 14:00:00	46.03360134	33.64471287	79.69139523
30-Oct-22 15:00:00	46.00981246	33.47928598	79.53440475
30-Oct-22 16:00:00	46.29071426	33.40471244	79.68119197
30-Oct-22 17:00:00	46.28765869	33.40419006	79.66587914
30-Oct-22 18:00:00	46.94792196	33.40187518	80.33711667
30-Oct-22 19:00:00	47.40739928	33.57644755	80.96188397
30-Oct-22 20:00:00	47.22079998	33.56668154	80.76658249
30-Oct-22 21:00:00	47.04533492	33.28010707	80.31986109
30-Oct-22 22:00:00	46.34423425	33.31915442	79.63729731
30-Oct-22 23:00:00	46.7522085	33.31673421	80.05212784
31-Oct-22 00:00:00	46.53069475	33.43922696	79.94329029
31-Oct-22 01:00:00	46.46591123	33.78133509	80.20504888
31-Oct-22 02:00:00	46.48582798	33.50862948	79.99971644
31-Oct-22 03:00:00	46.55149523	33.53608699	80.10581674
31-Oct-22 04:00:00	46.57971467	33.4525742	80.01135254
31-Oct-22 05:00:00	45.99147532	33.45779345	79.45699798
31-Oct-22 06:00:00	46.06651158	33.89993032	79.91520564
31-Oct-22 07:00:00	46.00143878	33.62829547	79.67056303

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
31-Oct-22 08:00:00	45.86862055	33.39994269	79.25599569
31-Oct-22 09:00:00	46.57435481	33.36785083	79.93547609
31-Oct-22 10:00:00	46.34071562	33.38668537	79.75932566
31-Oct-22 11:00:00	46.53766823	33.8878301	80.38933521
31-Oct-22 12:00:00	46.41901504	34.15349939	80.54070409
31-Oct-22 13:00:00	46.54592027	33.41771762	79.98233965
31-Oct-22 14:00:00	46.63128853	33.41495683	80.05028958
31-Oct-22 15:00:00	45.98007266	33.4286527	79.38892788
31-Oct-22 16:00:00	46.22678905	33.45672318	79.70824291
31-Oct-22 17:00:00	46.22286012	33.78281	79.99051984
31-Oct-22 18:00:00	46.27530162	33.58700562	79.87055567
31-Oct-22 19:00:00	46.69673856	33.65669371	80.35277656
31-Oct-22 20:00:00	46.4213668	33.6574848	80.05382623
31-Oct-22 21:00:00	47.07124519	33.66568339	80.72664515
31-Oct-22 22:00:00	47.02768008	33.61644893	80.63328976
31-Oct-22 23:00:00	47.00305939	33.95613437	81.02662489
01-Nov-22 00:00:00	46.95040109	33.40468788	80.33036988
01-Nov-22 01:00:00	45.9851123	33.44069629	79.40896077
01-Nov-22 02:00:00	45.93914859	33.36973529	79.32259157
01-Nov-22 03:00:00	45.50209173	33.80379857	79.32665507
01-Nov-22 04:00:00	45.52391137	33.99390263	79.52030309
01-Nov-22 05:00:00	45.49610477	33.85047277	79.34277132
01-Nov-22 06:00:00	46.20350393	33.78114149	79.97946379
01-Nov-22 07:00:00	46.07208167	33.75885857	79.83116531
01-Nov-22 08:00:00	45.9434007	33.81806109	79.78205363
01-Nov-22 09:00:00	45.88405863	33.67430962	79.58030828
01-Nov-22 10:00:00	45.85515001	33.97696792	79.82987976
01-Nov-22 11:00:00	46.00888697	33.98540751	80.00924534
01-Nov-22 12:00:00	46.39063856	33.98783497	80.35487366
01-Nov-22 13:00:00	46.77919091	34.03114107	80.81016329
01-Nov-22 14:00:00	46.75387849	33.75890356	80.51911813
01-Nov-22 15:00:00	46.9024601	33.95328161	80.86988972
01-Nov-22 16:00:00	46.67462709	33.77384726	80.43570921
01-Nov-22 17:00:00	45.93872197	33.77586555	79.69481871
01-Nov-22 18:00:00	46.61378627	33.76008966	80.38221147
01-Nov-22 19:00:00	47.46765497	34.08163802	81.59616258
01-Nov-22 20:00:00	47.50319354	33.78840605	81.2972316
01-Nov-22 21:00:00	47.54054917	33.54053978	81.07047272
01-Nov-22 22:00:00	46.53645219	33.58678648	80.11404843
01-Nov-22 23:00:00	46.31767704	33.52195729	79.82498014
02-Nov-22 00:00:00	46.23331791	33.64139769	79.8478614
02-Nov-22 01:00:00	46.22553274	33.9842951	80.20992279
02-Nov-22 02:00:00	46.29550446	34.40840071	80.7052909

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
02-Nov-22 03:00:00	46.47575124	34.22159047	80.69291744
02-Nov-22 04:00:00	46.24355083	34.24073996	80.47172123
02-Nov-22 05:00:00	45.50966708	34.18107202	79.69015736
02-Nov-22 06:00:00	45.41387812	34.22849023	79.61239115
02-Nov-22 07:00:00	45.24681483	34.10998832	79.35036031
02-Nov-22 08:00:00	45.45527946	33.81566917	79.25352393
02-Nov-22 09:00:00	46.40167088	33.75973786	80.1405894
02-Nov-22 10:00:00	46.29692735	33.79926745	80.10510508
02-Nov-22 11:00:00	47.01209259	33.8897597	80.92352041
02-Nov-22 12:00:00	47.02718269	34.03697353	81.02400419
02-Nov-22 13:00:00	47.00497564	33.58312819	80.63572545
02-Nov-22 14:00:00	46.66151301	33.377478	80.02889082
02-Nov-22 15:00:00	46.14463827	33.4026484	79.52159585
02-Nov-22 16:00:00	45.79594103	33.47476853	79.24448988
02-Nov-22 17:00:00	45.8194277	33.87456926	79.73556688
02-Nov-22 18:00:00	45.74916564	33.98561287	79.72613292
02-Nov-22 19:00:00	46.15068012	34.00282881	80.1490523
02-Nov-22 20:00:00	46.30627611	34.0185265	80.32953474
02-Nov-22 21:00:00	46.15027025	34.02330137	80.16852315
02-Nov-22 22:00:00	46.0171975	33.91600121	79.93279153
02-Nov-22 23:00:00	46.01326964	34.02425363	80.04373678
03-Nov-22 00:00:00	45.97703807	33.55342229	79.51681561
03-Nov-22 01:00:00	46.456977	33.53178151	79.9843839
03-Nov-22 02:00:00	46.42788463	33.4948828	79.91873508
03-Nov-22 03:00:00	45.0674093	33.70332209	78.75628055
03-Nov-22 04:00:00	45.03314463	34.0427297	79.05349265
03-Nov-22 05:00:00	44.98299832	33.98616042	78.99732378
03-Nov-22 06:00:00	45.62858242	33.59038427	79.23153263
03-Nov-22 07:00:00	46.53420957	33.66338433	80.18037711
03-Nov-22 08:00:00	45.35950322	33.64933798	78.98827023
03-Nov-22 09:00:00	45.35367817	33.9030482	79.22212643
03-Nov-22 10:00:00	45.28800922	33.70861287	78.98198446
03-Nov-22 11:00:00	45.50719855	33.39517339	78.92282698
03-Nov-22 12:00:00	46.69303322	33.40933281	80.11296103
03-Nov-22 13:00:00	45.9040112	33.39040961	79.29691272
03-Nov-22 14:00:00	45.86978277	33.91136106	79.8083992
03-Nov-22 15:00:00	45.86074681	34.02696164	79.81943978
03-Nov-22 16:00:00	45.88294962	33.74589899	79.64966287
03-Nov-22 17:00:00	46.87482452	33.66766965	80.53145133
03-Nov-22 18:00:00	46.51907984	33.6707147	80.19945399
03-Nov-22 19:00:00	47.38870388	33.77383169	81.13987033
03-Nov-22 20:00:00	47.52702332	33.77652062	81.29627948
03-Nov-22 21:00:00	47.54451667	34.00120693	81.54577976

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
03-Nov-22 22:00:00	47.05184831	33.75101111	80.78480021
03-Nov-22 23:00:00	46.11291016	33.75619528	79.86583794
04-Nov-22 00:00:00	46.42013613	33.74889826	80.17835024
04-Nov-22 01:00:00	46.27142461	33.85938602	80.12921312
04-Nov-22 02:00:00	46.45654933	34.18157154	80.61511951
04-Nov-22 03:00:00	46.34108692	34.15767479	80.49656762
04-Nov-22 04:00:00	46.28982311	34.11346647	80.40483729
04-Nov-22 05:00:00	46.01696947	34.11214172	80.13167275
04-Nov-22 06:00:00	45.38341395	34.09258178	79.48954646
04-Nov-22 07:00:00	45.48459095	33.70734554	79.17937024
04-Nov-22 08:00:00	45.3717111	33.84825897	79.24230745
04-Nov-22 09:00:00	46.03537369	33.85042747	79.86269421
04-Nov-22 10:00:00	46.48241552	33.74922689	80.2177603
04-Nov-22 11:00:00	47.18655438	33.81510078	80.97719235
04-Nov-22 12:00:00	47.17841975	33.88047134	81.08019426
04-Nov-22 13:00:00	47.20751656	34.04274686	81.25066479
04-Nov-22 14:00:00	46.82648426	33.75371263	80.57387882
04-Nov-22 15:00:00	46.3376219	33.75646623	80.08330282
04-Nov-22 16:00:00	46.8912468	33.73956779	80.6362542
04-Nov-22 17:00:00	46.87260373	34.0043168	80.87872781
04-Nov-22 18:00:00	46.88567119	33.95103264	80.84889857
04-Nov-22 19:00:00	46.8311225	33.94324727	80.82039091
04-Nov-22 20:00:00	45.98499277	34.03477259	80.00885815
04-Nov-22 21:00:00	46.56728999	34.04544979	80.59599092
04-Nov-22 22:00:00	46.82035107	34.24274084	81.00789798
04-Nov-22 23:00:00	46.94561132	33.77596537	80.74541092
05-Nov-22 00:00:00	46.89077907	33.95437039	80.86588796
05-Nov-22 01:00:00	46.84376293	33.73724204	80.57050634
05-Nov-22 02:00:00	46.63912752	33.78287146	80.42454317
05-Nov-22 03:00:00	46.12546179	33.76359473	79.8855061
05-Nov-22 04:00:00	46.11929554	33.94581731	80.08377669
05-Nov-22 05:00:00	46.19629796	33.87160386	80.04692261
05-Nov-22 06:00:00	46.17503505	34.03627099	80.18847976
05-Nov-22 07:00:00	46.22972234	34.21907156	80.45904626
05-Nov-22 08:00:00	46.13976627	34.23082751	80.34744517
05-Nov-22 09:00:00	46.07816484	34.22808584	80.29798423
05-Nov-22 10:00:00	46.18620978	35.54579459	81.08394538
05-Nov-22 11:00:00	47.04291831	45.94288079	93.0024609
05-Nov-22 12:00:00	46.77497673	45.89633772	92.68769836
05-Nov-22 13:00:00	46.76868757	45.93274854	92.664107
05-Nov-22 14:00:00	46.79131614	45.99915038	92.78485107
05-Nov-22 15:00:00	46.83517583	46.01617146	92.8453776
05-Nov-22 16:00:00	48.93247117	45.88187099	94.82152566

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
05-Nov-22 17:00:00	49.42251015	36.4029825	85.83843189
05-Nov-22 18:00:00	49.49528525	34.53432613	84.02988858
05-Nov-22 19:00:00	48.8151385	34.77360619	83.56930542
05-Nov-22 20:00:00	46.55837165	34.74392628	81.28429455
05-Nov-22 21:00:00	46.42481867	34.78907426	81.2156762
05-Nov-22 22:00:00	46.52133263	34.50923453	81.04169761
05-Nov-22 23:00:00	46.35013623	34.3045436	80.66382556
06-Nov-22 00:00:00	46.37988769	34.62634277	81.00300542
06-Nov-22 01:00:00	46.56926579	34.80083063	81.35184309
06-Nov-22 01:00:00	46.56613795	34.8094973	81.35719829
06-Nov-22 02:00:00	46.96000332	34.71198999	81.65319146
06-Nov-22 03:00:00	46.87134976	34.4043151	81.2973459
06-Nov-22 04:00:00	46.90955438	34.13106982	81.05209732
06-Nov-22 05:00:00	46.8677508	34.41537264	81.24886548
06-Nov-22 06:00:00	46.36125077	34.37661171	80.73025809
06-Nov-22 07:00:00	46.15008185	34.35479408	80.46665976
06-Nov-22 08:00:00	46.13997926	34.38710531	80.50356123
06-Nov-22 09:00:00	46.16821967	34.37376319	80.58505207
06-Nov-22 10:00:00	46.25864198	34.58277533	80.81579378
06-Nov-22 11:00:00	46.33527311	34.54089576	80.89342414
06-Nov-22 12:00:00	46.08430057	34.65299394	80.74026955
06-Nov-22 13:00:00	46.37135908	34.30905738	80.69763247
06-Nov-22 14:00:00	46.53030947	34.89855088	81.38431196
06-Nov-22 15:00:00	46.38772774	34.65642187	81.04072613
06-Nov-22 16:00:00	46.68018066	34.90812853	81.59343889
06-Nov-22 17:00:00	46.60977236	34.87812297	81.46464242
06-Nov-22 18:00:00	46.65893894	34.83583772	81.48008601
06-Nov-22 19:00:00	46.61809391	34.16167736	80.79460843
06-Nov-22 20:00:00	46.58739154	34.313582	80.87829293
06-Nov-22 21:00:00	46.73033312	34.59139729	81.32098219
06-Nov-22 22:00:00	46.51558876	34.58284329	81.08772532
06-Nov-22 23:00:00	47.19808133	34.59196748	81.81035656
07-Nov-22 00:00:00	47.40706274	34.19560793	81.65253364
07-Nov-22 01:00:00	47.36226612	34.38744503	81.70875231
07-Nov-22 02:00:00	47.38019647	34.05389849	81.41538323
07-Nov-22 03:00:00	46.48855951	34.02919911	80.52257156
07-Nov-22 04:00:00	46.52468088	34.02963702	80.55575053
07-Nov-22 05:00:00	45.44391378	33.89798666	79.36498303
07-Nov-22 06:00:00	45.37989638	34.26142671	79.59880426
07-Nov-22 07:00:00	45.38958613	33.85494995	79.2486325
07-Nov-22 08:00:00	46.18798235	33.7899769	79.9582918
07-Nov-22 09:00:00	46.88741091	33.807724	80.69326062
07-Nov-22 10:00:00	46.32590866	33.78392195	80.12788645

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
07-Nov-22 11:00:00	46.46303431	34.28765361	80.66277525
07-Nov-22 12:00:00	46.34884877	34.19980155	80.60225126
07-Nov-22 13:00:00	46.42296155	34.52685229	80.90687137
07-Nov-22 14:00:00	46.6642206	34.43273224	81.1196501
07-Nov-22 15:00:00	46.67209074	34.50385567	81.17826674
07-Nov-22 16:00:00	46.89705849	34.24116728	81.14426888
07-Nov-22 17:00:00	47.01953803	34.42623117	81.48229938
07-Nov-22 18:00:00	46.88146231	34.19441329	81.06040276
07-Nov-22 19:00:00	46.75460476	34.2944355	81.01011615
07-Nov-22 20:00:00	46.4480256	34.23784479	80.70333735
07-Nov-22 21:00:00	47.57275931	34.30348969	81.90837638
07-Nov-22 22:00:00	47.48469586	34.44220691	81.93099312
07-Nov-22 23:00:00	47.56475237	34.10745218	81.68145328
08-Nov-22 00:00:00	47.39842563	34.09883181	81.50712204
08-Nov-22 01:00:00	46.76023822	34.03902117	80.76780446
08-Nov-22 02:00:00	46.78544829	34.03829621	80.80951818
08-Nov-22 03:00:00	46.80354606	34.18104431	80.98637772
08-Nov-22 04:00:00	46.89403894	34.29264365	81.2039939
08-Nov-22 05:00:00	46.76193322	34.39181105	81.14532534
08-Nov-22 06:00:00	46.42078696	34.40033136	80.81131278
08-Nov-22 07:00:00	46.26271227	34.40105708	80.64577166
08-Nov-22 08:00:00	46.06438022	34.28747749	80.31739256
08-Nov-22 09:00:00	46.04681502	34.6714753	80.73508877
08-Nov-22 10:00:00	46.03106647	33.87645234	79.91831758
08-Nov-22 11:00:00	46.42736096	33.88499295	80.28982226
08-Nov-22 12:00:00	46.54191271	33.91011916	80.45187675
08-Nov-22 13:00:00	46.58585887	33.91372426	80.47746828
08-Nov-22 14:00:00	46.6980506	34.38028336	81.08872011
08-Nov-22 15:00:00	46.56582726	33.75834274	80.36451721
08-Nov-22 16:00:00	46.7201945	33.37647205	80.11282391
08-Nov-22 17:00:00	46.57504612	33.38458538	79.95355352
08-Nov-22 18:00:00	47.19458559	33.42721423	80.60280238
08-Nov-22 19:00:00	47.43179321	34.10115772	81.47320832
08-Nov-22 20:00:00	47.3222207	34.25613128	81.60059992
08-Nov-22 21:00:00	47.24685393	33.5105434	80.78218079
08-Nov-22 22:00:00	46.49625524	33.5021117	80.06138568
08-Nov-22 23:00:00	46.59146839	33.53031787	80.12188975
09-Nov-22 00:00:00	46.65828027	33.89722917	80.52505853
09-Nov-22 01:00:00	46.6224325	34.77430895	81.39969254
09-Nov-22 02:00:00	46.61721526	34.28334215	80.88860406
09-Nov-22 03:00:00	46.58875614	34.15362846	80.7269566
09-Nov-22 04:00:00	46.66104105	34.14684889	80.80919308
09-Nov-22 05:00:00	46.07898161	34.2070362	80.24554316

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
09-Nov-22 06:00:00	46.05659421	34.80772188	80.84992345
09-Nov-22 07:00:00	46.00177553	34.69875103	80.74204381
09-Nov-22 08:00:00	46.11959012	34.50045082	80.60575994
09-Nov-22 09:00:00	46.73708449	34.46928194	81.20160506
09-Nov-22 10:00:00	46.74892892	34.52534718	81.27837584
09-Nov-22 11:00:00	47.11875979	34.36568981	81.49073255
09-Nov-22 12:00:00	47.16695129	34.7447851	81.91191694
09-Nov-22 13:00:00	47.24259101	34.72698733	81.98161697
09-Nov-22 14:00:00	46.46684371	34.76851979	81.2166409
09-Nov-22 15:00:00	46.28611035	34.75984568	81.0695254
09-Nov-22 16:00:00	46.19893286	34.70720257	80.8675376
09-Nov-22 17:00:00	46.28756777	34.85460292	81.18509505
09-Nov-22 18:00:00	46.27770318	34.51995701	80.79127163
09-Nov-22 19:00:00	46.56216685	34.59314844	81.14869881
09-Nov-22 20:00:00	46.29421043	34.51612678	80.82505756
09-Nov-22 21:00:00	46.85795191	34.51869873	81.3692415
09-Nov-22 22:00:00	46.57209184	34.45664406	81.01012887
09-Nov-22 23:00:00	46.7192351	34.29333305	81.03918754
10-Nov-22 00:00:00	46.70947584	34.11181026	80.8034988
10-Nov-22 01:00:00	46.47159259	34.16905446	80.64595498
10-Nov-22 02:00:00	46.33023559	34.12691402	80.45208528
10-Nov-22 03:00:00	46.08594301	34.3919304	80.46785037
10-Nov-22 04:00:00	46.07289653	34.56333796	80.61889776
10-Nov-22 05:00:00	45.91070324	34.55031805	80.47627174
10-Nov-22 06:00:00	46.14827728	34.51948547	80.64735074
10-Nov-22 07:00:00	46.48239856	34.51586702	80.99938838
10-Nov-22 08:00:00	46.51976034	34.68624179	81.1736482
10-Nov-22 09:00:00	46.54504034	34.43443065	80.99182553
10-Nov-22 10:00:00	46.55521414	34.05735185	80.62065591
10-Nov-22 11:00:00	46.51027891	33.96759005	80.46478116
10-Nov-22 12:00:00	46.58193737	33.80440972	80.40638415
10-Nov-22 13:00:00	46.57054414	33.87372091	80.4144249
10-Nov-22 14:00:00	46.37756793	34.06858804	80.36859385
10-Nov-22 15:00:00	46.41011069	34.35018052	80.82220417
10-Nov-22 16:00:00	46.44119898	34.12204742	80.55186519
10-Nov-22 17:00:00	45.99404547	34.14624924	80.13486269
10-Nov-22 18:00:00	46.09679328	34.14233285	80.23341412
10-Nov-22 19:00:00	45.80951669	34.35473922	80.15528234
10-Nov-22 20:00:00	45.82790078	34.19145415	80.02212906
10-Nov-22 21:00:00	45.91737938	33.76558601	79.67388937
10-Nov-22 22:00:00	46.31281471	33.72705693	80.02024545
10-Nov-22 23:00:00	46.61753061	33.7323744	80.31572511
11-Nov-22 00:00:00	45.51605225	33.75393931	79.20753098

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
11-Nov-22 01:00:00	45.49136967	34.23883714	79.73889414
11-Nov-22 02:00:00	45.53788927	33.92949465	79.49037509
11-Nov-22 03:00:00	45.71021758	33.62596009	79.34774441
11-Nov-22 04:00:00	46.20555348	33.64890438	79.8550646
11-Nov-22 05:00:00	45.90588125	33.65682983	79.56501728
11-Nov-22 06:00:00	46.01778687	33.73787604	79.77592723
11-Nov-22 07:00:00	46.04444016	34.36098819	80.35266452
11-Nov-22 08:00:00	46.03058751	33.86981752	79.8943367
11-Nov-22 09:00:00	46.00378164	33.88345831	79.88225047
11-Nov-22 10:00:00	45.74512927	33.90067284	79.6290156
11-Nov-22 11:00:00	46.11437649	32.12963461	78.47509003
11-Nov-22 12:00:00	46.11628405	29.42244	75.49377569
11-Nov-22 13:00:00	46.25344382	29.26491801	75.51590602
11-Nov-22 14:00:00	46.16961182	29.31174819	75.44348187
11-Nov-22 15:00:00	45.54751587	29.28129612	74.82220756
11-Nov-22 16:00:00	47.10365401	29.37911383	76.49485609
11-Nov-22 17:00:00	47.16712464	28.42136214	75.6313839
11-Nov-22 18:00:00	47.17936537	28.35553063	75.58019723
11-Nov-22 19:00:00	46.81154717	27.90072703	74.7319172
11-Nov-22 20:00:00	45.56005753	27.93789229	73.52393383
11-Nov-22 21:00:00	46.13785807	27.76257762	73.90930345
11-Nov-22 22:00:00	46.26336649	27.05659882	73.3097407
11-Nov-22 23:00:00	46.28811243	26.27705553	72.50175476
12-Nov-22 00:00:00	46.33151097	25.75728067	72.09087753
12-Nov-22 01:00:00	45.77932146	25.69620662	71.48484929
12-Nov-22 02:00:00	45.62311935	25.68728107	71.29325655
12-Nov-22 03:00:00	45.49357584	25.63240397	71.15731698
12-Nov-22 04:00:00	45.49977112	25.17908902	70.71399731
12-Nov-22 05:00:00	45.54691654	25.43963464	70.98187722
12-Nov-22 06:00:00	45.76059914	25.46791373	71.23443646
12-Nov-22 07:00:00	46.18942218	25.44461971	71.63468848
12-Nov-22 08:00:00	46.44330661	25.44285006	71.87655682
12-Nov-22 09:00:00	46.62568347	25.07048819	71.71606255
12-Nov-22 10:00:00	46.60349168	25.29538653	71.85755327
12-Nov-22 11:00:00	46.53285302	25.3441252	71.86404885
12-Nov-22 12:00:00	45.93759071	25.35646364	71.27532853
12-Nov-22 13:00:00	45.87134785	25.38091638	71.23540031
12-Nov-22 14:00:00	46.33251211	25.39491487	71.73558172
12-Nov-22 15:00:00	46.20303853	25.38327673	71.57289251
12-Nov-22 16:00:00	46.27366299	25.29024045	71.56156413
12-Nov-22 17:00:00	45.95177375	25.36368676	71.32867177
12-Nov-22 18:00:00	45.98053127	25.37096568	71.34221141
12-Nov-22 19:00:00	45.72635629	25.34168699	71.06987084

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
12-Nov-22 20:00:00	45.73019769	24.9495946	70.70869403
12-Nov-22 21:00:00	45.79784817	25.26716169	71.05593999
12-Nov-22 22:00:00	45.8736585	25.1845274	71.0686192
12-Nov-22 23:00:00	45.98435444	25.16978455	71.14195357
13-Nov-22 00:00:00	45.53198285	25.19252493	70.71687317
13-Nov-22 01:00:00	45.48695501	24.95115937	70.46855418
13-Nov-22 02:00:00	45.50375578	24.81741948	70.31121233
13-Nov-22 03:00:00	45.51382362	24.41111586	69.95020252
13-Nov-22 04:00:00	45.7604599	24.401339	70.15326818
13-Nov-22 05:00:00	45.69576708	24.41491392	70.12094625
13-Nov-22 06:00:00	46.40162426	24.61045219	71.02107705
13-Nov-22 07:00:00	46.4917984	24.8472574	71.31039153
13-Nov-22 08:00:00	46.45937114	24.86451011	71.31554943
13-Nov-22 09:00:00	46.14563009	24.88020963	70.98277495
13-Nov-22 10:00:00	45.46794701	24.84552016	70.30374824
13-Nov-22 11:00:00	45.50441721	24.90819719	70.40632107
13-Nov-22 12:00:00	45.54514525	24.75625658	70.35642327
13-Nov-22 13:00:00	45.5317048	24.69281684	70.22002821
13-Nov-22 14:00:00	45.64723566	24.81521326	70.44964642
13-Nov-22 15:00:00	45.57913378	24.87577645	70.44605467
13-Nov-22 16:00:00	45.66224077	24.84624728	70.50512695
13-Nov-22 17:00:00	45.40879292	24.89529967	70.23539649
13-Nov-22 18:00:00	45.39975484	24.78665702	70.14586894
13-Nov-22 19:00:00	45.45080227	24.75092983	70.19075902
13-Nov-22 20:00:00	45.58466593	24.77599398	70.3518397
13-Nov-22 21:00:00	45.33932135	24.70663558	70.05953089
13-Nov-22 22:00:00	44.65831206	24.82171178	69.48894018
13-Nov-22 23:00:00	44.64681117	24.60107178	69.25096865
14-Nov-22 00:00:00	44.6982477	24.49021022	69.17141215
14-Nov-22 01:00:00	45.17917252	24.28237618	69.44553672
14-Nov-22 02:00:00	45.91838794	24.25991671	70.21768358
14-Nov-22 03:00:00	46.10462676	24.3480622	70.41988881
14-Nov-22 04:00:00	46.06609217	24.68287765	70.79730705
14-Nov-22 05:00:00	46.19256274	24.67433018	70.91779709
14-Nov-22 06:00:00	46.02186288	24.37001839	70.37472054
14-Nov-22 07:00:00	45.94290076	24.39888145	70.33447732
14-Nov-22 08:00:00	45.82600615	24.41747587	70.23305469
14-Nov-22 09:00:00	45.70944362	24.73760401	70.45498021
14-Nov-22 10:00:00	45.88825734	24.95713128	70.84851244
14-Nov-22 11:00:00	45.71936777	24.71892272	70.43692398
14-Nov-22 12:00:00	46.11022207	24.64371586	70.73122533
14-Nov-22 13:00:00	46.19928614	24.65098254	70.84856895
14-Nov-22 14:00:00	46.00026597	24.82814033	70.81868235

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
14-Nov-22 15:00:00	45.98479504	24.85924689	70.85071903
14-Nov-22 16:00:00	46.05800502	24.90429963	70.95044412
14-Nov-22 17:00:00	46.28696929	24.7833596	71.07258426
14-Nov-22 18:00:00	46.47125753	24.75653031	71.23118146
14-Nov-22 19:00:00	45.87959904	24.7220127	70.59275436
14-Nov-22 20:00:00	45.72139549	25.08951159	70.7718722
14-Nov-22 21:00:00	45.7799227	25.15667966	70.95792516
14-Nov-22 22:00:00	45.86827257	25.07446225	70.97323015
14-Nov-22 23:00:00	46.65906143	25.11959429	71.74287881
15-Nov-22 00:00:00	46.44040404	25.1091316	71.53831567
15-Nov-22 01:00:00	46.94327799	25.32838917	72.21451323
15-Nov-22 02:00:00	46.72334035	25.24649726	71.94830132
15-Nov-22 03:00:00	46.82691002	25.26891128	72.08798854
15-Nov-22 04:00:00	46.45389091	25.20529864	71.66526837
15-Nov-22 05:00:00	46.48795064	25.17040095	71.68114514
15-Nov-22 06:00:00	46.00928285	25.23697938	71.23608865
15-Nov-22 07:00:00	46.06439718	25.35107687	71.42962964
15-Nov-22 08:00:00	46.03349664	25.27427101	71.2990871
15-Nov-22 09:00:00	46.50050502	25.14751813	71.65901184
15-Nov-22 10:00:00	46.55098936	25.21670151	71.73851522
15-Nov-22 11:00:00	46.88821072	25.18111372	72.11171383
15-Nov-22 12:00:00	46.84415415	25.41932259	72.22181638
15-Nov-22 13:00:00	46.80789608	25.29584418	72.09035026
15-Nov-22 14:00:00	46.75182618	25.3733316	72.10078939
15-Nov-22 15:00:00	46.83745554	25.34757915	72.18245019
15-Nov-22 16:00:00	46.22568491	25.33923822	71.54990684
15-Nov-22 17:00:00	44.98149342	25.42417134	70.39652549
15-Nov-22 18:00:00	45.04312918	25.25266139	70.32059564
15-Nov-22 19:00:00	45.02418221	25.50655054	70.49722163
15-Nov-22 20:00:00	45.96830644	25.32636865	71.32336468
15-Nov-22 21:00:00	46.730299	25.36257331	72.08477402
15-Nov-22 22:00:00	46.47079468	25.39489049	71.83753755
15-Nov-22 23:00:00	46.41531817	25.25209743	71.69037671
16-Nov-22 00:00:00	46.34043376	25.11594825	71.41578759
16-Nov-22 01:00:00	46.28886011	25.1010348	71.40555106
16-Nov-22 02:00:00	46.86105135	25.11246363	71.95451016
16-Nov-22 03:00:00	46.60910903	25.10979292	71.7149993
16-Nov-22 04:00:00	47.01599354	25.10194785	72.18908903
16-Nov-22 05:00:00	46.968519	25.00152853	71.91268667
16-Nov-22 06:00:00	47.10024261	24.8993401	71.99387932
16-Nov-22 07:00:00	46.727936	24.83417935	71.54803509
16-Nov-22 08:00:00	46.50515768	24.83405569	71.32222324
16-Nov-22 09:00:00	47.10473548	25.02788035	72.09833753

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
16-Nov-22 10:00:00	47.14716424	25.01479912	72.18699095
16-Nov-22 11:00:00	47.20532015	25.21337085	72.42285283
16-Nov-22 12:00:00	46.99340863	25.03864325	72.03154755
16-Nov-22 13:00:00	46.53640599	25.12468274	71.66136254
16-Nov-22 14:00:00	47.14336713	25.0955244	72.23847749
16-Nov-22 15:00:00	46.95730506	25.11043994	72.08267869
16-Nov-22 16:00:00	47.06122631	25.0051828	72.05044344
16-Nov-22 17:00:00	47.04068989	25.09312909	72.11773823
16-Nov-22 18:00:00	46.58105257	25.08066387	71.67098999
16-Nov-22 19:00:00	46.62000571	25.07257077	71.7049658
16-Nov-22 20:00:00	46.53986782	25.23213106	71.78981724
16-Nov-22 21:00:00	46.65426869	24.99224779	71.65014097
16-Nov-22 22:00:00	46.50019624	25.14459366	71.63014306
16-Nov-22 23:00:00	46.13688024	25.04569105	71.19794824
17-Nov-22 00:00:00	46.32093853	25.10026423	71.41250314
17-Nov-22 01:00:00	47.00707542	25.19211378	72.19823343
17-Nov-22 02:00:00	47.0451995	25.02955405	72.09611087
17-Nov-22 03:00:00	46.96656969	25.14829392	72.09912533
17-Nov-22 04:00:00	46.98189587	25.18548092	72.18414222
17-Nov-22 05:00:00	47.10954115	25.17489144	72.25590727
17-Nov-22 06:00:00	46.8103004	25.19662642	72.02630001
17-Nov-22 07:00:00	46.73165173	25.27009542	71.96878603
17-Nov-22 08:00:00	46.85152774	25.0968487	71.92644374
17-Nov-22 09:00:00	46.86002668	25.40394481	72.29047139
17-Nov-22 10:00:00	46.64282121	25.43998983	72.08138529
17-Nov-22 11:00:00	47.2944177	25.43726192	72.71685028
17-Nov-22 12:00:00	47.50960456	25.41345427	72.93787342
17-Nov-22 13:00:00	47.47225189	24.90785747	72.37309223
17-Nov-22 14:00:00	47.50899378	25.14891614	72.68307538
17-Nov-22 15:00:00	47.07433425	25.06071822	72.16595953
17-Nov-22 16:00:00	46.96667046	25.10860984	72.05774964
17-Nov-22 17:00:00	45.62652291	25.09154987	70.71623739
17-Nov-22 18:00:00	45.66871018	25.23133797	70.90871175
17-Nov-22 19:00:00	45.70093282	25.05425053	70.71982066
17-Nov-22 20:00:00	46.00225279	25.31222644	71.31436756
17-Nov-22 21:00:00	46.69186762	25.32327362	72.02159627
17-Nov-22 22:00:00	46.30885315	25.29427315	71.61000273
17-Nov-22 23:00:00	46.3517509	25.30022642	71.65686713
18-Nov-22 00:00:00	46.43411446	25.0642649	71.5188569
18-Nov-22 01:00:00	46.42781629	25.54405954	71.93548838
18-Nov-22 02:00:00	46.92603069	25.5333882	72.44865714
18-Nov-22 03:00:00	46.68541336	25.50008371	72.18020206
18-Nov-22 04:00:00	46.9044554	25.58040743	72.46906106

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
18-Nov-22 05:00:00	46.96627786	25.3309323	72.35008558
18-Nov-22 06:00:00	47.06215201	25.43829091	72.42652257
18-Nov-22 07:00:00	47.12546433	25.40201689	72.53347312
18-Nov-22 08:00:00	46.67571322	25.39994476	72.0821245
18-Nov-22 09:00:00	47.75092167	25.47726493	73.21976768
18-Nov-22 10:00:00	47.95019023	25.18743112	73.15492323
18-Nov-22 11:00:00	47.88644854	25.18614128	73.02844323
18-Nov-22 12:00:00	47.74992794	25.36124279	73.08004888
18-Nov-22 13:00:00	46.98427497	25.35662024	72.33062829
18-Nov-22 14:00:00	47.29327265	25.35993552	72.65637037
18-Nov-22 15:00:00	47.30324025	25.31658779	72.62079762
18-Nov-22 16:00:00	47.22309473	25.01743984	72.24646759
18-Nov-22 17:00:00	47.45193651	25.48066881	72.90905507
18-Nov-22 18:00:00	46.92044682	25.51539223	72.42912801
18-Nov-22 19:00:00	46.69615788	25.535147	72.23021359
18-Nov-22 20:00:00	46.09828907	25.50480003	71.58661058
18-Nov-22 21:00:00	46.02548536	25.28236304	71.32626597
18-Nov-22 22:00:00	46.02877278	25.00945667	71.04700428
18-Nov-22 23:00:00	46.28420957	24.98893837	71.26718161
19-Nov-22 00:00:00	47.13540755	25.02081513	72.15781911
19-Nov-22 01:00:00	47.41298654	24.97765589	72.39112218
19-Nov-22 02:00:00	47.48674817	25.28838038	72.77425257
19-Nov-22 03:00:00	47.4669963	25.02911917	72.5039266
19-Nov-22 04:00:00	47.40926933	25.07691924	72.47021018
19-Nov-22 05:00:00	47.21241548	25.0865244	72.28099781
19-Nov-22 06:00:00	46.85212898	25.08638908	71.90974087
19-Nov-22 07:00:00	46.98706097	25.21585359	72.17562315
19-Nov-22 08:00:00	46.86489932	25.00022136	71.91955778
19-Nov-22 09:00:00	46.83918699	25.16694238	72.00263765
19-Nov-22 10:00:00	46.80381457	25.15429242	71.96095297
19-Nov-22 11:00:00	46.88553725	25.20045927	72.08125715
19-Nov-22 12:00:00	46.77575493	25.19049249	71.97109858
19-Nov-22 13:00:00	46.75346459	25.20421561	71.91913732
19-Nov-22 14:00:00	46.82841704	25.00797272	71.82122718
19-Nov-22 15:00:00	47.02128474	25.22582325	72.23802355
19-Nov-22 16:00:00	46.73198891	25.15112178	71.87697347
19-Nov-22 17:00:00	46.13053173	25.14729357	71.32679303
19-Nov-22 18:00:00	46.00784429	25.16673317	71.18067042
19-Nov-22 19:00:00	46.08251296	24.93144544	71.05401781
19-Nov-22 20:00:00	46.18287341	25.09678396	71.28222783
19-Nov-22 21:00:00	46.876393	25.05776829	71.95729277
19-Nov-22 22:00:00	46.53136402	25.08378022	71.6063847
19-Nov-22 23:00:00	46.52878147	25.16442537	71.65232962

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
20-Nov-22 00:00:00	46.54398621	25.22022798	71.75846863
20-Nov-22 01:00:00	46.46434975	25.17438539	71.64618132
20-Nov-22 02:00:00	46.55027962	25.33592153	71.88966228
20-Nov-22 03:00:00	46.7626364	25.32938696	72.07498678
20-Nov-22 04:00:00	46.56922171	25.32528676	71.9202101
20-Nov-22 05:00:00	46.55264007	25.09153084	71.65320841
20-Nov-22 06:00:00	46.54857784	24.87680848	71.38522339
20-Nov-22 07:00:00	46.75481097	25.15135903	71.89561517
20-Nov-22 08:00:00	46.84414397	25.20511986	72.0132353
20-Nov-22 09:00:00	47.28523593	25.1380416	72.45224211
20-Nov-22 10:00:00	47.41321352	25.21799022	72.65431362
20-Nov-22 11:00:00	47.3635877	24.99474918	72.35212029
20-Nov-22 12:00:00	47.34838655	25.3314121	72.67237727
20-Nov-22 13:00:00	46.78884549	25.34627414	72.10665003
20-Nov-22 14:00:00	46.97480159	25.34137445	72.31036165
20-Nov-22 15:00:00	45.10008346	25.23582466	70.33083965
20-Nov-22 16:00:00	45.16635619	25.28678237	70.44694533
20-Nov-22 17:00:00	45.05419498	25.12268268	70.17987993
20-Nov-22 18:00:00	45.80247773	25.19207138	71.01352098
20-Nov-22 19:00:00	46.80953111	25.17252456	71.99106895
20-Nov-22 20:00:00	45.73093075	25.2408322	70.95508787
20-Nov-22 21:00:00	45.682724	25.06941795	70.78945457
20-Nov-22 22:00:00	45.61767027	24.91416917	70.54061508
20-Nov-22 23:00:00	45.81828584	25.32295442	71.15552394
21-Nov-22 00:00:00	46.80473942	25.31318933	72.13648987
21-Nov-22 01:00:00	46.54695808	25.30888197	71.86982642
21-Nov-22 02:00:00	46.80662621	25.30482794	72.09918637
21-Nov-22 03:00:00	46.79231114	25.26338932	72.02568287
21-Nov-22 04:00:00	46.85457272	25.29812972	72.14527257
21-Nov-22 05:00:00	46.79150592	25.32576815	72.11076164
21-Nov-22 06:00:00	46.42044873	25.33062698	71.73018858
21-Nov-22 07:00:00	47.5593302	25.32356832	72.88950178
21-Nov-22 08:00:00	47.508955	25.29281913	72.81193373
21-Nov-22 09:00:00	47.52570428	25.20305612	72.71999465
21-Nov-22 10:00:00	47.47702217	25.33976565	72.82143699
21-Nov-22 11:00:00	47.02337138	25.35501102	72.36528736
21-Nov-22 12:00:00	47.07675531	25.29480733	72.35999171
21-Nov-22 13:00:00	47.03352017	25.27378266	72.34007772
21-Nov-22 14:00:00	47.01184548	25.14728652	72.16179954
21-Nov-22 15:00:00	47.04245038	25.54946306	72.58248817
21-Nov-22 16:00:00	46.55268012	25.53473261	72.08008787
21-Nov-22 17:00:00	46.65155941	25.57763619	72.20094342
21-Nov-22 18:00:00	46.34138107	25.43326388	71.76863903

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
21-Nov-22 19:00:00	46.25630951	25.44230853	71.68387985
21-Nov-22 20:00:00	46.18916363	25.37579685	71.54045147
21-Nov-22 21:00:00	46.38683213	25.5810592	71.94894536
21-Nov-22 22:00:00	46.51362822	25.57254993	72.08005185
21-Nov-22 23:00:00	47.37843598	25.49257967	72.91832097
22-Nov-22 00:00:00	47.37181833	25.10890304	72.5095698
22-Nov-22 01:00:00	47.3470993	25.02676914	72.32724296
22-Nov-22 02:00:00	47.29357571	25.45441553	72.73098402
22-Nov-22 03:00:00	46.73888122	25.38766261	72.1438018
22-Nov-22 04:00:00	47.18777593	25.43004649	72.61757702
22-Nov-22 05:00:00	47.23607869	25.21092569	72.44646242
22-Nov-22 06:00:00	47.25614781	24.99365759	72.29461585
22-Nov-22 07:00:00	47.23230277	25.31874535	72.51329358
22-Nov-22 08:00:00	46.88300429	25.3273741	72.22232649
22-Nov-22 09:00:00	46.92071067	25.37226426	72.32764675
22-Nov-22 10:00:00	46.97747019	25.15176031	72.15215273
22-Nov-22 11:00:00	46.94222132	25.09471967	71.99322637
22-Nov-22 12:00:00	47.00167868	24.93921966	71.9378713
22-Nov-22 13:00:00	47.03078228	25.09910937	72.13418706
22-Nov-22 14:00:00	47.13352776	25.12676186	72.25794969
22-Nov-22 15:00:00	46.68469556	25.06796349	71.74025048
22-Nov-22 16:00:00	46.79569425	24.98249658	71.77370453
22-Nov-22 17:00:00	46.80212	24.71060799	71.54270829
22-Nov-22 18:00:00	46.60717201	24.72124336	71.31714418
22-Nov-22 19:00:00	46.93326526	24.74459165	71.6694781
22-Nov-22 20:00:00	46.8783936	24.73131493	71.61905204
22-Nov-22 21:00:00	47.15300051	24.91039488	72.06434992
22-Nov-22 22:00:00	47.15969827	25.02000427	72.20076222
22-Nov-22 23:00:00	47.26651849	24.84394497	72.09773805
23-Nov-22 00:00:00	46.99417983	24.85502858	71.83746719
23-Nov-22 01:00:00	46.67824046	24.81865475	71.49463823
23-Nov-22 02:00:00	46.44971932	24.90454557	71.32710732
23-Nov-22 03:00:00	46.55220646	25.13289022	71.73846181
23-Nov-22 04:00:00	46.53774558	24.93128289	71.47674984
23-Nov-22 05:00:00	46.95360629	24.9692049	71.92967394
23-Nov-22 06:00:00	47.0071072	25.00115077	71.96368832
23-Nov-22 07:00:00	47.19293022	24.963281	72.16603512
23-Nov-22 08:00:00	47.18287235	24.99078369	72.20413801
23-Nov-22 09:00:00	47.1644107	25.04607285	72.17913395
23-Nov-22 10:00:00	47.23593118	24.81169918	72.05698607
23-Nov-22 11:00:00	46.90763601	24.80262767	71.71322038
23-Nov-22 12:00:00	46.71676996	24.85417112	71.55922233
23-Nov-22 13:00:00	46.06611972	24.95243814	70.95257794

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
23-Nov-22 14:00:00	46.11902915	25.1070563	71.26783371
23-Nov-22 15:00:00	46.07843208	24.91836951	71.01317215
23-Nov-22 16:00:00	46.49865765	24.98326418	71.47565587
23-Nov-22 17:00:00	46.5326555	25.0117569	71.52011787
23-Nov-22 18:00:00	46.14416822	25.03826035	71.15250185
23-Nov-22 19:00:00	46.15863482	25.19006454	71.36602826
23-Nov-22 20:00:00	46.14507633	25.02452172	71.18806726
23-Nov-22 21:00:00	46.50313886	25.2284029	71.71901745
23-Nov-22 22:00:00	47.24959056	25.14819279	72.39817852
23-Nov-22 23:00:00	46.97321722	25.16014552	72.11741532
24-Nov-22 00:00:00	46.69184515	25.05550989	71.73834356
24-Nov-22 01:00:00	46.87695864	25.23605484	72.07723914
24-Nov-22 02:00:00	46.75402705	25.05967106	71.80336465
24-Nov-22 03:00:00	47.06968901	25.08607727	72.1510476
24-Nov-22 04:00:00	47.2168471	25.08015563	72.28414663
24-Nov-22 05:00:00	47.66785516	25.20400611	72.88543946
24-Nov-22 06:00:00	47.46372943	25.40317737	72.80706448
24-Nov-22 07:00:00	47.52054109	24.90650325	72.42494541
24-Nov-22 08:00:00	46.9602765	24.74955232	71.69933573
24-Nov-22 09:00:00	46.93036355	24.72918818	71.67134137
24-Nov-22 10:00:00	46.4356255	24.70572669	71.16381158
24-Nov-22 11:00:00	46.41653124	25.311139	71.72653467
24-Nov-22 12:00:00	46.45756658	25.02482499	71.56437725
24-Nov-22 13:00:00	46.52332687	24.68303977	71.20510449
24-Nov-22 14:00:00	46.79044257	24.68012388	71.48967658
24-Nov-22 15:00:00	46.41016282	24.73248503	71.15801112
24-Nov-22 16:00:00	46.4194141	25.21209203	71.53714879
24-Nov-22 17:00:00	46.39617051	25.46677621	71.9012786
24-Nov-22 18:00:00	46.49408277	25.07978259	71.54936112
24-Nov-22 19:00:00	46.96024428	25.10485423	72.05203968
24-Nov-22 20:00:00	46.28172112	25.11618389	71.37003708
24-Nov-22 21:00:00	46.04937511	25.10149235	71.17769114
24-Nov-22 22:00:00	46.11660428	25.28788673	71.40780767
24-Nov-22 23:00:00	46.22434023	25.1461508	71.37519158
25-Nov-22 00:00:00	46.8106113	25.12058555	71.93150626
25-Nov-22 01:00:00	46.85353279	25.06912655	71.91265382
25-Nov-22 02:00:00	47.80283758	25.07529174	72.87365468
25-Nov-22 03:00:00	47.81671015	25.00397714	72.84487809
25-Nov-22 04:00:00	47.79950354	24.97700606	72.82123078
25-Nov-22 05:00:00	47.737193	25.4012014	73.07027732
25-Nov-22 06:00:00	47.74814351	26.11405712	73.87975029
25-Nov-22 07:00:00	47.86405139	26.14805258	73.97543759
25-Nov-22 08:00:00	47.80583869	26.16020595	73.95989532

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
25-Nov-22 09:00:00	47.72710186	27.2756218	74.95619795
25-Nov-22 10:00:00	47.79831929	45.84206249	93.62014092
25-Nov-22 11:00:00	47.9563569	45.84789297	93.81795544
25-Nov-22 12:00:00	47.98501926	45.89692243	93.89587869
25-Nov-22 13:00:00	48.00481309	45.83100068	93.84519139
25-Nov-22 14:00:00	47.99663713	45.86255942	93.87577099
25-Nov-22 15:00:00	48.64018906	45.87862576	94.48337733
25-Nov-22 16:00:00	48.92166371	28.23503494	78.25897513
25-Nov-22 17:00:00	48.89289559	25.51718828	74.40735923
25-Nov-22 18:00:00	48.7660461	25.05367378	73.79543813
25-Nov-22 19:00:00	47.78485001	24.96033223	72.73732546
25-Nov-22 20:00:00	47.22333484	25.02602302	72.22229936
25-Nov-22 21:00:00	47.29583677	25.16568629	72.45824136
25-Nov-22 22:00:00	47.26597722	25.02890597	72.27936469
25-Nov-22 23:00:00	47.27817599	24.95366274	72.25910653
26-Nov-22 00:00:00	47.73458714	24.83207996	72.5616489
26-Nov-22 01:00:00	47.40370962	24.83741881	72.23035558
26-Nov-22 02:00:00	46.9944174	24.90951317	71.88210297
26-Nov-22 03:00:00	46.99673716	25.2047969	72.18582747
26-Nov-22 04:00:00	46.95768102	25.18787953	72.12808312
26-Nov-22 05:00:00	47.44602691	25.08095067	72.53077104
26-Nov-22 06:00:00	47.56017219	25.0866749	72.63778644
26-Nov-22 07:00:00	47.90638754	25.09119329	72.99652269
26-Nov-22 08:00:00	47.92610338	25.14867751	73.05582499
26-Nov-22 09:00:00	47.87061501	25.06960958	72.91938294
26-Nov-22 10:00:00	47.85875554	24.84090911	72.72053457
26-Nov-22 11:00:00	47.70120663	24.85961382	72.58919419
26-Nov-22 12:00:00	47.52312597	24.83267275	72.36200417
26-Nov-22 13:00:00	45.82042185	25.0639272	70.87921694
26-Nov-22 14:00:00	45.72855102	25.13066313	70.86074829
26-Nov-22 15:00:00	45.84315321	25.21751457	71.07908122
26-Nov-22 16:00:00	46.69304339	25.07683961	71.75824709
26-Nov-22 17:00:00	47.6583733	25.06927702	72.72366672
26-Nov-22 18:00:00	46.57005819	25.09429377	71.65527429
26-Nov-22 19:00:00	46.54871856	25.21510124	71.78043577
26-Nov-22 20:00:00	46.44608498	25.16617669	71.6323026
26-Nov-22 21:00:00	46.75572077	24.99714751	71.72175492
26-Nov-22 22:00:00	47.84652032	24.96029112	72.82189263
26-Nov-22 23:00:00	47.66138013	25.02044694	72.6792912
27-Nov-22 00:00:00	47.79957411	25.21416463	72.953022
27-Nov-22 01:00:00	47.75628853	25.14754226	72.92257987
27-Nov-22 02:00:00	47.86142434	25.01998954	72.91061656
27-Nov-22 03:00:00	47.8147992	24.97785197	72.78934055

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
27-Nov-22 04:00:00	47.58566411	24.98021558	72.54175511
27-Nov-22 05:00:00	48.4020053	25.1653257	73.57639864
27-Nov-22 06:00:00	48.44408438	25.24581252	73.66353141
27-Nov-22 07:00:00	48.39420573	25.37441466	73.82139771
27-Nov-22 08:00:00	47.89066378	25.15075144	73.0475697
27-Nov-22 09:00:00	47.38219388	25.18649869	72.59173923
27-Nov-22 10:00:00	47.15306452	25.46969795	72.61820263
27-Nov-22 11:00:00	47.02555063	27.2772256	74.22697067
27-Nov-22 12:00:00	46.99592188	27.44118839	74.39731386
27-Nov-22 13:00:00	47.1467976	27.52999295	74.71502368
27-Nov-22 14:00:00	47.64703051	27.8885479	75.5332578
27-Nov-22 15:00:00	46.99174478	27.89748183	74.89180756
27-Nov-22 16:00:00	46.99524413	28.95331817	75.95315848
27-Nov-22 17:00:00	47.11329121	29.70149379	76.79650752
27-Nov-22 18:00:00	47.01319122	31.14868097	78.12803819
27-Nov-22 19:00:00	47.202233	31.19676288	78.41879951
27-Nov-22 20:00:00	47.19724719	31.18401277	78.3802681
27-Nov-22 21:00:00	47.90039635	31.25463221	79.13907581
27-Nov-22 22:00:00	47.82230377	31.15574752	78.97958755
27-Nov-22 23:00:00	47.70620155	32.21977033	79.90355555
28-Nov-22 00:00:00	47.70797454	32.67568101	80.39592912
28-Nov-22 01:00:00	47.36777433	32.72386572	80.06342358
28-Nov-22 02:00:00	48.07342784	32.69664425	80.75570297
28-Nov-22 03:00:00	48.39092255	32.82817671	81.20838292
28-Nov-22 04:00:00	48.3540234	33.17304823	81.49903064
28-Nov-22 05:00:00	48.23868412	33.13864009	81.36837853
28-Nov-22 06:00:00	47.3579553	33.14988221	80.49910355
28-Nov-22 07:00:00	47.67458428	33.12390709	80.79782274
28-Nov-22 08:00:00	47.84225951	33.44908513	81.31424777
28-Nov-22 09:00:00	47.77485339	33.3253266	81.11390389
28-Nov-22 10:00:00	47.74553299	33.75975185	81.50296317
28-Nov-22 11:00:00	47.42285411	33.82638762	81.26066335
28-Nov-22 12:00:00	47.46500884	33.85569551	81.3452691
28-Nov-22 13:00:00	47.07138199	33.98607508	80.96538417
28-Nov-22 14:00:00	47.19814385	34.72325473	81.96249771
28-Nov-22 15:00:00	47.0820944	34.62942017	81.69469862
28-Nov-22 16:00:00	47.05927828	34.42101987	81.49953037
28-Nov-22 17:00:00	47.49647374	34.37092103	81.86343087
28-Nov-22 18:00:00	47.6301206	34.41324345	82.02616077
28-Nov-22 19:00:00	48.26353603	34.73567846	83.01506113
28-Nov-22 20:00:00	48.25966093	34.12363349	82.33332683
28-Nov-22 21:00:00	48.23067114	34.48396407	82.75951174
28-Nov-22 22:00:00	47.59440994	34.45375349	82.05875058

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
28-Nov-22 23:00:00	46.90568119	34.467524	81.36561584
29-Nov-22 00:00:00	47.49441465	34.48871316	81.98009449
29-Nov-22 01:00:00	47.50043678	34.12469228	81.66108068
29-Nov-22 02:00:00	47.67231221	34.87427224	82.55037774
29-Nov-22 03:00:00	47.51387151	35.20931731	82.71763145
29-Nov-22 04:00:00	47.05735397	35.19837157	82.25586912
29-Nov-22 05:00:00	47.58425861	35.20688544	82.78304418
29-Nov-22 06:00:00	47.64541096	34.5557766	82.26438141
29-Nov-22 07:00:00	47.68008762	34.34044139	81.97565079
29-Nov-22 08:00:00	47.70276769	34.58305995	82.28005303
29-Nov-22 09:00:00	46.99225447	34.65881305	81.63049316
29-Nov-22 10:00:00	46.93706809	34.59720838	81.54901123
29-Nov-22 11:00:00	46.54727809	34.32736821	80.88590198
29-Nov-22 12:00:00	46.52602937	34.15642569	80.66034147
29-Nov-22 13:00:00	46.526975	34.49114015	81.00116052
29-Nov-22 14:00:00	46.92995495	34.44197077	81.38934029
29-Nov-22 15:00:00	46.92965465	34.4947656	81.42965147
29-Nov-22 16:00:00	47.03547117	34.56357755	81.60689629
29-Nov-22 17:00:00	47.20704587	34.46287473	81.70652941
29-Nov-22 18:00:00	46.89355787	34.38574621	81.2197017
29-Nov-22 19:00:00	47.02112283	34.49712367	81.52234989
29-Nov-22 20:00:00	47.26619254	34.46455125	81.7577006
29-Nov-22 21:00:00	46.77006192	34.54030322	81.26465819
29-Nov-22 22:00:00	46.53837946	34.61689123	81.21178267
29-Nov-22 23:00:00	46.47511885	34.26840676	80.70980623
30-Nov-22 00:00:00	46.76544995	34.6874485	81.44661162
30-Nov-22 01:00:00	47.12013499	34.56543258	81.67508104
30-Nov-22 02:00:00	47.22352282	34.59585232	81.8194383
30-Nov-22 03:00:00	47.02965927	34.51713912	81.53700935
30-Nov-22 04:00:00	47.0447375	34.1260643	81.16579564
30-Nov-22 05:00:00	46.96667565	34.43236853	81.40632545
30-Nov-22 06:00:00	46.90101751	34.4305954	81.36745241
30-Nov-22 07:00:00	46.98360019	34.48113039	81.45995839
30-Nov-22 08:00:00	45.75817574	34.42669966	80.20505545
30-Nov-22 09:00:00	45.77169228	34.33318117	80.11272197
30-Nov-22 10:00:00	45.71237797	34.6667294	80.32268058
30-Nov-22 11:00:00	46.07021946	35.15429391	81.20498668
30-Nov-22 12:00:00	46.95404731	35.12337022	82.09294934
30-Nov-22 13:00:00	46.15230581	35.06786927	81.24686665
30-Nov-22 14:00:00	46.29164378	34.55006041	80.84988757
30-Nov-22 15:00:00	46.24056753	33.98086527	80.20976851
30-Nov-22 16:00:00	46.32003212	34.46934128	80.8085395
30-Nov-22 17:00:00	47.36374728	34.46050898	81.83296034

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
30-Nov-22 18:00:00	46.69456524	34.4817276	81.17563248
30-Nov-22 19:00:00	46.54207251	34.32304834	80.86253823
30-Nov-22 20:00:00	46.52594927	34.47396304	81.01932653
30-Nov-22 21:00:00	46.54624685	34.82464918	81.31380124
30-Nov-22 22:00:00	47.00192536	35.03310638	82.02639177
30-Nov-22 23:00:00	46.74032275	34.97396077	81.70412064
01-Dec-22 00:00:00	47.14520009	35.02212312	82.17602963
01-Dec-22 01:00:00	47.16493797	34.69817924	81.90513865
01-Dec-22 02:00:00	47.17972162	34.53788694	81.65178977
01-Dec-22 03:00:00	47.21401914	34.46554343	81.66817474
01-Dec-22 04:00:00	46.56952095	34.49234263	81.06002172
01-Dec-22 05:00:00	46.16030969	34.53834407	80.68767844
01-Dec-22 06:00:00	45.38739438	34.88469429	80.25754674
01-Dec-22 07:00:00	45.53493987	34.29542542	79.84729618
01-Dec-22 08:00:00	45.34817886	34.8308838	80.19350306
01-Dec-22 09:00:00	46.84163094	34.85346674	81.67497296
01-Dec-22 10:00:00	46.74260097	34.89724816	81.61745792
01-Dec-22 11:00:00	46.26355447	34.4847544	80.78851785
01-Dec-22 12:00:00	46.28069221	34.62235811	80.86591424
01-Dec-22 13:00:00	46.31805738	34.55105125	80.82796436
01-Dec-22 14:00:00	46.54629548	34.78818872	81.30469047
01-Dec-22 15:00:00	46.76013544	34.74440553	81.50174628
01-Dec-22 16:00:00	46.81354353	34.75634554	81.54568651
01-Dec-22 17:00:00	46.55232578	34.45572652	81.03121567
01-Dec-22 18:00:00	46.50072161	34.37222184	80.82183456
01-Dec-22 19:00:00	46.73859363	34.46966934	81.22517302
01-Dec-22 20:00:00	47.02392515	34.53592318	81.53797184
01-Dec-22 21:00:00	47.54756037	34.4338239	81.97629547
01-Dec-22 22:00:00	47.60179117	34.53447872	82.10499573
01-Dec-22 23:00:00	47.63051436	34.29863845	81.94618267
02-Dec-22 00:00:00	47.63274765	34.10318809	81.74086846
02-Dec-22 01:00:00	47.02962176	34.24498923	81.2678549
02-Dec-22 02:00:00	47.3923484	34.20158513	81.58948771
02-Dec-22 03:00:00	46.69223679	34.37996207	81.05921046
02-Dec-22 04:00:00	46.60013178	34.71134398	81.35075209
02-Dec-22 05:00:00	46.49414868	34.32954937	80.86750327
02-Dec-22 06:00:00	46.72002093	34.49161063	81.18106291
02-Dec-22 07:00:00	47.27226024	34.53551934	81.79182646
02-Dec-22 08:00:00	46.49352455	34.45468669	80.95186954
02-Dec-22 09:00:00	46.58854442	34.3150574	80.86698956
02-Dec-22 10:00:00	46.63250139	33.97215229	80.59654829
02-Dec-22 11:00:00	46.65114551	34.64874946	81.29526138
02-Dec-22 12:00:00	47.38364834	34.52432781	81.93079207

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
02-Dec-22 13:00:00	47.13059404	34.57530785	81.73330349
02-Dec-22 14:00:00	47.56527392	34.42881047	82.00065062
02-Dec-22 15:00:00	47.64290004	34.30521668	81.95943536
02-Dec-22 16:00:00	47.47044839	34.21341832	81.6562784
02-Dec-22 17:00:00	47.33490668	34.52471214	81.86260711
02-Dec-22 18:00:00	47.05789481	34.49758805	81.55913332
02-Dec-22 19:00:00	47.91682201	34.41605462	82.37242423
02-Dec-22 20:00:00	47.99056689	34.70465607	82.70345253
02-Dec-22 21:00:00	48.01798863	33.99773661	82.02802489
02-Dec-22 22:00:00	47.82503382	34.62158351	82.42466897
02-Dec-22 23:00:00	47.07061111	34.61404207	81.65772374
03-Dec-22 00:00:00	47.69996198	34.57298809	82.27271059
03-Dec-22 01:00:00	47.89910041	34.29150115	82.20997238
03-Dec-22 02:00:00	48.00050227	34.0401499	82.0280092
03-Dec-22 03:00:00	47.86346775	34.66796218	82.50373416
03-Dec-22 04:00:00	47.25819927	34.72187839	81.9893536
03-Dec-22 05:00:00	47.20945507	34.74354504	81.93622843
03-Dec-22 06:00:00	47.30319066	34.46106193	81.84833315
03-Dec-22 07:00:00	47.28762054	34.28905932	81.60865529
03-Dec-22 08:00:00	47.25376362	34.10950915	81.35548189
03-Dec-22 09:00:00	47.04463408	34.14128092	81.17786958
03-Dec-22 10:00:00	46.97012605	34.13282225	81.09347619
03-Dec-22 11:00:00	47.2941157	34.05913784	81.40876304
03-Dec-22 12:00:00	47.27843179	34.08677906	81.38755586
03-Dec-22 13:00:00	47.21560065	33.72440402	80.92699284
03-Dec-22 14:00:00	47.2795336	33.76540587	81.03519376
03-Dec-22 15:00:00	47.03643841	33.74448889	80.79902522
03-Dec-22 16:00:00	47.99000062	33.83442863	81.82942284
03-Dec-22 17:00:00	48.50508351	33.99585667	82.47357051
03-Dec-22 18:00:00	48.51552963	34.15049892	82.67774921
03-Dec-22 19:00:00	48.53508229	33.01471519	81.55647575
03-Dec-22 20:00:00	47.31833967	33.04288724	80.34642156
03-Dec-22 21:00:00	47.49128681	33.01072629	80.49446487
03-Dec-22 22:00:00	47.53989898	33.30433853	80.85449537
03-Dec-22 23:00:00	47.52692604	34.42575243	81.94023938
04-Dec-22 00:00:00	47.44033792	33.6416787	81.1178555
04-Dec-22 01:00:00	47.40447553	33.652103	81.03768073
04-Dec-22 02:00:00	47.77993859	33.6791907	81.44529639
04-Dec-22 03:00:00	46.97332234	33.6220879	80.58428023
04-Dec-22 04:00:00	47.08554522	33.86269506	80.92219459
04-Dec-22 05:00:00	47.10760159	33.56922065	80.71533359
04-Dec-22 06:00:00	46.92282507	32.92918332	79.84048208
04-Dec-22 07:00:00	45.78295135	32.99591997	78.76992925

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
04-Dec-22 08:00:00	38.34426901	32.94376543	71.27132458
04-Dec-22 09:00:00	37.27573734	33.66318173	70.86609056
04-Dec-22 10:00:00	37.26772891	33.95497322	71.26088418
04-Dec-22 11:00:00	37.37381278	33.44858954	70.82494587
04-Dec-22 12:00:00	37.79803403	33.38749815	71.1630906
04-Dec-22 13:00:00	37.80137761	33.40461138	71.20911238
04-Dec-22 14:00:00	37.67678897	33.49355051	71.18152279
04-Dec-22 15:00:00	37.46954791	34.3644602	71.82311715
04-Dec-22 16:00:00	37.51368014	34.03384675	71.5382381
04-Dec-22 17:00:00	37.53848436	33.66838582	71.21110577
04-Dec-22 18:00:00	37.58561134	33.68181186	71.28646045
04-Dec-22 19:00:00	36.92928738	33.68101561	70.60163583
04-Dec-22 20:00:00	36.43975766	34.07286983	70.4737197
04-Dec-22 21:00:00	36.50842985	34.42846658	70.94681888
04-Dec-22 22:00:00	36.56269858	34.25690651	70.81941838
04-Dec-22 23:00:00	36.9470556	34.2205201	71.17984856
05-Dec-22 00:00:00	36.70060158	34.238625	70.90772586
05-Dec-22 01:00:00	36.50654305	34.23268255	70.70705951
05-Dec-22 02:00:00	36.48448033	34.23187065	70.76240031
05-Dec-22 03:00:00	36.45213996	33.37452253	69.82448917
05-Dec-22 04:00:00	36.56908502	33.29005496	69.85631434
05-Dec-22 05:00:00	36.59862645	33.2530507	69.86933433
05-Dec-22 06:00:00	37.38249715	33.33813487	70.68841129
05-Dec-22 07:00:00	37.91520903	34.10816998	72.04963628
05-Dec-22 08:00:00	38.05829769	34.13251693	72.1971071
05-Dec-22 09:00:00	39.43182034	33.88731893	73.32410812
05-Dec-22 10:00:00	41.56186612	33.84694597	75.39314312
05-Dec-22 11:00:00	41.13341459	33.86965582	74.99138006
05-Dec-22 12:00:00	40.75783115	33.73288133	74.48971727
05-Dec-22 13:00:00	40.79755105	34.36985016	75.15223143
05-Dec-22 14:00:00	40.83815426	34.32936944	75.14314821
05-Dec-22 15:00:00	41.19301372	34.38987817	75.54879506
05-Dec-22 16:00:00	41.37497012	34.37348578	75.75860447
05-Dec-22 17:00:00	41.25494766	34.31360224	75.55490451
05-Dec-22 18:00:00	41.25946532	33.861198	75.10002645
05-Dec-22 19:00:00	41.2650831	34.00149515	75.256933
05-Dec-22 20:00:00	41.8600661	34.00365045	75.83736293
05-Dec-22 21:00:00	42.19361729	34.01572439	76.20388921
05-Dec-22 22:00:00	41.53522576	33.96615622	75.49800534
05-Dec-22 23:00:00	41.5522764	34.1265458	75.66292106
06-Dec-22 00:00:00	41.64266205	33.89868715	75.53373633
06-Dec-22 01:00:00	41.61036046	33.26107527	74.86251549
06-Dec-22 02:00:00	42.23605135	33.28891635	75.55782276

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
06-Dec-22 03:00:00	42.18889872	33.27973239	75.46363873
06-Dec-22 04:00:00	42.42444293	33.71454281	76.09203438
06-Dec-22 05:00:00	42.42198393	34.49479421	76.95369848
06-Dec-22 06:00:00	42.51688215	33.89992714	76.43091117
06-Dec-22 07:00:00	42.25765673	33.80277761	76.05881076
06-Dec-22 08:00:00	41.86228307	33.89031601	75.72312419
06-Dec-22 09:00:00	42.0476816	33.81407335	75.92078824
06-Dec-22 10:00:00	42.11575635	34.24791633	76.35062959
06-Dec-22 11:00:00	42.10699781	33.85803964	75.99215359
06-Dec-22 12:00:00	42.17296346	33.61414952	75.78891881
06-Dec-22 13:00:00	41.82982466	33.6464013	75.47130966
06-Dec-22 14:00:00	42.457965	33.68586265	76.11438158
06-Dec-22 15:00:00	42.44302283	33.95784957	76.3167269
06-Dec-22 16:00:00	42.4682418	34.11860953	76.59964922
06-Dec-22 17:00:00	42.56170103	33.3932404	75.97925186
06-Dec-22 18:00:00	42.24337048	33.46673436	75.69988463
06-Dec-22 19:00:00	41.96056769	33.37311681	75.31582048
06-Dec-22 20:00:00	41.6124098	33.56064526	75.19584825
06-Dec-22 21:00:00	41.61546877	33.87677701	75.4319013
06-Dec-22 22:00:00	41.58321169	33.61547936	75.22360215
06-Dec-22 23:00:00	42.05116484	33.51189079	75.56848187
07-Dec-22 00:00:00	42.30812666	33.48181816	75.78644053
07-Dec-22 01:00:00	42.55599255	33.73863891	76.23550669
07-Dec-22 02:00:00	42.45344685	33.94742648	76.3783137
07-Dec-22 03:00:00	42.460296	33.90794203	76.37946404
07-Dec-22 04:00:00	42.1583519	33.72115734	75.89213562
07-Dec-22 05:00:00	42.1076266	33.79421801	75.91048389
07-Dec-22 06:00:00	42.38438246	33.77164427	76.1702652
07-Dec-22 07:00:00	42.29964828	34.09150267	76.32552804
07-Dec-22 08:00:00	42.34707303	34.18410418	76.51257324
07-Dec-22 09:00:00	42.37028164	33.76782396	76.16018253
07-Dec-22 10:00:00	42.36235364	33.72909101	76.10331641
07-Dec-22 11:00:00	42.52270275	33.74101151	76.26767886
07-Dec-22 12:00:00	42.83417299	33.92274072	76.75974005
07-Dec-22 13:00:00	42.84968535	34.14967791	76.96354633
07-Dec-22 14:00:00	42.8165368	33.9015416	76.76287545
07-Dec-22 15:00:00	42.43922763	33.74360811	76.18544218
07-Dec-22 16:00:00	42.15125169	33.73416716	75.93241685
07-Dec-22 17:00:00	40.9131599	33.82810402	74.67397605
07-Dec-22 18:00:00	40.82272678	34.0541864	74.9446657
07-Dec-22 19:00:00	40.87440109	33.92120573	74.74787013
07-Dec-22 20:00:00	41.39172088	33.80914201	75.22369766
07-Dec-22 21:00:00	42.30796835	33.90713331	76.22520489

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
07-Dec-22 22:00:00	41.45008956	33.85568598	75.31118562
07-Dec-22 23:00:00	41.33278932	33.95745786	75.33644062
08-Dec-22 00:00:00	41.30994479	34.126887	75.42118581
08-Dec-22 01:00:00	41.39519967	34.05121062	75.43855243
08-Dec-22 02:00:00	42.19050831	34.15573374	76.34122594
08-Dec-22 03:00:00	41.82335175	34.10130713	75.90808911
08-Dec-22 04:00:00	41.67343118	34.15006574	75.82216856
08-Dec-22 05:00:00	41.6682042	34.10532612	75.76797061
08-Dec-22 06:00:00	41.83899985	34.10473873	75.9526613
08-Dec-22 07:00:00	42.08419185	34.01721912	76.10385577
08-Dec-22 08:00:00	42.0312606	34.0486286	76.06304508
08-Dec-22 09:00:00	42.33765263	33.9575528	76.28370667
08-Dec-22 10:00:00	42.44178094	34.27311664	76.72800022
08-Dec-22 11:00:00	42.47773672	33.96656248	76.46419186
08-Dec-22 12:00:00	42.39558453	33.4901717	75.88120588
08-Dec-22 13:00:00	42.00343874	33.55200111	75.55140813
08-Dec-22 14:00:00	42.2615882	33.48843977	75.78518309
08-Dec-22 15:00:00	42.10397402	33.97510684	76.07851071
08-Dec-22 16:00:00	42.0431438	34.08094766	76.10172272
08-Dec-22 17:00:00	42.05616718	34.45944553	76.47382397
08-Dec-22 18:00:00	41.90755505	34.34661441	76.24091975
08-Dec-22 19:00:00	41.79349687	34.37179587	76.16954761
08-Dec-22 20:00:00	41.28237004	34.52290154	75.75635571
08-Dec-22 21:00:00	41.29454549	34.18334961	75.4962457
08-Dec-22 22:00:00	41.17650965	34.31207212	75.48724662
08-Dec-22 23:00:00	41.52141465	34.44110124	76.00117964
09-Dec-22 00:00:00	41.87350273	34.48830191	76.36440701
09-Dec-22 01:00:00	41.9221931	34.55403137	76.47655911
09-Dec-22 02:00:00	41.95716582	34.18636364	76.15351529
09-Dec-22 03:00:00	41.99006059	34.08399963	76.04948778
09-Dec-22 04:00:00	41.93782149	34.5133152	76.45388709
09-Dec-22 05:00:00	42.27999094	34.51241408	76.78776974
09-Dec-22 06:00:00	42.30538347	34.43755502	76.73552301
09-Dec-22 07:00:00	42.48712794	34.28922229	76.83083895
09-Dec-22 08:00:00	42.588409	33.76237806	76.33418009
09-Dec-22 09:00:00	42.5118067	34.19609197	76.74634213
09-Dec-22 10:00:00	42.18976784	34.01878807	76.19827822
09-Dec-22 11:00:00	42.14594756	34.00327608	76.15580198
09-Dec-22 12:00:00	41.704248	34.06076262	75.7475179
09-Dec-22 13:00:00	41.59614287	34.00580046	75.61890166
09-Dec-22 14:00:00	41.73426459	33.66884443	75.43738514
09-Dec-22 15:00:00	41.86902449	33.16093996	75.01336204
09-Dec-22 16:00:00	42.06509633	33.15935502	75.20520994

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
09-Dec-22 17:00:00	41.43930414	33.17224058	74.61643318
09-Dec-22 18:00:00	41.41847038	33.78324763	75.18025716
09-Dec-22 19:00:00	41.43852107	33.76800156	75.20173009
09-Dec-22 20:00:00	41.49739562	33.36248016	74.88070509
09-Dec-22 21:00:00	42.24717373	33.38245922	75.61581887
09-Dec-22 22:00:00	42.18519825	33.3825886	75.5769967
09-Dec-22 23:00:00	42.95424143	33.7784125	76.65558794
10-Dec-22 00:00:00	42.92636214	33.86127486	76.84574933
10-Dec-22 01:00:00	42.90949016	33.52799882	76.43481827
10-Dec-22 02:00:00	42.54267735	33.3887522	75.93257332
10-Dec-22 03:00:00	42.10507774	33.43469846	75.53914854
10-Dec-22 04:00:00	42.5822631	33.33803516	75.9263454
10-Dec-22 05:00:00	42.71391148	34.23741701	76.94989522
10-Dec-22 06:00:00	42.71604729	34.04272864	76.7163976
10-Dec-22 07:00:00	42.50041072	34.41343413	76.90340593
10-Dec-22 08:00:00	42.05527666	34.39536526	76.44889365
10-Dec-22 09:00:00	42.36002837	34.4246209	76.75127369
10-Dec-22 10:00:00	42.3753732	34.21548865	76.6164024
10-Dec-22 11:00:00	42.28931978	34.09812758	76.38695187
10-Dec-22 12:00:00	42.31336064	34.10970362	76.44218191
10-Dec-22 13:00:00	42.92006259	34.11612744	77.03269365
10-Dec-22 14:00:00	42.81014336	34.11074681	76.9181633
10-Dec-22 15:00:00	42.57919566	33.9930415	76.57996453
10-Dec-22 16:00:00	42.5163517	34.13221084	76.66885164
10-Dec-22 17:00:00	42.71105258	34.16271973	76.82196299
10-Dec-22 18:00:00	42.72906621	34.11841202	76.8551534
10-Dec-22 19:00:00	42.86860593	34.10708809	76.96647602
10-Dec-22 20:00:00	43.57556237	34.12026278	77.71653832
10-Dec-22 21:00:00	43.82104005	34.14582719	77.92856654
10-Dec-22 22:00:00	43.78233782	34.07176039	77.7998263
10-Dec-22 23:00:00	43.6528422	34.34432178	78.01193477
11-Dec-22 00:00:00	43.26344384	34.44083362	77.70558039
11-Dec-22 01:00:00	43.72557534	34.34994561	78.09674411
11-Dec-22 02:00:00	44.15553835	34.3917177	78.57350794
11-Dec-22 03:00:00	44.12418026	33.60730701	77.74259864
11-Dec-22 04:00:00	44.27970293	34.28403155	78.53694704
11-Dec-22 05:00:00	44.1021595	34.09614944	78.21226713
11-Dec-22 06:00:00	43.98505847	34.1350285	78.11579514
11-Dec-22 07:00:00	44.39986526	34.10568576	78.4766727
11-Dec-22 08:00:00	44.30578105	34.21135924	78.47559738
11-Dec-22 09:00:00	44.23640527	34.42304675	78.59618759
11-Dec-22 10:00:00	44.08780416	35.13037745	79.21860631
11-Dec-22 11:00:00	43.69751252	35.08047803	78.79242961

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
11-Dec-22 12:00:00	43.29764303	35.16164255	78.43829197
11-Dec-22 13:00:00	43.14128982	34.41668828	77.59557851
11-Dec-22 14:00:00	43.11571524	34.0718939	77.14437697
11-Dec-22 15:00:00	43.42247666	34.28363532	77.7143525
11-Dec-22 16:00:00	43.97678057	34.2053246	78.17505095
11-Dec-22 17:00:00	43.44770728	34.21246825	77.65864605
11-Dec-22 18:00:00	43.42085414	34.1241631	77.55449592
11-Dec-22 19:00:00	43.49066014	33.99720467	77.49328147
11-Dec-22 20:00:00	43.47262976	34.53453128	77.95483653
11-Dec-22 21:00:00	43.92841911	34.72383923	78.65732045
11-Dec-22 22:00:00	43.80711004	34.76724045	78.57462396
11-Dec-22 23:00:00	43.21655507	34.72946746	77.91746309
12-Dec-22 00:00:00	43.1959379	34.37904676	77.60688358
12-Dec-22 01:00:00	43.16049533	34.09343677	77.24385876
12-Dec-22 02:00:00	43.57918379	34.61226781	78.17982017
12-Dec-22 03:00:00	43.98905415	34.63052283	78.60540771
12-Dec-22 04:00:00	44.31968625	34.52041632	78.83902147
12-Dec-22 05:00:00	44.2263919	34.29698718	78.54862298
12-Dec-22 06:00:00	44.1531016	33.77609656	77.99414147
12-Dec-22 07:00:00	44.19205432	33.97591548	78.14456855
12-Dec-22 08:00:00	44.46667841	33.99506839	78.46613015
12-Dec-22 09:00:00	44.7699585	34.00763088	78.79199953
12-Dec-22 10:00:00	43.99324841	33.9983849	77.99339902
12-Dec-22 11:00:00	43.87355042	34.2937971	78.19144948
12-Dec-22 12:00:00	43.89562522	33.79581769	77.66145791
12-Dec-22 13:00:00	44.02453105	33.75118857	77.79261737
12-Dec-22 14:00:00	44.68369908	33.72818693	78.41636573
12-Dec-22 15:00:00	44.21778679	33.71870507	77.94146432
12-Dec-22 16:00:00	44.20193142	34.38764699	78.58350012
12-Dec-22 17:00:00	44.13949013	33.87807698	78.02418349
12-Dec-22 18:00:00	44.3319202	34.41934218	78.73349098
12-Dec-22 19:00:00	45.10418224	34.3781034	79.47366778
12-Dec-22 20:00:00	44.55677626	34.34510803	78.91447491
12-Dec-22 21:00:00	44.4725897	34.09642071	78.59851074
12-Dec-22 22:00:00	44.42855072	33.4933673	77.98309241
12-Dec-22 23:00:00	44.50383377	34.13146845	78.60383436
13-Dec-22 00:00:00	44.82249853	34.09243756	78.90022744
13-Dec-22 01:00:00	43.13767984	34.12555004	77.27800751
13-Dec-22 02:00:00	43.07627127	33.98254352	77.04155095
13-Dec-22 03:00:00	43.08324093	33.9924611	77.05877431
13-Dec-22 04:00:00	43.15955925	33.92986213	77.08359824
13-Dec-22 05:00:00	43.58773613	33.7536537	77.33848317
13-Dec-22 06:00:00	43.831206	33.76821083	77.58987427

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
13-Dec-22 07:00:00	42.9680979	33.76136839	76.75409317
13-Dec-22 08:00:00	42.51634958	33.89577463	76.38413578
13-Dec-22 09:00:00	42.57843261	33.57568995	76.13898553
13-Dec-22 10:00:00	42.77087381	33.79148293	76.54627101
13-Dec-22 11:00:00	43.92685954	33.7661335	77.6902415
13-Dec-22 12:00:00	43.87594075	33.75323349	77.61126751
13-Dec-22 13:00:00	43.73483192	33.68679301	77.39295776
13-Dec-22 14:00:00	43.75127559	33.93082152	77.68588596
13-Dec-22 15:00:00	43.71573088	34.30475595	78.00516468
13-Dec-22 16:00:00	43.60677867	34.42400254	78.03484387
13-Dec-22 17:00:00	43.74283515	34.36561521	78.08401574
13-Dec-22 18:00:00	44.03931554	34.2671814	78.32414881
13-Dec-22 19:00:00	43.9915638	33.99021149	78.01198959
13-Dec-22 20:00:00	43.84909958	33.92300754	77.74342855
13-Dec-22 21:00:00	44.12821558	34.59665604	78.73005825
13-Dec-22 22:00:00	44.11273956	34.55956226	78.68269857
13-Dec-22 23:00:00	44.53973982	34.59255741	79.11986499
14-Dec-22 00:00:00	44.87717523	33.79808617	78.71660826
14-Dec-22 01:00:00	44.79866791	33.4453622	78.27634289
14-Dec-22 02:00:00	44.79235649	33.695524	78.45876609
14-Dec-22 03:00:00	43.94706472	33.59390259	77.54750358
14-Dec-22 04:00:00	44.28971608	33.657316	77.92501181
14-Dec-22 05:00:00	44.19845899	33.75803757	77.9230601
14-Dec-22 06:00:00	44.16171837	33.88928127	78.07553736
14-Dec-22 07:00:00	44.13453208	34.18847338	78.24585109
14-Dec-22 08:00:00	43.96824625	34.88649125	78.84047381
14-Dec-22 09:00:00	43.99558046	34.8883596	78.86618
14-Dec-22 10:00:00	43.77337074	34.74956091	78.60451889
14-Dec-22 11:00:00	43.79387283	34.11792861	77.88678784
14-Dec-22 12:00:00	43.75449986	33.79186185	77.53621419
14-Dec-22 13:00:00	43.75458188	34.16742982	77.90558455
14-Dec-22 14:00:00	44.02963554	34.11523236	78.14456389
14-Dec-22 15:00:00	44.03648716	34.11612256	78.13960478
14-Dec-22 16:00:00	44.17069414	33.73744392	77.93559265
14-Dec-22 17:00:00	44.20147027	33.53284864	77.72714615
14-Dec-22 18:00:00	44.17888705	33.72242779	77.89867641
14-Dec-22 19:00:00	44.29921574	33.74813256	78.04805035
14-Dec-22 20:00:00	43.99727567	33.76617347	77.7645251
14-Dec-22 21:00:00	44.95670636	33.68755976	78.6478506
14-Dec-22 22:00:00	44.91687224	33.78274875	78.68795649
14-Dec-22 23:00:00	45.04857106	33.48913765	78.58428044
15-Dec-22 00:00:00	44.58765093	33.28236294	77.86846754
15-Dec-22 01:00:00	43.69522582	33.28661567	76.99308777

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
15-Dec-22 02:00:00	43.63682281	33.23053036	76.87614102
15-Dec-22 03:00:00	43.6996106	34.25269911	77.84406492
15-Dec-22 04:00:00	43.77597343	33.8211422	77.6252115
15-Dec-22 05:00:00	43.70666716	34.00254673	77.70635011
15-Dec-22 06:00:00	43.71707323	34.04017448	77.73141946
15-Dec-22 07:00:00	43.70215416	34.10219214	77.78753196
15-Dec-22 08:00:00	43.69126235	34.02278264	77.70853933
15-Dec-22 09:00:00	43.76431084	34.55117727	77.74968508
15-Dec-22 10:00:00	44.90860473	44.22653629	89.12869644
15-Dec-22 11:00:00	45.42078675	44.24572669	89.66694641
15-Dec-22 12:00:00	45.24639384	44.23409681	89.46508874
15-Dec-22 13:00:00	45.27279896	44.24368578	89.47329831
15-Dec-22 14:00:00	45.44117673	44.22408754	89.66003192
15-Dec-22 15:00:00	46.17443254	44.26396296	90.41501872
15-Dec-22 16:00:00	46.76114845	36.46510145	83.71144443
15-Dec-22 17:00:00	46.60368813	34.74218602	81.33637873
15-Dec-22 18:00:00	46.44829941	34.97534053	81.45453178
15-Dec-22 19:00:00	45.13560719	35.01482582	80.14339786
15-Dec-22 20:00:00	44.78320524	35.01327506	79.79133267
15-Dec-22 21:00:00	44.9831632	34.73533185	79.69985294
15-Dec-22 22:00:00	45.08088726	34.55434948	79.6320165
15-Dec-22 23:00:00	45.07107777	34.12661658	79.21479246
16-Dec-22 00:00:00	45.42500178	34.15039719	79.570229
16-Dec-22 01:00:00	44.91093191	34.08579609	79.00936084
16-Dec-22 02:00:00	45.40544552	34.21367751	79.57541953
16-Dec-22 03:00:00	45.44914797	34.30809106	79.72261132
16-Dec-22 04:00:00	45.45743963	34.41253302	79.88671324
16-Dec-22 05:00:00	45.42349943	34.0315443	79.45338864
16-Dec-22 06:00:00	44.7752143	34.05431324	78.80853314
16-Dec-22 07:00:00	44.18018108	34.01962407	78.19317288
16-Dec-22 08:00:00	43.53537454	34.32302062	77.79702504
16-Dec-22 09:00:00	43.56045893	34.50073263	78.06547674
16-Dec-22 10:00:00	43.64890777	34.23874664	77.8930397
16-Dec-22 11:00:00	45.22371059	34.24658076	79.50742997
16-Dec-22 12:00:00	45.01456303	34.23140272	79.25868437
16-Dec-22 13:00:00	44.83313433	34.42514504	79.32396401
16-Dec-22 14:00:00	44.78709263	33.90592914	78.64255863
16-Dec-22 15:00:00	44.82424545	34.3989315	79.23410924
16-Dec-22 16:00:00	45.13998646	34.46905624	79.61076779
16-Dec-22 17:00:00	45.12797017	34.48095597	79.5895017
16-Dec-22 18:00:00	45.02165307	34.4976297	79.53185442
16-Dec-22 19:00:00	45.11503071	34.44851144	79.58305613
16-Dec-22 20:00:00	45.00582398	34.43967374	79.4882609

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
16-Dec-22 21:00:00	45.08275562	33.63865009	78.73818768
16-Dec-22 22:00:00	45.28333961	33.62882317	78.92158127
16-Dec-22 23:00:00	45.11875004	33.68050088	78.81089783
17-Dec-22 00:00:00	44.64819177	34.02378951	78.70083163
17-Dec-22 01:00:00	44.55512004	34.30373743	78.87241236
17-Dec-22 02:00:00	44.60153474	33.80775833	78.45274353
17-Dec-22 03:00:00	45.39152781	33.78596369	79.17406887
17-Dec-22 04:00:00	45.19260173	33.69679218	78.90894996
17-Dec-22 05:00:00	44.83089108	33.99578412	78.77303357
17-Dec-22 06:00:00	44.8048687	34.168197	78.99214596
17-Dec-22 07:00:00	44.8861546	33.99572182	78.8751191
17-Dec-22 08:00:00	45.04376623	33.84536076	78.87621364
17-Dec-22 09:00:00	45.21009466	33.88091426	79.09551493
17-Dec-22 10:00:00	45.50303904	33.89763824	79.39024607
17-Dec-22 11:00:00	45.17506621	34.36366378	79.54385546
17-Dec-22 12:00:00	45.15569517	34.41098319	79.56683562
17-Dec-22 13:00:00	45.21700562	34.15985266	79.3800029
17-Dec-22 14:00:00	45.39102025	34.1423733	79.52638372
17-Dec-22 15:00:00	45.66454421	34.13878886	79.78734885
17-Dec-22 16:00:00	45.42848036	34.25313271	79.72055107
17-Dec-22 17:00:00	45.4385749	34.09239165	79.48796166
17-Dec-22 18:00:00	45.41719098	33.69613351	79.1116493
17-Dec-22 19:00:00	45.50011804	33.46646245	78.957008
17-Dec-22 20:00:00	45.60364638	33.48628002	79.06763755
17-Dec-22 21:00:00	44.67386119	33.67558034	78.29314889
17-Dec-22 22:00:00	44.68893496	34.14203093	78.82053418
17-Dec-22 23:00:00	44.64479616	33.76011213	78.41797108
18-Dec-22 00:00:00	44.8789728	33.40420396	78.27641593
18-Dec-22 01:00:00	45.06996282	33.41722149	78.48819309
18-Dec-22 02:00:00	44.87573369	33.40208011	78.2879164
18-Dec-22 03:00:00	45.17239761	34.05772654	79.2606976
18-Dec-22 04:00:00	45.11268912	34.41403495	79.48431396
18-Dec-22 05:00:00	45.22044881	34.03891585	79.2744662
18-Dec-22 06:00:00	45.83004612	34.04815759	79.87901052
18-Dec-22 07:00:00	45.38117091	34.02647047	79.42645306
18-Dec-22 08:00:00	45.58371268	34.15989198	79.77573268
18-Dec-22 09:00:00	45.52141613	33.70012813	79.25335863
18-Dec-22 10:00:00	45.60905457	34.05746831	79.68393623
18-Dec-22 11:00:00	45.57674387	33.87971598	79.44947773
18-Dec-22 12:00:00	45.62409041	33.84460504	79.47555966
18-Dec-22 13:00:00	45.98529646	33.90656429	79.82395045
18-Dec-22 14:00:00	45.91593128	34.28556252	80.19488483
18-Dec-22 15:00:00	45.96260664	34.24323739	80.18573012

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
18-Dec-22 16:00:00	45.70092456	34.24245516	79.92929798
18-Dec-22 17:00:00	45.42012893	34.21881209	79.6225018
18-Dec-22 18:00:00	45.21422683	34.23338742	79.41248491
18-Dec-22 19:00:00	45.37471983	34.21576088	79.62911521
18-Dec-22 20:00:00	45.43134668	34.22842301	79.66738425
18-Dec-22 21:00:00	45.43942388	34.27186097	79.74001736
18-Dec-22 22:00:00	45.42305268	34.24544181	79.6352467
18-Dec-22 23:00:00	45.42243597	34.27741022	79.66833411
19-Dec-22 00:00:00	45.9109726	34.50397343	80.35409631
19-Dec-22 01:00:00	45.97840309	34.03631581	80.07690133
19-Dec-22 02:00:00	45.98333147	34.76887682	80.74575933
19-Dec-22 03:00:00	45.75346459	35.09233195	80.83123779
19-Dec-22 04:00:00	44.9426473	35.08640205	80.04076216
19-Dec-22 05:00:00	45.67687564	35.12579621	80.8065478
19-Dec-22 06:00:00	45.80157704	34.51099841	80.31886461
19-Dec-22 07:00:00	45.71144485	34.34580824	80.03689236
19-Dec-22 08:00:00	45.62064044	34.49736945	80.11889903
19-Dec-22 09:00:00	44.94467036	34.53748396	79.4751943
19-Dec-22 10:00:00	44.82838101	34.47409368	79.32144589
19-Dec-22 11:00:00	44.6965775	34.45988909	79.189387
19-Dec-22 12:00:00	44.75643751	34.03936534	78.7879342
19-Dec-22 13:00:00	44.66128561	34.33960258	78.99435043
19-Dec-22 14:00:00	44.99377505	34.25010822	79.23109775
19-Dec-22 15:00:00	45.02159097	34.23805131	79.25195736
19-Dec-22 16:00:00	46.18039449	34.18437825	80.34828864
19-Dec-22 17:00:00	46.18002383	34.2043599	80.37873247
19-Dec-22 18:00:00	46.13718626	34.11684338	80.24851778
19-Dec-22 19:00:00	45.58154975	34.23782681	79.82089975
19-Dec-22 20:00:00	44.96594069	34.21244187	79.18807602
19-Dec-22 21:00:00	45.75262727	34.20352978	79.97377099
19-Dec-22 22:00:00	46.18525908	34.44926417	80.67887889
19-Dec-22 23:00:00	46.12218391	33.96116977	80.07901806
20-Dec-22 00:00:00	45.92805036	34.00425996	79.92282401
20-Dec-22 01:00:00	45.00419744	34.073123	79.09277344
20-Dec-22 02:00:00	45.23071162	34.00459501	79.23407957
20-Dec-22 03:00:00	45.52229012	34.20672883	79.73636712
20-Dec-22 04:00:00	45.38377211	33.95505142	79.35862139
20-Dec-22 05:00:00	45.4073302	34.38974932	79.78830422
20-Dec-22 06:00:00	44.89998817	34.43439611	79.32273314
20-Dec-22 07:00:00	44.856454	34.50320371	79.35745324
20-Dec-22 08:00:00	44.53270902	34.43238209	78.93525441
20-Dec-22 09:00:00	44.46413549	34.25989681	78.71157201
20-Dec-22 10:00:00	44.45047209	34.51558918	78.91510518

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
20-Dec-22 11:00:00	44.6610154	35.02320735	79.69225184
20-Dec-22 12:00:00	44.90946897	34.9950676	79.91980913
20-Dec-22 13:00:00	44.69751506	34.98899772	79.68567869
20-Dec-22 14:00:00	44.5421825	34.29233725	78.96789975
20-Dec-22 15:00:00	44.59404288	33.97639815	78.5813179
20-Dec-22 16:00:00	44.63691309	34.39187664	79.00862503
20-Dec-22 17:00:00	45.07150311	34.40159566	79.43159782
20-Dec-22 18:00:00	45.16782167	34.37401064	79.56529935
20-Dec-22 19:00:00	44.93239996	34.32601102	79.26868863
20-Dec-22 20:00:00	44.90044488	34.02656025	78.9530326
20-Dec-22 21:00:00	44.91860178	34.46363937	79.34080251
20-Dec-22 22:00:00	45.23270883	34.56866943	79.79881823
20-Dec-22 23:00:00	45.3725622	34.58935844	79.9441558
21-Dec-22 00:00:00	44.25306723	34.60927617	78.85195796
21-Dec-22 01:00:00	44.25543743	34.01923603	78.23613824
21-Dec-22 02:00:00	44.38180987	34.20056385	78.54900254
21-Dec-22 03:00:00	44.39545907	34.22183779	78.61639178
21-Dec-22 04:00:00	45.46964624	34.25437369	79.71102354
21-Dec-22 05:00:00	45.23987431	34.18974585	79.45436096
21-Dec-22 06:00:00	45.56366369	34.36012395	79.90322155
21-Dec-22 07:00:00	45.59583579	33.81794092	79.4224027
21-Dec-22 08:00:00	45.51083332	34.01085281	79.51820363
21-Dec-22 09:00:00	45.65734906	34.05766996	79.70289018
21-Dec-22 10:00:00	45.37427881	34.04888077	79.4159495
21-Dec-22 11:00:00	45.99786144	33.92918883	79.89287037
21-Dec-22 12:00:00	46.04331419	34.2392203	80.30812624
21-Dec-22 13:00:00	46.04274962	33.81616826	79.88455963
21-Dec-22 14:00:00	45.76828109	33.76237233	79.53103087
21-Dec-22 15:00:00	45.45592986	33.71761665	79.18467882
21-Dec-22 16:00:00	44.37763214	33.73113611	78.09299893
21-Dec-22 17:00:00	44.2119236	34.09582202	78.28903283
21-Dec-22 18:00:00	44.03742663	34.22643683	78.25004917
21-Dec-22 19:00:00	44.33679369	34.12726925	78.46371799
21-Dec-22 20:00:00	45.12390582	34.07385816	79.2159
21-Dec-22 21:00:00	44.84214867	34.12085629	78.99537383
21-Dec-22 22:00:00	44.90274684	34.16085184	79.05679152
21-Dec-22 23:00:00	44.96424251	34.15454123	79.15748745
22-Dec-22 00:00:00	44.98522483	34.46865167	79.46027982
22-Dec-22 01:00:00	45.4164469	34.46219673	79.88502969
22-Dec-22 02:00:00	45.06719504	34.50893805	79.55303743
22-Dec-22 03:00:00	44.397215	34.39714728	78.78675588
22-Dec-22 04:00:00	44.5470153	34.18399154	78.71361807
22-Dec-22 05:00:00	44.50857459	34.27119573	78.76241642

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
22-Dec-22 06:00:00	44.95719655	34.47674561	79.43952348
22-Dec-22 07:00:00	44.9463715	34.48241764	79.42697228
22-Dec-22 08:00:00	45.44357045	34.48494954	79.91622501
22-Dec-22 09:00:00	45.2579085	34.11116007	79.36984624
22-Dec-22 10:00:00	45.38964858	34.04880587	79.37625504
22-Dec-22 11:00:00	45.367502	35.00525157	80.37090641
22-Dec-22 12:00:00	44.87029923	34.98336967	79.86026933
22-Dec-22 13:00:00	44.78452322	35.0037326	79.80478541
22-Dec-22 14:00:00	44.47672992	34.70628802	79.23285166
22-Dec-22 15:00:00	44.49745941	33.94743411	78.44179323
22-Dec-22 16:00:00	44.44327672	34.27933608	78.6939686
22-Dec-22 17:00:00	44.80382729	34.51155387	79.31857921
22-Dec-22 18:00:00	45.21318817	34.44363463	79.6614329
22-Dec-22 19:00:00	45.74152565	34.42463748	80.15860579
22-Dec-22 20:00:00	45.70469793	34.32669396	79.99325985
22-Dec-22 21:00:00	45.59966723	34.13306575	79.71369002
22-Dec-22 22:00:00	45.48157692	34.3864043	79.89244849
22-Dec-22 23:00:00	45.00580533	34.35470263	79.368632
23-Dec-22 00:00:00	45.71428363	34.33205435	80.03120083
23-Dec-22 01:00:00	46.12231339	34.57368342	80.65246497
23-Dec-22 02:00:00	46.19442262	34.31277593	80.47982364
23-Dec-22 03:00:00	46.08513408	34.22075854	80.27247323
23-Dec-22 04:00:00	45.04251162	34.24304503	79.28875987
23-Dec-22 05:00:00	45.05005646	34.28614087	79.35491138
23-Dec-22 06:00:00	44.14082294	34.24272039	78.42729272
23-Dec-22 07:00:00	44.1201689	34.43487295	78.61028247
23-Dec-22 08:00:00	44.04051993	33.92194663	77.95425712
23-Dec-22 09:00:00	44.58690092	34.1974037	78.77559959
23-Dec-22 10:00:00	45.31654485	34.19734383	79.52874374
23-Dec-22 11:00:00	45.1774665	34.20754251	79.40166601
23-Dec-22 12:00:00	45.17251862	34.42660438	79.54693646
23-Dec-22 13:00:00	45.2357235	34.38977008	79.59024005
23-Dec-22 14:00:00	45.11339739	34.61655278	79.71002452
23-Dec-22 15:00:00	45.12613911	34.52373891	79.67297533
23-Dec-22 16:00:00	44.98569637	34.62172453	79.59923723
23-Dec-22 17:00:00	44.66472117	34.45779652	79.14124086
23-Dec-22 18:00:00	44.63335345	34.21970261	78.90491147
23-Dec-22 19:00:00	44.69919417	34.47972192	79.16934141
23-Dec-22 20:00:00	45.34725168	34.63081339	80.03248639
23-Dec-22 21:00:00	45.54024484	34.58399985	80.10966986
23-Dec-22 22:00:00	45.2803048	34.34818543	79.58049124
23-Dec-22 23:00:00	45.2493195	34.29566299	79.52812025
24-Dec-22 00:00:00	45.4020089	33.91925473	79.33648957

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
24-Dec-22 01:00:00	45.26591365	34.1262579	79.38446384
24-Dec-22 02:00:00	45.4493298	34.1097268	79.54239612
24-Dec-22 03:00:00	44.5582784	34.13067087	78.66423925
24-Dec-22 04:00:00	44.60433918	34.48742453	79.0749925
24-Dec-22 05:00:00	44.65374989	34.08745066	78.77249527
24-Dec-22 06:00:00	44.58410984	34.369293	78.94709375
24-Dec-22 07:00:00	45.53117434	34.37371261	79.89750036
24-Dec-22 08:00:00	45.14459144	34.42358102	79.56065962
24-Dec-22 09:00:00	45.41296853	34.09516716	79.51272866
24-Dec-22 10:00:00	45.42408159	34.38521692	79.74962828
24-Dec-22 11:00:00	45.42111015	34.09445508	79.4991595
24-Dec-22 12:00:00	45.46134758	34.20679008	79.67394129
24-Dec-22 13:00:00	44.92092938	34.23759863	79.15150409
24-Dec-22 14:00:00	45.91126569	34.13714282	80.06087028
24-Dec-22 15:00:00	45.9397299	34.18944846	80.11589559
24-Dec-22 16:00:00	45.96928724	33.70925903	79.71199346
24-Dec-22 17:00:00	45.94929165	33.45721642	79.43789546
24-Dec-22 18:00:00	45.03155814	33.50345929	78.52743912
24-Dec-22 19:00:00	44.38562308	33.49150802	77.87325075
24-Dec-22 20:00:00	44.29680146	34.12190904	78.3198748
24-Dec-22 21:00:00	44.28903347	33.87437206	78.22446145
24-Dec-22 22:00:00	44.36212455	34.03047922	78.39630148
24-Dec-22 23:00:00	45.28344409	34.00451194	79.3002616
25-Dec-22 00:00:00	45.03324106	34.02116636	79.02877723
25-Dec-22 01:00:00	45.34623379	33.82604769	79.15280024
25-Dec-22 02:00:00	45.30037138	33.85624674	79.2081498
25-Dec-22 03:00:00	45.31813028	33.6437042	78.96294403
25-Dec-22 04:00:00	45.35721906	33.85089133	79.18937895
25-Dec-22 05:00:00	45.01035118	33.83847208	78.83467738
25-Dec-22 06:00:00	45.12502925	33.83753622	78.9835612
25-Dec-22 07:00:00	45.21357346	33.95345624	79.13452827
25-Dec-22 08:00:00	45.1758035	33.41834492	78.64393997
25-Dec-22 09:00:00	45.4413698	33.15555009	78.58857346
25-Dec-22 10:00:00	44.9653492	33.13370286	78.07481766
25-Dec-22 11:00:00	44.96127786	33.14457677	78.15427455
25-Dec-22 12:00:00	44.55153932	33.48461225	78.05098428
25-Dec-22 13:00:00	44.55357191	33.67168448	78.24693023
25-Dec-22 14:00:00	44.512139	33.40166728	77.86058256
25-Dec-22 15:00:00	45.06087706	33.41196103	78.4691497
25-Dec-22 16:00:00	45.12331729	33.45817305	78.57395935
25-Dec-22 17:00:00	44.70369286	33.64830081	78.30532159
25-Dec-22 18:00:00	44.61412832	33.72709825	78.35846541
25-Dec-22 19:00:00	44.67511643	33.30726518	77.95508957

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
25-Dec-22 20:00:00	45.01002396	33.36549448	78.39861149
25-Dec-22 21:00:00	45.1866809	33.40787411	78.5952496
25-Dec-22 22:00:00	45.42645751	33.39384562	78.81336043
25-Dec-22 23:00:00	45.27041478	33.78120677	78.94610935
26-Dec-22 00:00:00	45.21906153	34.11469777	79.32825597
26-Dec-22 01:00:00	45.17724821	33.48618409	78.6778467
26-Dec-22 02:00:00	45.23457273	33.49240437	78.73074426
26-Dec-22 03:00:00	45.68470573	33.50112025	79.17886141
26-Dec-22 04:00:00	45.95933893	33.63186292	79.65193897
26-Dec-22 05:00:00	45.92416297	34.1200979	80.04653592
26-Dec-22 06:00:00	45.89990552	33.48677805	79.37284978
26-Dec-22 07:00:00	45.38281589	33.49884826	78.84664239
26-Dec-22 08:00:00	45.45792855	33.37320667	78.82809957
26-Dec-22 09:00:00	44.80567508	33.49607646	78.31238443
26-Dec-22 10:00:00	44.80942557	34.16876729	78.91832013
26-Dec-22 11:00:00	44.81857342	33.64776463	78.50175688
26-Dec-22 12:00:00	44.93663555	33.49940236	78.42471737
26-Dec-22 13:00:00	45.3974531	33.48778292	78.86417558
26-Dec-22 14:00:00	45.81083912	33.50165897	79.30547078
26-Dec-22 15:00:00	45.95360586	33.96897014	79.93180579
26-Dec-22 16:00:00	45.90743065	34.32813856	80.24724346
26-Dec-22 17:00:00	45.69644504	33.84267553	79.53839535
26-Dec-22 18:00:00	45.41185019	33.91251677	79.30895784
26-Dec-22 19:00:00	45.44964006	33.82463402	79.27023188
26-Dec-22 20:00:00	45.82538668	33.90846486	79.68044917
26-Dec-22 21:00:00	45.72010379	34.26475949	79.91241116
26-Dec-22 22:00:00	45.82121044	33.68869838	79.55102539
26-Dec-22 23:00:00	45.57807308	33.47403177	79.04817214
27-Dec-22 00:00:00	45.48416011	33.49503415	78.96386464
27-Dec-22 01:00:00	45.93723445	33.48840141	79.40011046
27-Dec-22 02:00:00	45.8926025	33.85158991	79.71213998
27-Dec-22 03:00:00	45.9449785	34.1641265	80.15223016
27-Dec-22 04:00:00	45.5867335	33.98526255	79.5508858
27-Dec-22 05:00:00	45.31468434	34.0074091	79.29840575
27-Dec-22 06:00:00	45.11054484	34.04342243	79.15300666
27-Dec-22 07:00:00	45.40977436	34.10181692	79.533433
27-Dec-22 08:00:00	45.38560677	34.30723148	79.74427753
27-Dec-22 09:00:00	45.41886393	33.90827719	79.30084398
27-Dec-22 10:00:00	45.32652219	33.84907087	79.16964764
27-Dec-22 11:00:00	45.17680656	33.87550121	79.06101651
27-Dec-22 12:00:00	45.33941438	33.87976519	79.22971711
27-Dec-22 13:00:00	45.4410678	33.99320115	79.43565962
27-Dec-22 14:00:00	45.44155057	33.93372705	79.41317579

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
27-Dec-22 15:00:00	45.65216944	34.12727314	79.7824688
27-Dec-22 16:00:00	44.9376723	34.08338038	79.02314843
27-Dec-22 17:00:00	45.7778581	34.13667806	79.92345174
27-Dec-22 18:00:00	45.79423629	34.16630152	79.95999103
27-Dec-22 19:00:00	45.86698405	34.09521781	79.95492978
27-Dec-22 20:00:00	45.830243	34.33834521	80.16019553
27-Dec-22 21:00:00	44.93005074	34.39248477	79.33875868
27-Dec-22 22:00:00	45.18532202	34.41042482	79.57514191
27-Dec-22 23:00:00	45.16441345	33.92677784	79.1403834
28-Dec-22 00:00:00	45.23200311	33.87896199	79.05454042
28-Dec-22 01:00:00	45.21906429	33.34693188	78.55358929
28-Dec-22 02:00:00	45.42167685	33.32596736	78.76742956
28-Dec-22 03:00:00	45.41026624	33.32490484	78.72532569
28-Dec-22 04:00:00	46.45358107	33.60170492	79.98225445
28-Dec-22 05:00:00	46.42797682	33.73186747	80.18244044
28-Dec-22 06:00:00	46.41068967	33.68025907	80.11650368
28-Dec-22 07:00:00	45.75744989	33.26233456	79.01355192
28-Dec-22 08:00:00	45.17413966	33.29305108	78.46291478
28-Dec-22 09:00:00	45.79544809	33.27487585	79.06103728
28-Dec-22 10:00:00	46.08364656	33.87580879	79.9417411
28-Dec-22 11:00:00	45.90834978	33.80821779	79.79379612
28-Dec-22 12:00:00	45.79829216	33.60426219	79.43855625
28-Dec-22 13:00:00	45.17246988	33.65776571	78.80569365
28-Dec-22 14:00:00	45.21547529	33.68036249	78.89276038
28-Dec-22 15:00:00	45.37159856	33.83134558	79.2001169
28-Dec-22 16:00:00	45.27833981	33.7530774	79.02157508
28-Dec-22 17:00:00	45.28101306	33.78867234	79.06593492
28-Dec-22 18:00:00	45.39008628	33.89598112	79.27577358
28-Dec-22 19:00:00	45.18062358	33.83672121	79.0038859
28-Dec-22 20:00:00	44.27393235	33.92163022	78.17901738
28-Dec-22 21:00:00	44.27956454	33.75489277	78.08093813
28-Dec-22 22:00:00	44.29200935	33.67933888	77.94140879
28-Dec-22 23:00:00	44.74850549	33.66181522	78.41922845
29-Dec-22 00:00:00	45.37888696	33.67899789	79.06368574
29-Dec-22 01:00:00	44.9186821	33.66085815	78.59058423
29-Dec-22 02:00:00	44.45535893	34.04384622	78.44708803
29-Dec-22 03:00:00	44.42761125	33.99864896	78.43795904
29-Dec-22 04:00:00	44.55435075	33.66894213	78.24236679
29-Dec-22 05:00:00	45.20013258	33.67828274	78.87962299
29-Dec-22 06:00:00	45.39287376	33.65410932	79.05269962
29-Dec-22 07:00:00	44.8373021	33.9216084	78.75646761
29-Dec-22 08:00:00	45.0053516	33.80543115	78.79087109
29-Dec-22 09:00:00	44.90754318	33.59364086	78.5164494

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
29-Dec-22 10:00:00	45.1821075	33.29098807	78.43446753
29-Dec-22 11:00:00	45.3706203	33.30484228	78.65649541
29-Dec-22 12:00:00	44.55216747	33.34238614	77.85340076
29-Dec-22 13:00:00	44.52671666	33.80649715	78.34245088
29-Dec-22 14:00:00	44.39563052	33.93033261	78.31742689
29-Dec-22 15:00:00	44.62930255	33.84579743	78.46767044
29-Dec-22 16:00:00	45.20190387	33.86536061	79.05785709
29-Dec-22 17:00:00	45.23570824	33.84529389	79.09906684
29-Dec-22 18:00:00	45.65489197	34.08029175	79.7142991
29-Dec-22 19:00:00	45.62060632	34.24320348	79.78795285
29-Dec-22 20:00:00	45.68007533	33.49422752	79.20638106
29-Dec-22 21:00:00	45.06480577	33.45835686	78.53394911
29-Dec-22 22:00:00	45.13276079	33.50433201	78.63458337
29-Dec-22 23:00:00	45.5580811	33.77713288	79.28825463
30-Dec-22 00:00:00	45.55193753	33.67180485	79.20877202
30-Dec-22 01:00:00	45.5750086	33.83446222	79.40526581
30-Dec-22 02:00:00	45.32649655	33.56506634	78.93559689
30-Dec-22 03:00:00	45.05741543	33.65558128	78.708594
30-Dec-22 04:00:00	43.97686852	33.62643327	77.59354189
30-Dec-22 05:00:00	43.69224506	34.24153377	77.99331771
30-Dec-22 06:00:00	43.83139759	34.04314698	77.90223206
30-Dec-22 07:00:00	43.95408334	33.73382314	77.70903397
30-Dec-22 08:00:00	45.08233833	33.71242015	78.81865565
30-Dec-22 09:00:00	44.61189694	33.75587165	78.3522678
30-Dec-22 10:00:00	44.66228527	34.02681949	78.68618986
30-Dec-22 11:00:00	44.68161413	33.97327529	78.59089957
30-Dec-22 12:00:00	44.69370969	33.97473929	78.6904797
30-Dec-22 13:00:00	45.15110355	33.87605487	79.03732936
30-Dec-22 14:00:00	44.97924444	33.86487495	78.83559884
30-Dec-22 15:00:00	44.86507119	33.90278117	78.77852871
30-Dec-22 16:00:00	44.98931207	33.8266502	78.865345
30-Dec-22 17:00:00	44.97651842	34.0993601	79.03283649
30-Dec-22 18:00:00	45.29702356	33.62154918	78.91624196
30-Dec-22 19:00:00	44.85478253	33.5952514	78.46058697
30-Dec-22 20:00:00	45.11262406	33.62786494	78.75858561
30-Dec-22 21:00:00	45.16127947	34.01788542	79.14801746
30-Dec-22 22:00:00	45.09237876	34.1152882	79.2084287
30-Dec-22 23:00:00	45.03182602	34.35194609	79.36958483
31-Dec-22 00:00:00	44.81250805	34.37838427	79.17585627
31-Dec-22 01:00:00	45.12923898	34.39162925	79.50560888
31-Dec-22 02:00:00	45.2338721	34.13456641	79.42235523
31-Dec-22 03:00:00	45.22746192	33.71284506	78.90658061
31-Dec-22 04:00:00	45.18141895	34.17533239	79.37874137

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
31-Dec-22 05:00:00	45.0268792	34.18693818	79.2048953
31-Dec-22 06:00:00	45.07181952	34.23841816	79.27801217
31-Dec-22 07:00:00	45.56687291	34.15106251	79.70702871
31-Dec-22 08:00:00	45.62288772	33.92727492	79.54274835
31-Dec-22 09:00:00	45.60708597	33.98264631	79.60420693
31-Dec-22 10:00:00	45.19508277	34.04329978	79.21266471
31-Dec-22 11:00:00	44.92970975	33.97957081	78.93114768
31-Dec-22 12:00:00	45.58831702	33.96901281	79.5501781
31-Dec-22 13:00:00	45.73522197	34.08529799	79.84628889
31-Dec-22 14:00:00	45.71845839	33.72410478	79.39767075
31-Dec-22 15:00:00	45.79033619	34.04287571	79.82558272
31-Dec-22 16:00:00	45.02742153	34.00639915	79.03438356
31-Dec-22 17:00:00	44.94385423	33.9821593	78.90055423
31-Dec-22 18:00:00	45.08444532	33.95929209	79.015458
31-Dec-22 19:00:00	45.05052439	33.50497479	78.60384411
31-Dec-22 20:00:00	45.04052459	33.60641204	78.6424124
31-Dec-22 21:00:00	44.93392097	33.59903664	78.52910444
31-Dec-22 22:00:00	44.83323775	33.62270885	78.46115663
31-Dec-22 23:00:00	45.68011793	33.64863586	79.32816739
01-Jan-23 00:00:00	45.60266516	33.79945225	79.3963267
01-Jan-23 01:00:00	11.61774664	0.717769404	12.27340052
01-Jan-23 02:00:00	11.56407579	0.52540945	12.10966884
01-Jan-23 03:00:00	11.40415865	0.481573236	11.92029338
01-Jan-23 04:00:00	11.27887927	0.481304244	11.76221222
01-Jan-23 05:00:00	11.54156277	0.483815837	12.02752781
01-Jan-23 06:00:00	11.58092391	0.694077341	12.27194632
01-Jan-23 07:00:00	11.59741211	0.461288129	12.08501168
01-Jan-23 08:00:00	11.56094397	0.607281056	12.17025525
01-Jan-23 09:00:00	11.31370274	0.613848161	11.91864949
01-Jan-23 10:00:00	11.57654635	0.615425597	12.21707563
01-Jan-23 11:00:00	11.56682973	0.660712137	12.24930512
01-Jan-23 12:00:00	11.61565733	0.480402676	12.14407396
01-Jan-23 13:00:00	11.59013271	0.500801327	12.05129487
01-Jan-23 14:00:00	11.29013417	0.480948606	11.75895321
01-Jan-23 15:00:00	11.39689965	0.483028699	11.86835885
01-Jan-23 16:00:00	11.1846473	0.482133654	11.67628151
01-Jan-23 17:00:00	11.21008587	0.65349123	11.85356649
01-Jan-23 18:00:00	11.17069446	0.48978914	11.59927066
01-Jan-23 19:00:00	11.14480061	0.424630964	11.53499938
01-Jan-23 20:00:00	11.39843904	0.397567009	11.77210138
01-Jan-23 21:00:00	11.46127092	0.394492108	11.85356845
01-Jan-23 22:00:00	11.59044635	0.569962382	12.16784001
01-Jan-23 23:00:00	11.59961404	0.471693777	12.04080375

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
02-Jan-23 00:00:00	11.57671732	0.409077913	12.07153232
02-Jan-23 01:00:00	11.29421552	0.47126021	11.77183453
02-Jan-23 02:00:00	11.42589135	0.4818105	11.91167593
02-Jan-23 03:00:00	11.67592986	0.576308245	12.28556003
02-Jan-23 04:00:00	11.69561195	0.545011963	12.26395118
02-Jan-23 05:00:00	11.67519236	0.47179727	12.0953216
02-Jan-23 06:00:00	11.4445721	0.404325405	11.82996185
02-Jan-23 07:00:00	11.22429673	0.394943625	11.62622886
02-Jan-23 08:00:00	11.54589054	0.397528248	11.952799
02-Jan-23 09:00:00	11.47913912	0.665086908	12.11866131
02-Jan-23 10:00:00	11.50710408	0.488029445	11.98934603
02-Jan-23 11:00:00	11.39549491	0.476937262	11.79155717
02-Jan-23 12:00:00	11.32191457	0.411158286	11.71013575
02-Jan-23 13:00:00	11.48626704	0.394191511	11.87495451
02-Jan-23 14:00:00	11.37327809	0.584832359	11.97758389
02-Jan-23 15:00:00	11.37218804	0.544086889	11.92873282
02-Jan-23 16:00:00	11.34221792	0.581270847	11.92093669
02-Jan-23 17:00:00	11.27220774	0.616779758	11.85389209
02-Jan-23 18:00:00	11.34778743	0.613960934	11.96668228
02-Jan-23 19:00:00	11.28140503	0.656419104	11.9448268
02-Jan-23 20:00:00	11.30055009	0.590395549	11.89007976
02-Jan-23 21:00:00	11.27374909	0.527522948	11.81338253
02-Jan-23 22:00:00	11.27380302	1.094336328	12.37140944
02-Jan-23 23:00:00	11.27620623	1.401739347	12.65534828
03-Jan-23 00:00:00	11.27109369	1.404984376	12.67027166
03-Jan-23 01:00:00	11.30030743	1.406055577	12.70524215
03-Jan-23 02:00:00	11.27336968	9.950127615	21.23039816
03-Jan-23 03:00:00	17.94522648	32.2107741	49.81370629
03-Jan-23 04:00:00	15.75072267	32.23367808	47.97138517
03-Jan-23 05:00:00	15.75274425	32.12276914	47.90119468
03-Jan-23 06:00:00	15.75910732	32.16342735	47.92224609
03-Jan-23 07:00:00	15.72291332	32.18127802	47.90708902
03-Jan-23 08:00:00	22.30853171	30.6136369	52.91535197
03-Jan-23 09:00:00	23.066702	1.634198831	24.68612766
03-Jan-23 10:00:00	23.07221572	0.825106088	23.91144357
03-Jan-23 11:00:00	18.81756221	0.722592366	19.64288155
03-Jan-23 12:00:00	11.74054199	0.783958011	12.53401073
03-Jan-23 13:00:00	11.69775534	0.78911896	12.46458107
03-Jan-23 14:00:00	11.56429429	0.722535436	12.26743866
03-Jan-23 15:00:00	11.59784895	0.643434385	12.27240119
03-Jan-23 16:00:00	11.60097578	0.616147776	12.21679841
03-Jan-23 17:00:00	11.39174477	0.615969563	12.01417102
03-Jan-23 18:00:00	11.53332594	0.614895964	12.1469637

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
03-Jan-23 19:00:00	11.49478171	0.727403431	12.14988033
03-Jan-23 20:00:00	11.49856975	0.634899586	12.17820915
03-Jan-23 21:00:00	11.49610647	0.653340402	12.19251357
03-Jan-23 22:00:00	11.52107726	0.701481442	12.17216707
03-Jan-23 23:00:00	11.62870815	0.70092861	12.32241933
04-Jan-23 00:00:00	11.56567367	0.722778515	12.26005411
04-Jan-23 01:00:00	11.59338511	0.740448539	12.29786814
04-Jan-23 02:00:00	11.58182489	0.593793756	12.20453305
04-Jan-23 03:00:00	11.50380686	0.615816021	12.10607888
04-Jan-23 04:00:00	11.44960758	0.615547729	12.07201995
04-Jan-23 05:00:00	11.71097279	0.613368201	12.34406964
04-Jan-23 06:00:00	11.82438405	0.716296491	12.54752285
04-Jan-23 07:00:00	11.80381325	0.701486995	12.48115219
04-Jan-23 08:00:00	11.82598178	0.767207828	12.5987912
04-Jan-23 09:00:00	11.51560185	0.787334774	12.30584521
04-Jan-23 10:00:00	11.52163839	0.788248525	12.28939729
04-Jan-23 11:00:00	11.21156592	0.897571483	12.02465306
04-Jan-23 12:00:00	11.17406575	0.698801465	11.87360039
04-Jan-23 13:00:00	11.2179905	0.612199942	11.89438507
04-Jan-23 14:00:00	11.17331256	0.611840472	11.77249647
04-Jan-23 15:00:00	11.48037095	0.611655808	12.07691685
04-Jan-23 16:00:00	11.60901456	0.674497735	12.20327812
04-Jan-23 17:00:00	11.66759512	0.867928322	12.4660644
04-Jan-23 18:00:00	11.68631803	0.648443167	12.3830089
04-Jan-23 19:00:00	11.54816929	0.641654889	12.23215518
04-Jan-23 20:00:00	11.4169257	0.702172632	12.12386391
04-Jan-23 21:00:00	11.52656147	0.706011058	12.21604792
04-Jan-23 22:00:00	11.48746109	0.80420295	12.25114691
04-Jan-23 23:00:00	11.51572789	0.638166512	12.16623478
05-Jan-23 00:00:00	11.48411851	0.613078713	12.16439629
05-Jan-23 01:00:00	11.51600213	0.678614799	12.19254623
05-Jan-23 02:00:00	11.57542536	0.702794182	12.29438985
05-Jan-23 03:00:00	11.81476651	0.727657825	12.5458045
05-Jan-23 04:00:00	11.81976562	0.771012015	12.56711433
05-Jan-23 05:00:00	11.78609938	0.627895966	12.44010746
05-Jan-23 06:00:00	11.60688077	0.613218303	12.21837949
05-Jan-23 07:00:00	11.39713706	0.613320607	12.00113201
05-Jan-23 08:00:00	11.31606483	0.614203188	11.92081253
05-Jan-23 09:00:00	11.18978273	0.83489368	11.92485221
05-Jan-23 10:00:00	11.16709407	0.600261115	11.78585099
05-Jan-23 11:00:00	11.19908412	0.483580149	11.71320486
05-Jan-23 12:00:00	11.42627684	0.484026216	11.90117115
05-Jan-23 13:00:00	11.49729098	0.484268924	11.99100832

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
05-Jan-23 14:00:00	11.59266975	0.63917211	12.20504906
05-Jan-23 15:00:00	11.56524595	0.625035314	12.21460056
05-Jan-23 16:00:00	11.60917674	0.574928613	12.18216748
05-Jan-23 17:00:00	11.23363956	0.613455753	11.8508474
05-Jan-23 18:00:00	11.40394534	0.612061019	12.00951351
05-Jan-23 19:00:00	11.56377967	0.614095937	12.17206865
05-Jan-23 20:00:00	11.58250422	0.751244833	12.32808749
05-Jan-23 21:00:00	11.59884209	0.558115438	12.16664969
05-Jan-23 22:00:00	11.41766326	0.479666698	11.90851411
05-Jan-23 23:00:00	11.45188162	0.481801414	11.91565291
06-Jan-23 00:00:00	11.58964602	0.48393478	12.07563088
06-Jan-23 01:00:00	11.58757618	0.711984945	12.32973792
06-Jan-23 02:00:00	11.58232816	0.593403078	12.16140333
06-Jan-23 03:00:00	11.61068691	0.614573896	12.2365444
06-Jan-23 04:00:00	11.26849159	0.613288164	11.89659813
06-Jan-23 05:00:00	11.40706539	0.613107955	12.01653253
06-Jan-23 06:00:00	11.37376128	0.707005784	12.08746045
06-Jan-23 07:00:00	11.37853744	0.674752259	12.05448437
06-Jan-23 08:00:00	11.36226283	0.5937878	11.95285418
06-Jan-23 09:00:00	11.24504104	0.613798809	11.86854707
06-Jan-23 10:00:00	11.4982819	0.613851513	12.10923555
06-Jan-23 11:00:00	11.51510037	0.613657882	12.13876389
06-Jan-23 12:00:00	11.48586967	0.742926674	12.23389965
06-Jan-23 13:00:00	11.5135986	0.581680495	12.13211118
06-Jan-23 14:00:00	11.39052672	0.613320947	12.03117548
06-Jan-23 15:00:00	11.36510128	0.6140697	11.98633501
06-Jan-23 16:00:00	11.60342688	0.614493704	12.21099625
06-Jan-23 17:00:00	11.79332998	0.740765651	12.51741971
06-Jan-23 18:00:00	11.81794262	0.648902649	12.44641436
06-Jan-23 19:00:00	11.8215793	0.671579758	12.44945153
06-Jan-23 20:00:00	11.34562863	0.611462745	11.95646191
06-Jan-23 21:00:00	11.63430945	0.61378621	12.23879557
06-Jan-23 22:00:00	11.65140152	0.749961547	12.34997613
06-Jan-23 23:00:00	11.70212878	0.65449257	12.36002703
07-Jan-23 00:00:00	11.67029667	0.524167947	12.20937236
07-Jan-23 01:00:00	11.36346504	0.48231467	11.84539046
07-Jan-23 02:00:00	11.40629525	0.482725741	11.86148834
07-Jan-23 03:00:00	11.09538359	0.482523644	11.59207439
07-Jan-23 04:00:00	11.06237674	0.735425668	11.79996771
07-Jan-23 05:00:00	11.06422032	0.561881769	11.62085191
07-Jan-23 06:00:00	11.01485538	0.486895025	11.48975727
07-Jan-23 07:00:00	11.42892371	0.48260907	11.8880949
07-Jan-23 08:00:00	11.48753675	0.481690057	11.97430036

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
07-Jan-23 09:00:00	11.61514393	0.64286725	12.2372597
07-Jan-23 10:00:00	11.5678366	0.602574678	12.1821483
07-Jan-23 11:00:00	11.59796953	0.495826128	12.11966218
07-Jan-23 12:00:00	11.28482315	0.48259945	11.76912064
07-Jan-23 13:00:00	11.36686982	0.483687484	11.83823501
07-Jan-23 14:00:00	11.39057827	0.513019794	11.92430835
07-Jan-23 15:00:00	11.34849432	0.720918597	12.0478259
07-Jan-23 16:00:00	11.38554764	0.571722708	11.94202056
07-Jan-23 17:00:00	11.35601314	0.61454078	11.99545049
07-Jan-23 18:00:00	11.3345258	0.617093098	11.93194919
07-Jan-23 19:00:00	11.40789011	0.616318882	12.01794434
07-Jan-23 20:00:00	11.36936182	0.717592067	12.10892624
07-Jan-23 21:00:00	11.3732489	0.542706433	11.94767437
07-Jan-23 22:00:00	11.35634507	0.496508943	11.81926227
07-Jan-23 23:00:00	11.16832256	0.483736077	11.64610921
08-Jan-23 00:00:00	11.37364806	0.484713988	11.83911782
08-Jan-23 01:00:00	11.25598945	0.600376969	11.85372061
08-Jan-23 02:00:00	11.285429	0.583691666	11.88598726
08-Jan-23 03:00:00	11.27402189	0.566047831	11.84350579
08-Jan-23 04:00:00	11.2708096	0.615362728	11.87944129
08-Jan-23 05:00:00	11.4134575	0.618585598	12.03954087
08-Jan-23 06:00:00	11.37876537	0.616173014	11.98883526
08-Jan-23 07:00:00	11.37370123	0.749853926	12.13458761
08-Jan-23 08:00:00	11.35648966	0.567187595	11.97160064
08-Jan-23 09:00:00	11.26086828	0.615401435	11.85834372
08-Jan-23 10:00:00	11.2296967	0.613568056	11.83009312
08-Jan-23 11:00:00	11.54865774	0.613720405	12.1519595
08-Jan-23 12:00:00	11.59060446	0.707846304	12.32090763
08-Jan-23 13:00:00	11.58805466	0.543434186	12.17352176
08-Jan-23 14:00:00	11.6008083	0.483727157	12.07787801
08-Jan-23 15:00:00	11.39946445	0.48031047	11.86761319
08-Jan-23 16:00:00	11.40875763	0.48036752	11.90408479
08-Jan-23 17:00:00	11.21264882	0.571582918	11.79413948
08-Jan-23 18:00:00	11.17096504	0.634245761	11.81637589
08-Jan-23 19:00:00	11.21100887	0.512167435	11.74107877
08-Jan-23 20:00:00	11.12766658	0.481172377	11.60875898
08-Jan-23 21:00:00	11.34297848	0.481993808	11.82914125
08-Jan-23 22:00:00	11.5067989	0.483193492	11.99909657
08-Jan-23 23:00:00	11.59002129	0.708514679	12.29017005
09-Jan-23 00:00:00	11.60726346	0.508710829	12.11335272
09-Jan-23 01:00:00	11.45241716	0.481767835	11.94297572
09-Jan-23 02:00:00	11.48494699	0.482754451	11.94984595
09-Jan-23 03:00:00	11.43589539	0.482784114	11.90092823

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
09-Jan-23 04:00:00	11.50356489	0.641816349	12.12010676
09-Jan-23 05:00:00	11.49833144	0.550295268	12.03555016
09-Jan-23 06:00:00	11.51117706	0.482246412	11.92213559
09-Jan-23 07:00:00	11.24692249	0.415375719	11.61647439
09-Jan-23 08:00:00	11.44129785	0.394770241	11.81944243
09-Jan-23 09:00:00	11.47698026	0.495280968	11.95178717
09-Jan-23 10:00:00	11.53161213	0.626579702	12.15263209
09-Jan-23 11:00:00	11.48002566	0.533411071	12.0141271
09-Jan-23 12:00:00	11.31509362	0.482342488	11.79976318
09-Jan-23 13:00:00	11.34845887	0.480659016	11.824556
09-Jan-23 14:00:00	11.30238814	0.481131166	11.77830813
09-Jan-23 15:00:00	11.27605703	0.667867995	11.94291597
09-Jan-23 16:00:00	11.26427507	0.544346734	11.83351543
09-Jan-23 17:00:00	11.22838026	0.484843113	11.69669512
09-Jan-23 18:00:00	11.35139831	0.483766279	11.82797276
09-Jan-23 19:00:00	11.29080402	0.48275347	11.77504209
09-Jan-23 20:00:00	11.38815329	0.606847704	11.99523739
09-Jan-23 21:00:00	11.35702886	0.538326346	11.90602965
09-Jan-23 22:00:00	11.37057853	0.589096054	11.907926
09-Jan-23 23:00:00	11.25915676	0.616034488	11.88316044
10-Jan-23 00:00:00	11.26001782	0.616496557	11.86132998
10-Jan-23 01:00:00	11.51866722	0.631462686	12.14036338
10-Jan-23 02:00:00	11.49089723	0.651518802	12.14255375
10-Jan-23 03:00:00	11.49850194	0.492940642	11.95665399
10-Jan-23 04:00:00	11.34035285	0.482209492	11.80955876
10-Jan-23 05:00:00	11.31697188	0.480983257	11.80995708
10-Jan-23 06:00:00	11.3420932	0.482359382	11.8070275
10-Jan-23 07:00:00	11.17528915	0.644254549	11.86580409
10-Jan-23 08:00:00	11.20876625	0.531305549	11.77503411
10-Jan-23 09:00:00	11.18898328	0.483257488	11.67735675
10-Jan-23 10:00:00	11.08358611	0.483801814	11.56173489
10-Jan-23 11:00:00	11.32251501	0.483245715	11.81289534
10-Jan-23 12:00:00	11.26830191	0.558811575	11.81707656
10-Jan-23 13:00:00	11.30104245	0.648501635	11.92654451
10-Jan-23 14:00:00	11.25995376	0.446993689	11.72716162
10-Jan-23 15:00:00	11.19592317	0.395217448	11.58731312
10-Jan-23 16:00:00	11.46929275	0.398122129	11.86472358
10-Jan-23 17:00:00	11.29125346	0.395425968	11.67590136
10-Jan-23 18:00:00	11.27326059	0.677328782	11.94989824
10-Jan-23 19:00:00	11.29037951	0.51868425	11.80590298
10-Jan-23 20:00:00	11.24898741	0.615060202	11.86658103
10-Jan-23 21:00:00	11.25243033	0.616551752	11.88281201
10-Jan-23 22:00:00	11.47824388	0.616278203	12.09005509

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
10-Jan-23 23:00:00	11.51529667	0.697638323	12.21737925
11-Jan-23 00:00:00	11.49529955	0.524778874	12.03737669
11-Jan-23 01:00:00	11.5192309	0.482727043	11.95836684
11-Jan-23 02:00:00	11.19992468	0.483895058	11.67012675
11-Jan-23 03:00:00	11.59829066	0.481382211	12.09988806
11-Jan-23 04:00:00	11.51407554	0.562896295	12.08101474
11-Jan-23 05:00:00	11.49528972	0.591408252	12.0823861
11-Jan-23 06:00:00	11.4996224	0.50311326	12.00453809
11-Jan-23 07:00:00	11.28134367	0.481400979	11.75792024
11-Jan-23 08:00:00	11.3487774	0.479994357	11.81876494
11-Jan-23 09:00:00	11.31271489	0.481025783	11.82007595
11-Jan-23 10:00:00	11.37477968	0.674748227	12.06359369
11-Jan-23 11:00:00	11.34828239	0.520086474	11.86437882
11-Jan-23 12:00:00	11.2998813	0.611421764	11.92040597
11-Jan-23 13:00:00	11.3677578	0.613650934	11.98457326
11-Jan-23 14:00:00	11.50233248	0.614177704	12.14013158
11-Jan-23 15:00:00	11.52280352	0.707156532	12.23340056
11-Jan-23 16:00:00	11.49163633	0.526089695	12.03670963
11-Jan-23 17:00:00	11.49982315	0.483959138	11.96826331
11-Jan-23 18:00:00	11.32696316	0.484021797	11.81447633
11-Jan-23 19:00:00	11.40739107	0.483445007	11.90131613
11-Jan-23 20:00:00	11.3588455	0.530951809	11.89951584
11-Jan-23 21:00:00	11.38127502	0.612520759	11.98693599
11-Jan-23 22:00:00	11.3632483	0.466700157	11.81174937
11-Jan-23 23:00:00	11.33411286	0.402145183	11.76123331
12-Jan-23 00:00:00	11.40814765	0.396501585	11.78430748
12-Jan-23 01:00:00	11.38391341	0.400367397	11.73596878
12-Jan-23 02:00:00	11.35823398	0.657761675	11.99877829
12-Jan-23 03:00:00	11.37974644	0.505916336	11.88215023
12-Jan-23 04:00:00	11.32583789	0.485068254	11.80288087
12-Jan-23 05:00:00	11.24258492	0.480354829	11.73221784
12-Jan-23 06:00:00	11.45809486	0.480513304	11.91142868
12-Jan-23 07:00:00	11.56522645	0.615256052	12.17489949
12-Jan-23 08:00:00	11.60400285	0.583089441	12.15808788
12-Jan-23 09:00:00	11.58591504	0.503637628	12.08008006
12-Jan-23 10:00:00	11.45812209	0.484910202	11.9545971
12-Jan-23 11:00:00	11.36651791	0.482698381	11.85060342
12-Jan-23 12:00:00	11.65977314	0.480417436	12.1098015
12-Jan-23 13:00:00	11.67896467	0.708861869	12.40296094
12-Jan-23 14:00:00	11.68231609	0.565571614	12.26010466
12-Jan-23 15:00:00	11.5031102	0.618493873	12.12412545
12-Jan-23 16:00:00	11.30449502	0.617043826	11.90196975
12-Jan-23 17:00:00	11.47766855	0.614621729	12.08407036

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
12-Jan-23 18:00:00	11.50977363	0.690426454	12.20620709
12-Jan-23 19:00:00	11.50821691	0.550233131	12.06243812
12-Jan-23 20:00:00	11.49416637	0.605889762	12.01175568
12-Jan-23 21:00:00	11.40241877	0.613732287	11.98326232
12-Jan-23 22:00:00	11.4582803	0.614453697	12.06804901
12-Jan-23 23:00:00	11.29245536	0.688178833	11.96888431
13-Jan-23 00:00:00	11.28646742	0.606542528	11.86958161
13-Jan-23 01:00:00	11.27126307	0.488937885	11.72363308
13-Jan-23 02:00:00	11.23632741	0.4543386	11.53691181
13-Jan-23 03:00:00	11.29397196	0.398763116	11.668656
13-Jan-23 04:00:00	11.50089969	0.395619452	11.92193855
13-Jan-23 05:00:00	11.50134728	0.672192087	12.18516731
13-Jan-23 06:00:00	11.5253968	0.548260164	12.08317063
13-Jan-23 07:00:00	11.40563583	0.612459926	12.02761451
13-Jan-23 08:00:00	11.43088743	0.618959088	12.03856966
13-Jan-23 09:00:00	11.53090747	0.619351262	12.14977562
13-Jan-23 10:00:00	11.48735642	0.698243679	12.17543037
13-Jan-23 11:00:00	11.50611909	0.555132151	12.04527542
13-Jan-23 12:00:00	11.50178999	0.497493287	12.00206476
13-Jan-23 13:00:00	11.31912062	0.482490822	11.80850554
13-Jan-23 14:00:00	11.46853156	0.481509447	11.96757477
13-Jan-23 15:00:00	11.26796675	0.555951562	11.83359373
13-Jan-23 16:00:00	11.30383603	0.640676444	11.9343036
13-Jan-23 17:00:00	11.28300911	0.517536892	11.80041295
13-Jan-23 18:00:00	11.15727458	0.480919238	11.62261014
13-Jan-23 19:00:00	11.39815866	0.481757333	11.87165024
13-Jan-23 20:00:00	11.21308274	0.484460096	11.66666485
13-Jan-23 21:00:00	11.29624171	0.679297427	11.97166618
13-Jan-23 22:00:00	11.27654309	0.520358516	11.82040797
13-Jan-23 23:00:00	11.22768572	0.48012087	11.71567304
14-Jan-23 00:00:00	11.3487961	0.48184317	11.84342813
14-Jan-23 01:00:00	11.27937773	0.48223803	11.77895553
14-Jan-23 02:00:00	11.29917685	0.632500688	11.94915062
14-Jan-23 03:00:00	11.2717948	0.580272151	11.87362101
14-Jan-23 04:00:00	11.29253266	0.498128883	11.73858602
14-Jan-23 05:00:00	11.35480499	0.430316103	11.72044199
14-Jan-23 06:00:00	11.31727086	0.392262292	11.71121248
14-Jan-23 07:00:00	11.51255984	0.428722847	11.93433046
14-Jan-23 08:00:00	11.48980872	0.683066784	12.18762461
14-Jan-23 09:00:00	11.50762595	0.549206448	12.04246136
14-Jan-23 10:00:00	11.36270528	0.482652211	11.85254939
14-Jan-23 11:00:00	11.34479459	0.480375878	11.82134914
14-Jan-23 12:00:00	11.38081948	0.481015956	11.86805649

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
14-Jan-23 13:00:00	11.26914607	0.725340494	11.96507793
14-Jan-23 14:00:00	11.28414325	0.517464992	11.7766206
14-Jan-23 15:00:00	11.28279172	0.410866559	11.67775141
14-Jan-23 16:00:00	11.25734234	0.393841668	11.65086296
14-Jan-23 17:00:00	11.337756	0.39343856	11.71011231
14-Jan-23 18:00:00	11.66786597	0.541289524	12.21245713
14-Jan-23 19:00:00	11.68973956	0.578089486	12.26240033
14-Jan-23 20:00:00	11.68986241	0.509213283	12.19804459
14-Jan-23 21:00:00	11.28211482	0.483706773	11.78406367
14-Jan-23 22:00:00	11.39088599	0.483814252	11.8745358
14-Jan-23 23:00:00	11.63852035	0.480511943	12.11653278
15-Jan-23 00:00:00	11.68336646	0.683679228	12.36372079
15-Jan-23 01:00:00	11.68876203	0.547983492	12.22678275
15-Jan-23 02:00:00	11.4883052	0.613740301	12.09207571
15-Jan-23 03:00:00	11.35171731	0.614783055	11.96156564
15-Jan-23 04:00:00	11.34621477	0.613536114	11.97119347
15-Jan-23 05:00:00	11.26119677	0.695414709	11.94471078
15-Jan-23 06:00:00	11.27859614	0.54686914	11.84908439
15-Jan-23 07:00:00	11.2975746	0.491200947	11.7554023
15-Jan-23 08:00:00	11.21257008	0.48194811	11.68814202
15-Jan-23 09:00:00	11.41066106	0.481027379	11.89929807
15-Jan-23 10:00:00	11.37444109	0.565608383	11.95266247
15-Jan-23 11:00:00	11.36376123	0.592764881	11.98353084
15-Jan-23 12:00:00	11.38086446	0.478707194	11.85132074
15-Jan-23 13:00:00	11.10013236	0.481365095	11.57485316
15-Jan-23 14:00:00	11.2729844	0.482898414	11.73184729
15-Jan-23 15:00:00	11.40673425	0.484976719	11.90258982
15-Jan-23 16:00:00	11.34088177	0.641380707	12.01617767
15-Jan-23 17:00:00	11.38991393	0.530023725	11.93023464
15-Jan-23 18:00:00	11.30787743	0.483068931	11.77476846
15-Jan-23 19:00:00	11.45551327	0.487100237	11.95046782
15-Jan-23 20:00:00	11.54011811	0.48649267	12.02990998
15-Jan-23 21:00:00	11.68193706	0.607958412	12.27499485
15-Jan-23 22:00:00	11.69033162	0.546246025	12.22874242
15-Jan-23 23:00:00	11.65916125	0.475256004	12.06237149
16-Jan-23 00:00:00	11.30349943	0.411280819	11.68349234
16-Jan-23 01:00:00	11.45369339	0.395071075	11.83996467
16-Jan-23 02:00:00	11.06263166	0.445249976	11.52338987
16-Jan-23 03:00:00	11.05171892	0.609119201	11.67767908
16-Jan-23 04:00:00	11.07447248	0.461374955	11.54098341
16-Jan-23 05:00:00	11.02458435	0.454274181	11.40263128
16-Jan-23 06:00:00	11.57214032	0.395699517	11.98196268
16-Jan-23 07:00:00	11.3605468	0.396687773	11.76216359

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
16-Jan-23 08:00:00	11.37817436	0.700157589	12.04325618
16-Jan-23 09:00:00	11.35712666	0.515286397	11.88027055
16-Jan-23 10:00:00	11.33620301	0.609409048	11.94978621
16-Jan-23 11:00:00	11.31328985	0.613269395	11.9360501
16-Jan-23 12:00:00	11.31782076	0.614265243	11.94321415
16-Jan-23 13:00:00	11.29248688	0.699210647	11.97081841
16-Jan-23 14:00:00	11.25726318	0.526618258	11.80219415
16-Jan-23 15:00:00	11.30509832	0.567535904	11.89434565
16-Jan-23 16:00:00	11.27795362	0.610842566	11.88323667
16-Jan-23 17:00:00	11.48128054	0.613842929	12.07026249
16-Jan-23 18:00:00	11.9296235	0.617461727	12.53045938
16-Jan-23 19:00:00	11.87702311	0.648743353	12.55485074
16-Jan-23 20:00:00	11.90511068	0.489757755	12.37503237
16-Jan-23 21:00:00	11.66601133	0.466321141	12.03955025
16-Jan-23 22:00:00	11.37336813	0.398947964	11.7611214
16-Jan-23 23:00:00	11.30003977	0.393579775	11.65044157
17-Jan-23 00:00:00	11.2675671	0.640694383	11.9130293
17-Jan-23 01:00:00	11.30045207	0.5324202	11.8394637
17-Jan-23 02:00:00	11.25909217	0.482276469	11.71216843
17-Jan-23 03:00:00	11.26974641	0.481242067	11.74004274
17-Jan-23 04:00:00	11.46580309	0.481267753	11.95281808
17-Jan-23 05:00:00	11.48405049	0.576434085	12.05693452
17-Jan-23 06:00:00	11.51645189	0.547952733	12.10300573
17-Jan-23 07:00:00	11.5038423	0.50782526	11.95178821
17-Jan-23 08:00:00	11.25142272	0.481995708	11.71152985
17-Jan-23 09:00:00	11.40048901	0.48277235	11.88972083
17-Jan-23 10:00:00	11.37813007	0.481357696	11.86517561
17-Jan-23 11:00:00	11.37682062	0.673122047	12.0554702
17-Jan-23 12:00:00	11.35182836	0.451208565	11.81095261
17-Jan-23 13:00:00	11.33138657	0.39461722	11.74221903
17-Jan-23 14:00:00	11.44985872	0.395804712	11.84797488
17-Jan-23 15:00:00	11.52558189	0.39562769	11.91003805
17-Jan-23 16:00:00	11.61056354	0.611077408	12.20334393
17-Jan-23 17:00:00	11.57610724	0.508012057	12.06783295
17-Jan-23 18:00:00	11.60175228	0.441482207	12.0277163
17-Jan-23 19:00:00	11.15341896	0.393336014	11.48902671
17-Jan-23 20:00:00	11.37665182	0.394579908	11.76475131
17-Jan-23 21:00:00	11.19219965	0.467912378	11.66999234
17-Jan-23 22:00:00	11.20288785	0.566839796	11.78968604
17-Jan-23 23:00:00	11.19046471	0.548424576	11.70445878
18-Jan-23 00:00:00	11.14976941	0.617192809	11.78214317
18-Jan-23 01:00:00	11.44616048	0.61225344	12.06113635
18-Jan-23 02:00:00	11.31291747	0.613072917	11.93281555

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
18-Jan-23 03:00:00	11.35394112	0.69340638	12.08767765
18-Jan-23 04:00:00	11.38498969	0.502608195	11.87282228
18-Jan-23 05:00:00	11.28999408	0.481538015	11.76118705
18-Jan-23 06:00:00	11.26341126	0.480605137	11.74861966
18-Jan-23 07:00:00	11.48378997	0.482590508	11.95058346
18-Jan-23 08:00:00	11.81688727	0.616002298	12.44540743
18-Jan-23 09:00:00	11.8044722	0.513879673	12.33547621
18-Jan-23 10:00:00	11.80651903	0.482600564	12.28268509
18-Jan-23 11:00:00	11.40934955	0.481721329	11.86552413
18-Jan-23 12:00:00	11.44861979	0.482988698	11.93367277
18-Jan-23 13:00:00	11.34832931	0.532011959	11.88975568
18-Jan-23 14:00:00	11.40709402	0.646749702	12.02099493
18-Jan-23 15:00:00	11.34573136	0.500406683	11.83312403
18-Jan-23 16:00:00	11.27965058	0.482705286	11.75263882
18-Jan-23 17:00:00	11.35875538	0.485419425	11.85255043
18-Jan-23 18:00:00	11.303438	0.484114748	11.80175078
18-Jan-23 19:00:00	11.28676711	0.668523962	11.96194251
18-Jan-23 20:00:00	11.26786979	0.531151385	11.78936919
18-Jan-23 21:00:00	11.25649479	0.480320396	11.71708499
18-Jan-23 22:00:00	11.27183003	0.482959884	11.75532562
18-Jan-23 23:00:00	11.36283822	0.484591987	11.85866923
19-Jan-23 00:00:00	11.35088793	0.558812615	11.91868162
19-Jan-23 01:00:00	11.35575679	0.479228516	11.8537371
19-Jan-23 02:00:00	11.39576716	0.421181032	11.87792232
19-Jan-23 03:00:00	11.25676706	0.480521986	11.74482881
19-Jan-23 04:00:00	11.4265568	0.482999543	11.92591268
19-Jan-23 05:00:00	11.65009965	0.483735412	12.12607257
19-Jan-23 06:00:00	11.69476281	0.654574984	12.35647472
19-Jan-23 07:00:00	11.68647008	0.494791736	12.15150012
19-Jan-23 08:00:00	11.52050458	0.422116601	11.92630474
19-Jan-23 09:00:00	11.25024483	0.3926777	11.64883587
19-Jan-23 10:00:00	11.31415314	0.394167314	11.73395286
19-Jan-23 11:00:00	11.28813463	0.608993908	11.8974861
19-Jan-23 12:00:00	11.28441978	0.534912513	11.81493812
19-Jan-23 13:00:00	11.28398265	0.482222291	11.65738175
19-Jan-23 14:00:00	11.13700906	0.413110592	11.53083555
19-Jan-23 15:00:00	11.4394207	0.392568765	11.84380677
19-Jan-23 16:00:00	11.29291407	0.541374113	11.83201645
19-Jan-23 17:00:00	11.27656417	0.594882051	11.88324798
19-Jan-23 18:00:00	11.27145158	0.410628882	11.72541268
19-Jan-23 19:00:00	11.19258515	0.395549567	11.60092387
19-Jan-23 20:00:00	11.30663649	0.394007087	11.70757431
19-Jan-23 21:00:00	11.22604995	0.393000968	11.63882218

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
19-Jan-23 22:00:00	11.1944108	0.683965305	11.87150574
19-Jan-23 23:00:00	11.18654135	0.495651671	11.6613063
20-Jan-23 00:00:00	11.18096982	0.472581437	11.58047409
20-Jan-23 01:00:00	11.26499891	0.406034423	11.67812245
20-Jan-23 02:00:00	11.66438972	0.393334973	12.07234785
20-Jan-23 03:00:00	11.68008147	0.559792715	12.23648638
20-Jan-23 04:00:00	11.66965368	0.536423643	12.24291572
20-Jan-23 05:00:00	11.69681999	0.47911494	12.10397037
20-Jan-23 06:00:00	11.13568899	0.411197412	11.52288335
20-Jan-23 07:00:00	11.44273223	0.39479205	11.85372761
20-Jan-23 08:00:00	11.2580514	0.485397779	11.74610964
20-Jan-23 09:00:00	11.28752947	0.610047579	11.90314229
20-Jan-23 10:00:00	11.29640537	0.52152516	11.80759066
20-Jan-23 11:00:00	11.22349877	0.481944871	11.71129674
20-Jan-23 12:00:00	11.4948198	0.483116345	11.96984307
20-Jan-23 13:00:00	11.48399883	0.482260251	11.97111612
20-Jan-23 14:00:00	11.58264152	0.680324872	12.28291591
20-Jan-23 15:00:00	11.60357375	0.517131219	12.13789362
20-Jan-23 16:00:00	11.46095668	0.39848873	11.87703525
20-Jan-23 17:00:00	11.30827596	0.396442465	11.68515709
20-Jan-23 18:00:00	11.41621828	0.39489941	11.82229551
20-Jan-23 19:00:00	11.53944169	0.552565453	12.09431532
20-Jan-23 20:00:00	11.47126606	0.556585375	12.04753027
20-Jan-23 21:00:00	11.52223571	0.567368034	12.08230509
20-Jan-23 22:00:00	11.40578281	0.61693812	12.02052053
20-Jan-23 23:00:00	11.53497325	0.610210597	12.14072434
21-Jan-23 00:00:00	11.3731149	0.628446421	12.01488758
21-Jan-23 01:00:00	11.39444799	0.653230334	12.03246117
21-Jan-23 02:00:00	11.35326974	0.507331741	11.84098117
21-Jan-23 03:00:00	11.30058609	0.48418015	11.79073185
21-Jan-23 04:00:00	11.26309559	0.482921778	11.74693346
21-Jan-23 05:00:00	11.3319469	0.483246028	11.83116229
21-Jan-23 06:00:00	11.37019693	0.605200454	11.98547638
21-Jan-23 07:00:00	11.35309633	0.497599082	11.84852883
21-Jan-23 08:00:00	11.39443451	0.39434399	11.78613642
21-Jan-23 09:00:00	11.32222478	0.393731686	11.72367387
21-Jan-23 10:00:00	11.55119371	0.394755736	11.94133907
21-Jan-23 11:00:00	11.4903726	0.535075246	12.03274214
21-Jan-23 12:00:00	11.48928049	0.569720685	12.05742375
21-Jan-23 13:00:00	11.53187407	0.480482003	11.96615876
21-Jan-23 14:00:00	11.33353451	0.412914361	11.72637059
21-Jan-23 15:00:00	11.3108094	0.393105878	11.70329762
21-Jan-23 16:00:00	11.46755754	0.394895768	11.85470406

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
21-Jan-23 17:00:00	11.50687403	0.687759944	12.21778149
21-Jan-23 18:00:00	11.50035429	0.518811782	12.00559685
21-Jan-23 19:00:00	11.37767718	0.480871572	11.85494769
21-Jan-23 20:00:00	11.42146084	0.482508175	11.89544863
21-Jan-23 21:00:00	11.63474618	0.482011406	12.13087951
21-Jan-23 22:00:00	11.69464808	0.630259262	12.31665495
21-Jan-23 23:00:00	11.6693662	0.527847716	12.20517831
22-Jan-23 00:00:00	11.69200235	0.590770298	12.27232366
22-Jan-23 01:00:00	11.230602	0.611978647	11.80689222
22-Jan-23 02:00:00	11.41334973	0.614744357	12.03748073
22-Jan-23 03:00:00	11.28751204	0.687626861	11.96391879
22-Jan-23 04:00:00	11.27548889	0.62931809	11.88609464
22-Jan-23 05:00:00	11.29224486	0.499471765	11.79340098
22-Jan-23 06:00:00	11.23815844	0.482501027	11.72352134
22-Jan-23 07:00:00	11.40497865	0.479999844	11.87329589
22-Jan-23 08:00:00	11.21646595	0.481742553	11.69988129
22-Jan-23 09:00:00	11.18349017	0.674074481	11.86799351
22-Jan-23 10:00:00	11.21120146	0.456185426	11.7058301
22-Jan-23 11:00:00	11.12541877	0.484311702	11.60078197
22-Jan-23 12:00:00	11.25557364	0.4815047	11.73043972
22-Jan-23 13:00:00	11.53388617	0.481494341	12.01393625
22-Jan-23 14:00:00	11.68748347	0.633949293	12.32874938
22-Jan-23 15:00:00	11.69004308	0.510572011	12.22773605
22-Jan-23 16:00:00	11.6662755	0.42416162	12.15537813
22-Jan-23 17:00:00	11.4210177	0.445713222	11.89370033
22-Jan-23 18:00:00	11.51712412	0.482057068	11.99328279
22-Jan-23 19:00:00	11.28552257	0.522610359	11.81070201
22-Jan-23 20:00:00	11.2786572	0.593928099	11.87404066
22-Jan-23 21:00:00	11.27655819	0.495819396	11.71840964
22-Jan-23 22:00:00	11.28323544	0.941849854	12.18730223
22-Jan-23 23:00:00	11.28781668	1.315486908	12.60897481
23-Jan-23 00:00:00	11.26749282	1.327197814	12.57333887
23-Jan-23 01:00:00	11.30282206	1.315930465	12.64713979
23-Jan-23 02:00:00	11.26189068	8.235020121	19.50049835
23-Jan-23 03:00:00	17.28900094	32.20324389	49.47639974
23-Jan-23 04:00:00	15.61736096	32.3032546	47.90433218
23-Jan-23 05:00:00	15.63493231	32.28341505	47.912393
23-Jan-23 06:00:00	15.60202074	32.20376078	47.7739155
23-Jan-23 07:00:00	15.60685545	32.25908099	47.86842113
23-Jan-23 08:00:00	21.36792771	32.34915337	53.67686844
23-Jan-23 09:00:00	22.44400215	1.303110709	23.73546028
23-Jan-23 10:00:00	22.48270978	0.648294251	23.14604489
23-Jan-23 11:00:00	18.81231271	0.613461085	19.43622441

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
23-Jan-23 12:00:00	11.64329449	0.613810718	12.26435651
23-Jan-23 13:00:00	11.62116602	0.613594277	12.22212614
23-Jan-23 14:00:00	11.6621525	0.57241702	12.27921776
23-Jan-23 15:00:00	11.7056773	0.507368356	12.181444
23-Jan-23 16:00:00	11.66258393	0.476595297	12.07821623
23-Jan-23 17:00:00	11.31564204	0.413542243	11.69364847
23-Jan-23 18:00:00	11.409418	0.395407023	11.78464317
23-Jan-23 19:00:00	11.36939266	0.450957744	11.83457804
23-Jan-23 20:00:00	11.37548542	0.450641745	11.85717597
23-Jan-23 21:00:00	11.35827335	0.450739486	11.79440492
23-Jan-23 22:00:00	11.33049817	0.419953927	11.82883533
23-Jan-23 23:00:00	11.67032067	0.481437149	12.16468058
24-Jan-23 00:00:00	11.34926791	0.48481745	11.83845123
24-Jan-23 01:00:00	11.39135006	0.630597102	11.96671796
24-Jan-23 02:00:00	11.36664772	0.522143651	11.83499596
24-Jan-23 03:00:00	11.31657224	0.482743615	11.79375113
24-Jan-23 04:00:00	11.39601893	0.479347102	11.87626867
24-Jan-23 05:00:00	11.28479454	0.480217856	11.76088331
24-Jan-23 06:00:00	11.36487571	0.573724873	11.95382445
24-Jan-23 07:00:00	11.35981501	0.537114218	11.89442661
24-Jan-23 08:00:00	11.36856662	0.4981338	11.87367418
24-Jan-23 09:00:00	11.43879048	0.482259726	11.92195924
24-Jan-23 10:00:00	11.48992862	0.481339696	11.96784685
24-Jan-23 11:00:00	11.83231327	0.533666591	12.36051022
24-Jan-23 12:00:00	11.7873924	0.544692111	12.33323865
24-Jan-23 13:00:00	11.83188915	0.505648631	12.33803255
24-Jan-23 14:00:00	11.48895762	0.482101887	11.95762968
24-Jan-23 15:00:00	11.33404213	0.478943189	11.83158339
24-Jan-23 16:00:00	11.33221584	0.480669058	11.77802734
24-Jan-23 17:00:00	11.30398295	0.655656996	11.93100341
24-Jan-23 18:00:00	11.27037319	0.513191999	11.79095406
24-Jan-23 19:00:00	11.28101762	0.482092023	11.79183102
24-Jan-23 20:00:00	11.33821408	0.480043441	11.82550211
24-Jan-23 21:00:00	11.38849449	0.479836118	11.84993479
24-Jan-23 22:00:00	11.26255518	0.580166511	11.83628001
24-Jan-23 23:00:00	11.30230898	0.50440836	11.8341342
25-Jan-23 00:00:00	11.26127434	0.459340115	11.6949056
25-Jan-23 01:00:00	11.16283131	0.395718881	11.54863062
25-Jan-23 02:00:00	11.33947664	0.394498577	11.75533522
25-Jan-23 03:00:00	11.66690005	0.426810972	12.09052491
25-Jan-23 04:00:00	11.6848704	0.596196627	12.28406077
25-Jan-23 05:00:00	11.66051541	0.512241218	12.16431989
25-Jan-23 06:00:00	11.5316746	0.48398239	12.01109764

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
25-Jan-23 07:00:00	11.41955593	0.483163613	11.91114389
25-Jan-23 08:00:00	11.46971766	0.482054621	11.95643017
25-Jan-23 09:00:00	11.50841697	0.628722019	12.13292106
25-Jan-23 10:00:00	11.5038351	0.487665219	12.00851213
25-Jan-23 11:00:00	11.48908554	0.454469705	11.8986845
25-Jan-23 12:00:00	11.21486447	0.395280204	11.6145837
25-Jan-23 13:00:00	11.4448452	0.397332706	11.85013583
25-Jan-23 14:00:00	11.49889308	0.513151228	12.01516752
25-Jan-23 15:00:00	11.50754934	0.535903762	12.04235664
25-Jan-23 16:00:00	11.50117615	0.484429455	11.98019383
25-Jan-23 17:00:00	11.30863629	0.481894074	11.81177081
25-Jan-23 18:00:00	11.49902254	0.481514657	11.99389368
25-Jan-23 19:00:00	11.28806729	0.481291264	11.77981551
25-Jan-23 20:00:00	11.30443981	0.684745464	11.95740575
25-Jan-23 21:00:00	11.24030431	0.538272059	11.77847257
25-Jan-23 22:00:00	11.25126939	0.613489735	11.85493692
25-Jan-23 23:00:00	11.33010636	0.616407889	11.96159891
26-Jan-23 00:00:00	11.25955333	0.616161162	11.86767954
26-Jan-23 01:00:00	11.21157667	0.690044135	11.91441833
26-Jan-23 02:00:00	11.19315047	0.536448423	11.74644505
26-Jan-23 03:00:00	11.16641336	0.490344145	11.65770923
26-Jan-23 04:00:00	11.29623471	0.482429871	11.7809159
26-Jan-23 05:00:00	11.36393415	0.482488155	11.84956357
26-Jan-23 06:00:00	11.71047391	0.559478237	12.25730165
26-Jan-23 07:00:00	11.65297725	0.648040073	12.32301021
26-Jan-23 08:00:00	11.68748252	0.570069866	12.27638202
26-Jan-23 09:00:00	11.41153675	0.616421217	12.01939662
26-Jan-23 10:00:00	11.38240751	0.619025414	11.99795559
26-Jan-23 11:00:00	11.38126506	0.61652497	12.00140305
26-Jan-23 12:00:00	11.24049992	0.669992469	11.89514383
26-Jan-23 13:00:00	11.29963324	0.506884669	11.77570537
26-Jan-23 14:00:00	11.24475092	0.481882546	11.73477789
26-Jan-23 15:00:00	11.29077154	0.481607768	11.77478059
26-Jan-23 16:00:00	11.19916911	0.482487292	11.67655606
26-Jan-23 17:00:00	11.03618293	0.618016348	11.66746002
26-Jan-23 18:00:00	11.06344091	0.555312913	11.62618341
26-Jan-23 19:00:00	11.06496783	0.494370076	11.56135478
26-Jan-23 20:00:00	11.14593781	0.482449338	11.6243683
26-Jan-23 21:00:00	11.49500555	0.482642314	11.96207979
26-Jan-23 22:00:00	11.55275159	0.515989903	12.06875923
26-Jan-23 23:00:00	11.61856206	0.579071149	12.17635648
27-Jan-23 00:00:00	11.58420897	0.514681909	12.10379299
27-Jan-23 01:00:00	11.39038112	0.481124993	11.87195085

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
27-Jan-23 02:00:00	11.35983753	0.480409961	11.84215977
27-Jan-23 03:00:00	11.47877947	0.4823738	11.93983157
27-Jan-23 04:00:00	11.52051989	0.679397408	12.17373859
27-Jan-23 05:00:00	11.4904472	0.522609619	12.01934338
27-Jan-23 06:00:00	11.46015856	0.484721893	11.9532387
27-Jan-23 07:00:00	11.33660481	0.480886596	11.80480952
27-Jan-23 08:00:00	11.42806286	0.481101124	11.90630706
27-Jan-23 09:00:00	11.28995101	0.631789184	11.86650731
27-Jan-23 10:00:00	11.2534745	0.561968254	11.84186633
27-Jan-23 11:00:00	11.31797319	0.491445444	11.79333962
27-Jan-23 12:00:00	11.063622	0.482556178	11.54009836
27-Jan-23 13:00:00	11.36651633	0.481288188	11.83657842
27-Jan-23 14:00:00	11.28377708	0.507141469	11.78417931
27-Jan-23 15:00:00	11.26561737	0.67255463	11.90745301
27-Jan-23 16:00:00	11.29374218	0.535583647	11.81818669
27-Jan-23 17:00:00	11.16320599	0.611645683	11.78052398
27-Jan-23 18:00:00	11.56360865	0.614292417	12.17848704
27-Jan-23 19:00:00	11.55415856	0.613610645	12.19532424
27-Jan-23 20:00:00	11.57774634	0.723627379	12.3041664
27-Jan-23 21:00:00	11.60522805	0.530890753	12.1285029
27-Jan-23 22:00:00	11.57060358	0.599666026	12.15937922
27-Jan-23 23:00:00	11.20519198	0.614066561	11.82014624
28-Jan-23 00:00:00	11.35113287	0.61483773	11.97713411
28-Jan-23 01:00:00	11.3726817	0.651274188	11.99923542
28-Jan-23 02:00:00	11.36770418	0.541837422	11.92164463
28-Jan-23 03:00:00	11.35990874	0.519383594	11.86837066
28-Jan-23 04:00:00	11.32271767	0.484870058	11.80700949
28-Jan-23 05:00:00	11.55176311	0.486272683	12.03137346
28-Jan-23 06:00:00	11.45713292	0.483443808	11.93688663
28-Jan-23 07:00:00	11.36038992	0.666954741	12.02675789
28-Jan-23 08:00:00	11.36330001	0.560570649	11.90585052
28-Jan-23 09:00:00	11.29592747	0.396235859	11.68112737
28-Jan-23 10:00:00	11.33407564	0.395442615	11.74435458
28-Jan-23 11:00:00	11.19608694	0.394965347	11.56611558
28-Jan-23 12:00:00	11.04705615	0.590368195	11.66268326
28-Jan-23 13:00:00	11.0505138	0.54388232	11.5890273
28-Jan-23 14:00:00	11.06563033	0.482481927	11.53814824
28-Jan-23 15:00:00	11.28286441	0.481540259	11.75845881
28-Jan-23 16:00:00	11.53842905	0.481676012	12.02895576
28-Jan-23 17:00:00	11.56155872	0.575291753	12.17334196
28-Jan-23 18:00:00	11.5957006	0.574472101	12.18102994
28-Jan-23 19:00:00	11.59729325	0.500311402	12.1212709
28-Jan-23 20:00:00	11.38680893	0.481245766	11.85169178

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
28-Jan-23 21:00:00	11.40049299	0.481290272	11.90848144
28-Jan-23 22:00:00	11.48580843	0.481156541	11.99370723
28-Jan-23 23:00:00	11.51496638	0.703936562	12.21452012
29-Jan-23 00:00:00	11.51736959	0.53953658	12.07394778
29-Jan-23 01:00:00	11.42937681	0.481909096	11.90703493
29-Jan-23 02:00:00	11.4772573	0.482358632	11.95296602
29-Jan-23 03:00:00	11.51031309	0.48285166	12.01336785
29-Jan-23 04:00:00	11.38322613	0.635115562	12.03093227
29-Jan-23 05:00:00	11.34758287	0.590804017	11.95558961
29-Jan-23 06:00:00	11.38973697	0.51890453	11.9154439
29-Jan-23 07:00:00	11.24077866	0.482204457	11.70717375
29-Jan-23 08:00:00	11.44167317	0.482512346	11.91165294
29-Jan-23 09:00:00	11.37409051	0.542715186	11.90586954
29-Jan-23 10:00:00	11.36052598	0.670828402	12.04099184
29-Jan-23 11:00:00	11.40072446	0.510829979	11.89970807
29-Jan-23 12:00:00	11.23836962	0.481588145	11.72797719
29-Jan-23 13:00:00	11.51968622	0.480275184	11.99750053
29-Jan-23 14:00:00	11.39198987	0.482127226	11.89968411
29-Jan-23 15:00:00	11.35448398	0.659757199	12.01382746
29-Jan-23 16:00:00	11.36680788	0.526795766	11.90510141
29-Jan-23 17:00:00	11.33926463	0.611934188	11.95238323
29-Jan-23 18:00:00	11.33478069	0.613066481	11.93392457
29-Jan-23 19:00:00	11.21135155	0.612181127	11.82024686
29-Jan-23 20:00:00	0.874873614	0.706302604	1.575267278
29-Jan-23 21:00:00	0.019841725	0.564065289	0.588029237
29-Jan-23 22:00:00	0.012990304	0.481102134	0.491296038
29-Jan-23 23:00:00	0.002453591	0.486935795	0.489235798
30-Jan-23 00:00:00	0.000867323	0.485602076	0.486512495
30-Jan-23 01:00:00	0.000427821	0.482077444	0.482255931
30-Jan-23 02:00:00	0.00052532	0.480950508	0.481709289
30-Jan-23 03:00:00	0.000559959	0.466252729	0.467177098
30-Jan-23 04:00:00	0.000556972	0.403032232	0.403512255
30-Jan-23 05:00:00	0.000519764	0.394801582	0.395214086
30-Jan-23 06:00:00	0.000464359	0.393931081	0.394320813
30-Jan-23 07:00:00	0.000527486	0.42578954	0.426341993
30-Jan-23 08:00:00	0.000551847	0.434018667	0.434600362
30-Jan-23 09:00:00	0.000557004	0.451558044	0.452186137
30-Jan-23 10:00:00	0.925719478	0.394759387	1.309008363
30-Jan-23 11:00:00	1.063441181	0.396065966	1.45745386
30-Jan-23 12:00:00	1.007696655	0.426296745	1.417858115
30-Jan-23 13:00:00	1.005950914	0.531626592	1.434361986
30-Jan-23 14:00:00	1.010601064	0.460731101	1.426198817
30-Jan-23 15:00:00	6.215752284	0.396919666	6.599306266

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
30-Jan-23 16:00:00	10.761287	0.393923076	11.15280143
30-Jan-23 17:00:00	11.08704185	0.393643826	11.46494905
30-Jan-23 18:00:00	11.13877153	0.641300047	11.79008007
30-Jan-23 19:00:00	11.1764698	0.497777008	11.65696695
30-Jan-23 20:00:00	11.00749445	0.486920318	11.50442455
30-Jan-23 21:00:00	10.75127157	0.481876246	11.22696817
30-Jan-23 22:00:00	10.7856937	0.480481691	11.25763051
30-Jan-23 23:00:00	10.57391649	0.622601249	11.16623063
31-Jan-23 00:00:00	10.58080255	0.513182352	11.04639249
31-Jan-23 01:00:00	10.59636005	0.449956004	10.98799064
31-Jan-23 02:00:00	10.59960625	0.392327596	10.99770464
31-Jan-23 03:00:00	10.71054029	0.394875076	11.12107245
31-Jan-23 04:00:00	10.23609893	0.542543568	10.7043857
31-Jan-23 05:00:00	10.21326039	0.541189896	10.76217012
31-Jan-23 06:00:00	10.24089755	0.491626299	10.69216818
31-Jan-23 07:00:00	10.28420194	0.421421555	10.67108514
31-Jan-23 08:00:00	10.75950612	0.392954896	11.15513839
31-Jan-23 09:00:00	10.53106144	0.393560311	10.92073388
31-Jan-23 10:00:00	10.51824851	0.66365087	11.14274309
31-Jan-23 11:00:00	10.50844558	0.477726853	10.97586653
31-Jan-23 12:00:00	10.47825628	0.480604847	10.87025811
31-Jan-23 13:00:00	10.55157767	0.414072249	10.95726004
31-Jan-23 14:00:00	10.5360206	0.393949633	10.93724555
31-Jan-23 15:00:00	10.63878489	0.548048784	11.17729923
31-Jan-23 16:00:00	10.69177951	0.487192076	11.17043024
31-Jan-23 17:00:00	10.66550689	0.428375122	11.0627257
31-Jan-23 18:00:00	10.54647451	0.397445667	10.91418547
31-Jan-23 19:00:00	10.6797391	0.393506134	11.08618531
31-Jan-23 20:00:00	10.31190846	0.422228412	10.71016725
31-Jan-23 21:00:00	10.30517382	0.579998314	10.90793604
31-Jan-23 22:00:00	10.31687588	0.508341837	10.79902622
31-Jan-23 23:00:00	10.33458021	0.447664368	10.71951387
01-Feb-23 00:00:00	10.56526947	0.393372864	10.96221201
01-Feb-23 01:00:00	10.39091264	0.395284414	10.77721368
01-Feb-23 02:00:00	10.38558112	0.572334844	10.94539351
01-Feb-23 03:00:00	10.38476393	0.4943371	10.84358833
01-Feb-23 04:00:00	10.39282529	0.485611294	10.86920051
01-Feb-23 05:00:00	10.35383564	0.485990544	10.84222762
01-Feb-23 06:00:00	10.54161835	0.480934801	11.04007089
01-Feb-23 07:00:00	10.59389989	0.551471084	11.17458322
01-Feb-23 08:00:00	10.5871874	0.51873279	11.1029877
01-Feb-23 09:00:00	10.59403361	0.483923846	11.04245965
01-Feb-23 10:00:00	10.51971637	0.488723191	11.01272689

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
01-Feb-23 11:00:00	10.64902465	0.485938245	11.13017792
01-Feb-23 12:00:00	10.9472963	0.481106371	11.42658864
01-Feb-23 13:00:00	10.94341644	0.654540781	11.60652157
01-Feb-23 14:00:00	10.96184805	0.483749062	11.3798826
01-Feb-23 15:00:00	10.81286955	0.417077935	11.23198929
01-Feb-23 16:00:00	10.70845429	0.393130296	11.12224065
01-Feb-23 17:00:00	10.47818703	0.394217126	10.87715689
01-Feb-23 18:00:00	10.36681959	0.597125775	10.96860668
01-Feb-23 19:00:00	10.4105267	0.507232584	10.90661531
01-Feb-23 20:00:00	10.36969471	0.419163996	10.86047384
01-Feb-23 21:00:00	10.44023614	0.45214162	10.92301093
01-Feb-23 22:00:00	10.68915992	0.48420313	11.16537329
01-Feb-23 23:00:00	10.66745822	0.564513769	11.20555125
02-Feb-23 00:00:00	10.67485401	0.550242429	11.20577007
02-Feb-23 01:00:00	10.67410644	0.471048523	11.10852045
02-Feb-23 02:00:00	10.42156392	0.395193477	10.80795776
02-Feb-23 03:00:00	10.5404679	0.395340596	10.93714062
02-Feb-23 04:00:00	10.55749199	0.394625262	10.95335939
02-Feb-23 05:00:00	10.50626903	0.642687074	11.11449967
02-Feb-23 06:00:00	10.5335208	0.47991763	11.00594725
02-Feb-23 07:00:00	10.45014095	0.412685117	10.85904854
02-Feb-23 08:00:00	10.63917287	0.393070919	11.03906919
02-Feb-23 09:00:00	10.76274363	0.395148425	11.15342469
02-Feb-23 10:00:00	10.86939565	0.569923227	11.40618089
02-Feb-23 11:00:00	10.8828339	0.512633743	11.37279945
02-Feb-23 12:00:00	10.86964777	0.482657224	11.32228639
02-Feb-23 13:00:00	10.61440863	0.482806559	11.11681615
02-Feb-23 14:00:00	10.62928677	0.482762635	11.09861607
02-Feb-23 15:00:00	10.50417799	0.52320477	11.04844766
02-Feb-23 16:00:00	10.53105598	0.577826236	11.10134496
02-Feb-23 17:00:00	10.50845279	0.368641555	10.90480587
02-Feb-23 18:00:00	10.31219059	0.331707231	10.69146257
02-Feb-23 19:00:00	10.60447078	0.394878034	11.01576519
02-Feb-23 20:00:00	10.43734852	0.395130861	10.8481493
02-Feb-23 21:00:00	10.413963	0.579163258	10.98829444
02-Feb-23 22:00:00	10.36536153	0.477067049	10.81313297
02-Feb-23 23:00:00	10.38083363	0.410833201	10.7756162
03-Feb-23 00:00:00	10.63254923	0.394904959	11.02401665
03-Feb-23 01:00:00	10.57417472	0.396135408	10.97765425
03-Feb-23 02:00:00	10.60187652	0.515378237	11.1320884
03-Feb-23 03:00:00	10.57227559	0.514997608	11.04897134
03-Feb-23 04:00:00	10.59950537	0.329542435	10.98955446
03-Feb-23 05:00:00	10.64713944	0.338252219	11.02921528

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
03-Feb-23 06:00:00	10.46572871	0.392677829	10.86871947
03-Feb-23 07:00:00	10.68875853	0.396517706	11.08292511
03-Feb-23 08:00:00	10.67739942	0.593362388	11.28129064
03-Feb-23 09:00:00	10.65737938	0.41955427	11.05240555
03-Feb-23 10:00:00	10.5928341	0.45855851	10.98439843
03-Feb-23 11:00:00	10.54602565	0.396508325	10.93811793
03-Feb-23 12:00:00	10.76513788	0.394378659	11.15766753
03-Feb-23 13:00:00	10.66115602	0.598208126	11.25671893
03-Feb-23 14:00:00	10.68361478	0.48902422	11.12376171
03-Feb-23 15:00:00	10.65428416	0.308449083	11.02770307
03-Feb-23 16:00:00	10.37667645	0.362340273	10.73820464
03-Feb-23 17:00:00	10.69842333	0.394148837	11.09259793
03-Feb-23 18:00:00	10.56830088	0.504093145	11.06705798
03-Feb-23 19:00:00	10.61231512	0.505728196	11.09486149
03-Feb-23 20:00:00	10.56960837	0.440222583	10.99885501
03-Feb-23 21:00:00	10.49324094	0.394851361	10.89444431
03-Feb-23 22:00:00	10.61257129	0.394485624	11.01712566
03-Feb-23 23:00:00	10.71147638	0.394375265	11.11797214
04-Feb-23 00:00:00	10.6884897	0.651828796	11.35472955
04-Feb-23 01:00:00	10.65562508	0.49807018	11.09305731
04-Feb-23 02:00:00	10.59155634	0.428537729	10.98423483
04-Feb-23 03:00:00	10.45063867	0.396695435	10.82990159
04-Feb-23 04:00:00	10.65167316	0.393973695	11.06867419
04-Feb-23 05:00:00	10.58496049	0.577998966	11.16197305
04-Feb-23 06:00:00	10.61381737	0.501974376	11.11709587
04-Feb-23 07:00:00	10.57355007	0.482352382	11.04684612
04-Feb-23 08:00:00	10.50826926	0.483712083	10.9807912
04-Feb-23 09:00:00	10.74224493	0.484609613	11.22713719
04-Feb-23 10:00:00	10.60273857	0.536355351	11.12066507
04-Feb-23 11:00:00	10.59321751	0.537957336	11.11809815
04-Feb-23 12:00:00	10.58456257	0.392211703	10.99252124
04-Feb-23 13:00:00	10.44421985	0.392848136	10.83039989
04-Feb-23 14:00:00	10.63681263	0.394014323	11.03678216
04-Feb-23 15:00:00	10.47245428	0.396676048	10.87422111
04-Feb-23 16:00:00	10.52330308	0.621952166	11.12421375
04-Feb-23 17:00:00	10.50072241	0.478966789	10.9313462
04-Feb-23 18:00:00	10.45042144	0.413118636	10.81914669
04-Feb-23 19:00:00	10.51111073	0.393712406	10.90749497
04-Feb-23 20:00:00	10.62237032	0.39514233	11.03551911
04-Feb-23 21:00:00	10.51253017	0.548235595	11.04373826
04-Feb-23 22:00:00	10.48882751	0.407503972	10.93210659
04-Feb-23 23:00:00	10.49772702	0.474282918	10.90762367
05-Feb-23 00:00:00	10.59079334	0.434424636	10.99081797

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
05-Feb-23 01:00:00	10.57950126	0.400004944	10.97692442
05-Feb-23 02:00:00	10.60592392	0.437850836	11.04491831
05-Feb-23 03:00:00	10.58289756	0.552158535	11.13999759
05-Feb-23 04:00:00	10.57478317	0.484243882	11.01499844
05-Feb-23 05:00:00	10.55879164	0.482166619	11.04712269
05-Feb-23 06:00:00	10.64950991	0.483077519	11.118991
05-Feb-23 07:00:00	10.68362649	0.48376435	11.14150281
05-Feb-23 08:00:00	10.65007167	0.576649042	11.30668705
05-Feb-23 09:00:00	10.68700525	0.39391136	11.10472812
05-Feb-23 10:00:00	10.63895893	0.396047793	11.04456682
05-Feb-23 11:00:00	10.50746467	0.396404682	10.89507315
05-Feb-23 12:00:00	10.68346988	0.395950973	11.06383016
05-Feb-23 13:00:00	10.80175066	0.661561615	11.31132142
05-Feb-23 14:00:00	10.78135957	0.515862987	11.25906155
05-Feb-23 15:00:00	10.8017247	0.461792562	11.20706558
05-Feb-23 16:00:00	10.43500307	0.395351847	10.84588083
05-Feb-23 17:00:00	10.51751428	0.393699816	10.90773402
05-Feb-23 18:00:00	10.5106278	0.394732356	10.91169055
05-Feb-23 19:00:00	10.52546332	0.618708452	11.1550711
05-Feb-23 20:00:00	10.50489479	0.468487258	10.95482397
05-Feb-23 21:00:00	10.4879544	0.405154202	10.8892613
05-Feb-23 22:00:00	10.60185258	0.39593443	10.99690474
05-Feb-23 23:00:00	10.7883873	0.393384127	11.20417939
06-Feb-23 00:00:00	10.80180269	0.68541988	11.35954216
06-Feb-23 01:00:00	10.76667685	0.511778702	11.26098257
06-Feb-23 02:00:00	10.81154654	0.482508682	11.26819003
06-Feb-23 03:00:00	10.31759686	0.480156225	10.78553046
06-Feb-23 04:00:00	10.58520412	0.480203644	11.07460652
06-Feb-23 05:00:00	10.53462897	0.558109101	11.10559029
06-Feb-23 06:00:00	10.49198288	0.539177616	11.02944014
06-Feb-23 07:00:00	10.50696728	0.480527381	10.93291283
06-Feb-23 08:00:00	10.41925314	0.481996421	10.91715678
06-Feb-23 09:00:00	10.68188821	0.486376273	11.1710767
06-Feb-23 10:00:00	10.56497987	0.488862365	11.03626286
06-Feb-23 11:00:00	10.57100651	0.655425236	11.20344056
06-Feb-23 12:00:00	10.58071253	0.501685115	11.05723578
06-Feb-23 13:00:00	10.47844733	0.483190368	10.92625256
06-Feb-23 14:00:00	10.63378392	0.48027793	11.11250112
06-Feb-23 15:00:00	10.43506469	0.479992496	10.92362526
06-Feb-23 16:00:00	10.29181899	0.591020837	10.89076612
06-Feb-23 17:00:00	10.30836068	0.525201385	10.82632642
06-Feb-23 18:00:00	10.30905332	0.503761666	10.81700898
06-Feb-23 19:00:00	10.47287544	0.481157212	10.9689513

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
06-Feb-23 20:00:00	10.76512067	0.482892308	11.24789206
06-Feb-23 21:00:00	10.86552636	0.564824217	11.42873777
06-Feb-23 22:00:00	10.87800095	0.664737069	11.55155638
06-Feb-23 23:00:00	10.85405525	0.504882666	11.3635776
07-Feb-23 00:00:00	10.71462848	0.484847561	11.18190735
07-Feb-23 01:00:00	10.58913729	0.480097748	11.06725438
07-Feb-23 02:00:00	10.43468086	0.481393275	10.91803484
07-Feb-23 03:00:00	10.39540995	0.672105691	11.02724081
07-Feb-23 04:00:00	10.36738676	0.540050872	10.88362119
07-Feb-23 05:00:00	10.37278891	0.486018735	10.83266274
07-Feb-23 06:00:00	10.50107617	0.481035679	10.97785282
07-Feb-23 07:00:00	10.70851538	0.480713325	11.18976604
07-Feb-23 08:00:00	10.95684433	0.609973093	11.5555145
07-Feb-23 09:00:00	10.92856905	0.603647215	11.52285568
07-Feb-23 10:00:00	10.96767939	0.584150111	11.56159963
07-Feb-23 11:00:00	10.60432837	0.613752876	11.20733705
07-Feb-23 12:00:00	10.65076833	0.614664385	11.26398993
07-Feb-23 13:00:00	10.66791614	0.625793303	11.31174307
07-Feb-23 14:00:00	10.66055123	0.697351681	11.35803424
07-Feb-23 15:00:00	10.69395463	0.544806837	11.23957531
07-Feb-23 16:00:00	10.51556836	0.482779016	10.97263257
07-Feb-23 17:00:00	10.60136345	0.486361536	11.08254254
07-Feb-23 18:00:00	10.65464507	0.484804525	11.13213674
07-Feb-23 19:00:00	10.59397146	0.672435033	11.26162932
07-Feb-23 20:00:00	10.58227777	0.55105432	11.12882466
07-Feb-23 21:00:00	10.5922823	0.604548136	11.18734282
07-Feb-23 22:00:00	10.57449177	0.615664164	11.12205267
07-Feb-23 23:00:00	10.70063019	0.615834157	11.32995839
08-Feb-23 00:00:00	10.59158119	0.711101046	11.28912346
08-Feb-23 01:00:00	10.59330093	0.678851528	11.24169743
08-Feb-23 02:00:00	10.59988091	0.512115669	11.10548021
08-Feb-23 03:00:00	10.53548725	0.481185049	11.02284686
08-Feb-23 04:00:00	10.62678806	0.480290214	11.10645088
08-Feb-23 05:00:00	10.8669236	0.483324183	11.37236526
08-Feb-23 06:00:00	10.8541299	0.736133556	11.58639956
08-Feb-23 07:00:00	10.89152739	0.52922869	11.43768459
08-Feb-23 08:00:00	10.64920068	0.480179189	11.14407449
08-Feb-23 09:00:00	10.69151507	0.482388532	11.18185388
08-Feb-23 10:00:00	10.63218456	0.484285706	11.12994194
08-Feb-23 11:00:00	10.57811801	0.692579873	11.25557073
08-Feb-23 12:00:00	10.60148229	0.571358984	11.12658479
08-Feb-23 13:00:00	10.58936744	0.483841121	11.05843
08-Feb-23 14:00:00	10.41509051	0.480737225	10.89205005

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
08-Feb-23 15:00:00	10.43585046	0.480387795	10.93264867
08-Feb-23 16:00:00	10.49864335	0.564792157	11.0619692
08-Feb-23 17:00:00	10.51923927	0.61498278	11.16257903
08-Feb-23 18:00:00	10.5139131	0.578980865	11.09815693
08-Feb-23 19:00:00	10.47225067	0.613808882	11.08589437
08-Feb-23 20:00:00	10.6471174	0.611214962	11.25852442
08-Feb-23 21:00:00	10.59778118	0.612960746	11.21709538
08-Feb-23 22:00:00	10.59510157	0.70317326	11.3035871
08-Feb-23 23:00:00	10.589913	0.547927058	11.12300173
09-Feb-23 00:00:00	10.4597719	0.483496726	10.93828064
09-Feb-23 01:00:00	10.69059637	0.481903056	11.18012057
09-Feb-23 02:00:00	10.51379903	0.481733644	10.99949408
09-Feb-23 03:00:00	10.66737927	0.673793656	11.3283294
09-Feb-23 04:00:00	10.66705603	0.584882809	11.25529936
09-Feb-23 05:00:00	10.6771653	0.578521945	11.25736785
09-Feb-23 06:00:00	10.4909899	0.613002682	11.10701921
09-Feb-23 07:00:00	10.4988904	0.615243256	11.13476741
09-Feb-23 08:00:00	10.67613448	0.648339979	11.31855165
09-Feb-23 09:00:00	10.65961568	0.657230223	11.35145611
09-Feb-23 10:00:00	10.67777586	0.568544516	11.23326651
09-Feb-23 11:00:00	10.55285459	0.61767875	11.18536668
09-Feb-23 12:00:00	10.508366	0.612229808	11.12120514
09-Feb-23 13:00:00	10.59935755	0.611291635	11.22583186
09-Feb-23 14:00:00	10.50897619	0.69913637	11.22235673
09-Feb-23 15:00:00	10.52033859	0.547222645	11.10625602
09-Feb-23 16:00:00	10.50334676	0.618284096	11.11948076
09-Feb-23 17:00:00	10.37711069	0.613372025	10.99836413
09-Feb-23 18:00:00	10.55256833	0.610806386	11.17395684
09-Feb-23 19:00:00	10.37400752	0.703148312	11.06679349
09-Feb-23 20:00:00	10.40666003	0.593313962	11.04059952
09-Feb-23 21:00:00	10.3828222	0.498707568	10.87122385
09-Feb-23 22:00:00	10.40290223	0.483876395	10.88926526
09-Feb-23 23:00:00	10.46486971	0.483548585	10.9447701
10-Feb-23 00:00:00	10.64869595	0.482947345	11.13473059
10-Feb-23 01:00:00	10.67410093	0.679689621	11.35513179
10-Feb-23 02:00:00	10.6645067	0.521418097	11.175919
10-Feb-23 03:00:00	10.47374858	0.481929189	10.92544371
10-Feb-23 04:00:00	10.42905601	0.483956313	10.92656388
10-Feb-23 05:00:00	10.71099721	0.484068054	11.18243321
10-Feb-23 06:00:00	10.78547027	0.684290585	11.46326791
10-Feb-23 07:00:00	10.79833746	0.52581439	11.34317997
10-Feb-23 08:00:00	10.80225499	0.48810666	11.28527387
10-Feb-23 09:00:00	10.3955778	0.481484596	10.86974721

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
10-Feb-23 10:00:00	10.62417089	0.482594152	11.10601367
10-Feb-23 11:00:00	10.49046506	0.606789244	11.06941815
10-Feb-23 12:00:00	10.53976679	0.625432798	11.15946176
10-Feb-23 13:00:00	10.50186957	0.503630978	11.0038423
10-Feb-23 14:00:00	10.58004157	0.481376658	11.07391871
10-Feb-23 15:00:00	10.48945173	0.483209688	10.98399063
10-Feb-23 16:00:00	10.23300203	0.48522107	10.71008105
10-Feb-23 17:00:00	10.24412632	0.634442735	10.90569841
10-Feb-23 18:00:00	10.21884203	0.556780626	10.76788738
10-Feb-23 19:00:00	10.20161334	0.481771016	10.66800003
10-Feb-23 20:00:00	10.57429059	0.481554093	11.0413386
10-Feb-23 21:00:00	10.58380699	0.481523007	11.09794601
10-Feb-23 22:00:00	10.80470032	0.644665208	11.45464293
10-Feb-23 23:00:00	10.78544527	0.555785833	11.34363537
11-Feb-23 00:00:00	10.775196	0.408529951	11.25178671
11-Feb-23 01:00:00	10.44031498	0.449037388	10.93278282
11-Feb-23 02:00:00	10.40137519	0.479417769	10.88995398
11-Feb-23 03:00:00	10.59352069	0.558088717	11.14002727
11-Feb-23 04:00:00	10.59054645	0.636605463	11.2196635
11-Feb-23 05:00:00	10.58183177	0.573127768	11.17073259
11-Feb-23 06:00:00	10.54993338	0.615341608	11.17329317
11-Feb-23 07:00:00	10.66263342	0.613508403	11.27483682
11-Feb-23 08:00:00	10.60352643	0.613588612	11.20215665
11-Feb-23 09:00:00	10.49125285	0.696959573	11.15624387
11-Feb-23 10:00:00	10.51739481	0.548660609	11.05489951
11-Feb-23 11:00:00	10.49997913	0.615842191	11.12035538
11-Feb-23 12:00:00	10.57703643	0.614184487	11.1769649
11-Feb-23 13:00:00	10.83213017	0.613020957	11.44365493
11-Feb-23 14:00:00	10.48514191	0.740319649	11.21089766
11-Feb-23 15:00:00	10.51498153	0.591015761	11.11055409
11-Feb-23 16:00:00	10.50957537	0.552693829	11.09659389
11-Feb-23 17:00:00	10.42825535	0.614942425	11.05218006
11-Feb-23 18:00:00	10.64276499	0.617392626	11.26631002
11-Feb-23 19:00:00	10.7544499	0.630613842	11.3812578
11-Feb-23 20:00:00	10.79746813	0.684165461	11.48292577
11-Feb-23 21:00:00	10.79899648	0.555095664	11.34997023
11-Feb-23 22:00:00	10.80396032	1.010305792	11.80802824
11-Feb-23 23:00:00	10.79070568	1.401521218	12.16942231
12-Feb-23 00:00:00	10.79531275	1.40027627	12.17072842
12-Feb-23 01:00:00	10.78560771	1.410750359	12.17388397
12-Feb-23 02:00:00	10.7942596	6.455787096	17.22384314
12-Feb-23 03:00:00	14.80488772	31.65733306	46.46943167
12-Feb-23 04:00:00	13.61479404	31.65812069	45.26792357

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
12-Feb-23 05:00:00	13.61311685	31.6573107	45.24573212
12-Feb-23 06:00:00	13.60523616	31.61637582	45.22412964
12-Feb-23 07:00:00	13.64629798	31.66775894	45.31678613
12-Feb-23 08:00:00	19.33668444	31.68342126	50.99335565
12-Feb-23 09:00:00	20.39978049	2.249917004	23.45538351
12-Feb-23 10:00:00	20.48064751	0.782670954	21.2502078
12-Feb-23 11:00:00	17.69982571	0.624698397	18.41198259
12-Feb-23 12:00:00	10.62736792	0.693911443	11.32073309
12-Feb-23 13:00:00	10.64517286	0.704862376	11.34148439
12-Feb-23 14:00:00	10.58163028	0.682181418	11.243941
12-Feb-23 15:00:00	10.6022342	0.540917037	11.16890791
12-Feb-23 16:00:00	10.58930943	0.487418039	11.065382
12-Feb-23 17:00:00	10.69799116	0.481136954	11.21029213
12-Feb-23 18:00:00	10.57673528	0.479864995	11.05960035
12-Feb-23 19:00:00	10.38346791	0.532461098	10.88732891
12-Feb-23 20:00:00	10.3821067	0.52624579	10.91229435
12-Feb-23 21:00:00	10.40407965	0.504691616	10.86797183
12-Feb-23 22:00:00	10.29064581	0.447221601	10.67580949
12-Feb-23 23:00:00	10.52291955	0.39621532	10.91591496
13-Feb-23 00:00:00	10.80381166	0.394705705	11.17003653
13-Feb-23 01:00:00	10.87346453	0.656277479	11.50941139
13-Feb-23 02:00:00	10.8828462	0.527434331	11.40848487
13-Feb-23 03:00:00	10.75955465	0.48104943	11.24955602
13-Feb-23 04:00:00	10.63601809	0.482015116	11.12842915
13-Feb-23 05:00:00	10.52922185	0.482161276	11.00001547
13-Feb-23 06:00:00	10.49590503	0.589095828	11.08189032
13-Feb-23 07:00:00	10.53118584	0.530507741	11.05371476
13-Feb-23 08:00:00	10.49614922	0.599476053	11.07088844
13-Feb-23 09:00:00	10.54689377	0.614769607	11.18135539
13-Feb-23 10:00:00	10.53418001	0.61635441	11.16737792
13-Feb-23 11:00:00	10.58064779	0.632502205	11.21273602
13-Feb-23 12:00:00	10.59839794	0.644147582	11.25161139
13-Feb-23 13:00:00	10.57784568	0.544404795	11.13321177
13-Feb-23 14:00:00	10.60549953	0.618557763	11.20308892
13-Feb-23 15:00:00	10.57934194	0.613783465	11.18224992
13-Feb-23 16:00:00	10.4978284	0.613271755	11.10805662
13-Feb-23 17:00:00	10.38766665	0.676123714	11.12441792
13-Feb-23 18:00:00	10.38932207	0.56160285	10.95663189
13-Feb-23 19:00:00	10.37422249	0.490968482	10.8535391
13-Feb-23 20:00:00	10.42921019	0.482109544	10.91970249
13-Feb-23 21:00:00	10.59433254	0.481741135	11.07618752
13-Feb-23 22:00:00	10.59390328	0.59874795	11.17281799
13-Feb-23 23:00:00	10.57695002	0.602497627	11.20506806

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
14-Feb-23 00:00:00	10.60342672	0.532670894	11.12725454
14-Feb-23 01:00:00	10.509624	0.48225378	10.99659339
14-Feb-23 02:00:00	10.58838219	0.483580376	11.06557004
14-Feb-23 03:00:00	10.30405739	0.483037744	10.77519899
14-Feb-23 04:00:00	10.3095181	0.698753733	11.01652961
14-Feb-23 05:00:00	10.30025726	0.551949098	10.85902635
14-Feb-23 06:00:00	10.28609811	0.614089866	10.89101322
14-Feb-23 07:00:00	10.43856335	0.61852911	11.0559424
14-Feb-23 08:00:00	10.76210504	0.616763671	11.36598274
14-Feb-23 09:00:00	10.80428293	0.705130534	11.56724654
14-Feb-23 10:00:00	10.7616094	0.571741894	11.35576001
14-Feb-23 11:00:00	10.80789047	0.591728965	11.40051853
14-Feb-23 12:00:00	10.46775389	0.613071894	11.07894564
14-Feb-23 13:00:00	10.62882201	0.612741047	11.2110316
14-Feb-23 14:00:00	10.53158871	0.67901043	11.21151092
14-Feb-23 15:00:00	10.49005201	0.646280911	11.13088821
14-Feb-23 16:00:00	10.52156258	0.580492743	11.12329245
14-Feb-23 17:00:00	10.51291296	0.613491948	11.13112093
14-Feb-23 18:00:00	10.46701696	0.611674736	11.07108773
14-Feb-23 19:00:00	10.45198515	0.613705254	11.09087441
14-Feb-23 20:00:00	10.49019867	0.751893057	11.19806351
14-Feb-23 21:00:00	10.52106153	0.530896776	11.07770141
14-Feb-23 22:00:00	10.41180754	0.611752323	11.02177196
14-Feb-23 23:00:00	10.62278408	0.614616449	11.22403187
15-Feb-23 00:00:00	10.61075295	0.615274847	11.24453772
15-Feb-23 01:00:00	10.60949892	0.732693328	11.33556318
15-Feb-23 02:00:00	10.58966049	0.56570769	11.1850715
15-Feb-23 03:00:00	10.58737538	0.609076079	11.20651399
15-Feb-23 04:00:00	10.46612549	0.611759158	11.09217183
15-Feb-23 05:00:00	10.54422622	0.612481187	11.16513766
15-Feb-23 06:00:00	10.66300514	0.651670656	11.31626592
15-Feb-23 07:00:00	10.6768473	0.630708683	11.33225048
15-Feb-23 08:00:00	10.6531309	0.519200599	11.19576419
15-Feb-23 09:00:00	10.62898631	0.482108619	11.11619658
15-Feb-23 10:00:00	10.53187503	0.481782232	10.9952497
15-Feb-23 11:00:00	10.4533534	0.481382067	10.92968556
15-Feb-23 12:00:00	10.38620578	0.665484342	11.03705851
15-Feb-23 13:00:00	10.37401581	0.555259826	10.9301486
15-Feb-23 14:00:00	10.34455713	0.611096203	10.95536868
15-Feb-23 15:00:00	10.40560351	0.612587722	11.02149937
15-Feb-23 16:00:00	10.60134029	0.61340692	11.22346852
15-Feb-23 17:00:00	10.76058647	0.719510206	11.49352005
15-Feb-23 18:00:00	10.78102922	0.610811593	11.37898536

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
15-Feb-23 19:00:00	10.79625161	0.603649586	11.3571424
15-Feb-23 20:00:00	10.55313958	0.616915172	11.1545924
15-Feb-23 21:00:00	10.45202486	0.614178906	11.07446459
15-Feb-23 22:00:00	10.35024646	0.64636097	11.00275875
15-Feb-23 23:00:00	10.32997645	0.706713718	11.01134862
16-Feb-23 00:00:00	10.34713364	0.59017743	10.94729856
16-Feb-23 01:00:00	10.32855071	0.616447443	10.93058059
16-Feb-23 02:00:00	10.56306511	0.612165337	11.17258356
16-Feb-23 03:00:00	10.83394363	0.613606469	11.47367096
16-Feb-23 04:00:00	10.80017609	0.736675431	11.50217597
16-Feb-23 05:00:00	10.79101933	0.539127203	11.34188516
16-Feb-23 06:00:00	10.76773641	0.481898115	11.28024525
16-Feb-23 07:00:00	10.49581745	0.484574769	10.98765302
16-Feb-23 08:00:00	10.57657337	0.485031872	11.04908906
16-Feb-23 09:00:00	10.50767936	0.591559398	11.09873613
16-Feb-23 10:00:00	10.50949028	0.58629641	11.1228897
16-Feb-23 11:00:00	10.52119117	0.502898624	11.02449147
16-Feb-23 12:00:00	10.43272697	0.483482337	10.8916547
16-Feb-23 13:00:00	10.63723914	0.486826479	11.11086093
16-Feb-23 14:00:00	10.76325692	0.482318463	11.2320158
16-Feb-23 15:00:00	10.77036068	0.705991581	11.47515387
16-Feb-23 16:00:00	10.79396121	0.535649689	11.33637683
16-Feb-23 17:00:00	10.59176244	0.482892975	11.10807585
16-Feb-23 18:00:00	10.40548552	0.485834576	10.9166059
16-Feb-23 19:00:00	10.46096669	0.484897953	10.92995523
16-Feb-23 20:00:00	10.41054922	0.698199416	11.09993888
16-Feb-23 21:00:00	10.420235	0.579404749	11.01155593
16-Feb-23 22:00:00	10.42425558	0.489830118	10.93086624
16-Feb-23 23:00:00	10.52458747	0.481680025	10.99291723
17-Feb-23 00:00:00	10.70289151	0.480706845	11.18807334
17-Feb-23 01:00:00	10.61988306	0.581675119	11.22615085
17-Feb-23 02:00:00	10.64316675	0.607597648	11.25750492
17-Feb-23 03:00:00	10.61282142	0.537054173	11.13173379
17-Feb-23 04:00:00	10.47705475	0.480586137	10.96875408
17-Feb-23 05:00:00	10.44383627	0.480922885	10.92820655
17-Feb-23 06:00:00	10.45681413	0.483472523	10.90338596
17-Feb-23 07:00:00	10.50677866	0.749643283	11.20052968
17-Feb-23 08:00:00	10.51262617	0.553482216	11.12677241
17-Feb-23 09:00:00	10.39709695	0.481261977	10.88577763
17-Feb-23 10:00:00	10.57464939	0.482725277	11.0424099
17-Feb-23 11:00:00	10.66758786	0.482369443	11.14276899
17-Feb-23 12:00:00	10.77848646	0.638359538	11.42228434
17-Feb-23 13:00:00	10.79865853	0.588066837	11.3763939

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
17-Feb-23 14:00:00	10.788804	0.482277617	11.2148019
17-Feb-23 15:00:00	10.40657139	0.420942807	10.80034664
17-Feb-23 16:00:00	10.70823934	0.393648361	11.09775713
17-Feb-23 17:00:00	10.52712727	0.482441415	11.00457552
17-Feb-23 18:00:00	10.48389906	0.642761888	11.07555845
17-Feb-23 19:00:00	10.4876248	0.517426946	10.97388911
17-Feb-23 20:00:00	10.5441156	0.451822327	10.95273723
17-Feb-23 21:00:00	10.63644579	0.396856744	11.04208473
17-Feb-23 22:00:00	10.72618257	0.393407917	11.13657204
17-Feb-23 23:00:00	10.69159476	0.678177241	11.37038051
18-Feb-23 00:00:00	10.71256161	0.535995889	11.2447256
18-Feb-23 01:00:00	10.66155836	0.614388585	11.26752488
18-Feb-23 02:00:00	10.22738308	0.613585369	10.83608431
18-Feb-23 03:00:00	10.42548566	0.613111138	11.04045841
18-Feb-23 04:00:00	10.33246581	0.724111226	11.04460377
18-Feb-23 05:00:00	10.34559875	0.604842126	10.95371382
18-Feb-23 06:00:00	10.34112305	0.589895437	10.90851066
18-Feb-23 07:00:00	10.42231247	0.616444278	10.97321099
18-Feb-23 08:00:00	10.67018143	0.615317106	11.27725479
18-Feb-23 09:00:00	10.60128148	0.629213819	11.24460475
18-Feb-23 10:00:00	10.63922064	0.694603468	11.34001058
18-Feb-23 11:00:00	10.61431477	0.520788176	11.1141714
18-Feb-23 12:00:00	10.4289119	0.487236937	10.90577062
18-Feb-23 13:00:00	10.54516914	0.481925457	11.02941982
18-Feb-23 14:00:00	10.43344222	0.481461229	10.93193655
18-Feb-23 15:00:00	10.34906816	0.670515435	11.02654462
18-Feb-23 16:00:00	10.32797376	0.546144879	10.88658861
18-Feb-23 17:00:00	10.34121964	0.480899602	10.84103144
18-Feb-23 18:00:00	10.48642095	0.481126135	10.97562774
18-Feb-23 19:00:00	10.67203675	0.482340883	11.12959581
18-Feb-23 20:00:00	10.61416483	0.6098682	11.25092817
18-Feb-23 21:00:00	10.63191525	0.603343551	11.24915796
18-Feb-23 22:00:00	10.64146132	0.513483417	11.15760263
18-Feb-23 23:00:00	10.39765363	0.483578099	10.87051604
19-Feb-23 00:00:00	10.54839214	0.487245534	11.0247025
19-Feb-23 01:00:00	10.33550347	0.483247307	10.8444314
19-Feb-23 02:00:00	10.33206177	0.683004989	11.06935617
19-Feb-23 03:00:00	10.34726795	0.525837298	10.87354114
19-Feb-23 04:00:00	10.32140181	0.482707813	10.7977928
19-Feb-23 05:00:00	10.65770568	0.481072621	11.13384757
19-Feb-23 06:00:00	10.56861226	0.48150913	11.06649997
19-Feb-23 07:00:00	10.8069947	0.689060973	11.49111456
19-Feb-23 08:00:00	10.76793199	0.554969258	11.3389642

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
19-Feb-23 09:00:00	10.80910402	0.503438626	11.30987008
19-Feb-23 10:00:00	10.33100377	0.483049036	10.82808569
19-Feb-23 11:00:00	10.46492485	0.48214789	10.9318376
19-Feb-23 12:00:00	10.64414491	0.57571678	11.22833014
19-Feb-23 13:00:00	10.61207543	0.627672243	11.25855255
19-Feb-23 14:00:00	10.62420172	0.52040058	11.14065791
19-Feb-23 15:00:00	10.51803234	0.481222595	11.01614894
19-Feb-23 16:00:00	10.56105804	0.480580358	11.03582981
19-Feb-23 17:00:00	10.49309042	0.482646086	10.99002976
19-Feb-23 18:00:00	10.41105175	0.72484398	11.10546297
19-Feb-23 19:00:00	10.42181312	0.565458731	10.98987779
19-Feb-23 20:00:00	10.41129245	0.6110502	11.02239985
19-Feb-23 21:00:00	10.32123963	0.612455017	10.9453196
19-Feb-23 22:00:00	10.50098223	0.61297245	11.1155868
19-Feb-23 23:00:00	10.32555691	0.721413383	11.04193944
20-Feb-23 00:00:00	10.34004137	0.596270622	10.94864005
20-Feb-23 01:00:00	10.34434619	0.497016749	10.8466132
20-Feb-23 02:00:00	10.41677841	0.480325242	10.89012782
20-Feb-23 03:00:00	10.56646681	0.479108343	11.04366154
20-Feb-23 04:00:00	10.91149955	0.541720031	11.46185483
20-Feb-23 05:00:00	10.90040821	0.697165425	11.56720675
20-Feb-23 06:00:00	10.89762518	0.547931174	11.44425541
20-Feb-23 07:00:00	10.62343942	0.483004987	11.1120449
20-Feb-23 08:00:00	10.53233523	0.48015244	11.02335037
20-Feb-23 09:00:00	10.68051593	0.480665842	11.16894184
20-Feb-23 10:00:00	10.69582849	0.639324287	11.38704352
20-Feb-23 11:00:00	10.70780966	0.542196151	11.24812216
20-Feb-23 12:00:00	10.70844391	0.486700808	11.19674841
20-Feb-23 13:00:00	10.44563484	0.483065285	10.93835025
20-Feb-23 14:00:00	10.69068819	0.482429135	11.17351675
20-Feb-23 15:00:00	10.78700813	0.62402567	11.46655778
20-Feb-23 16:00:00	10.78943459	0.602445778	11.37828943
20-Feb-23 17:00:00	10.79684687	0.579983789	11.40231494
20-Feb-23 18:00:00	10.36084149	0.61348503	10.97715065
20-Feb-23 19:00:00	10.56900713	0.615638973	11.18247228
20-Feb-23 20:00:00	10.32978514	0.614242322	10.94584425
20-Feb-23 21:00:00	10.36962451	0.673333663	11.04571448
20-Feb-23 22:00:00	10.34340647	0.571948833	10.89390249
20-Feb-23 23:00:00	10.28639364	0.691286534	10.90390497
21-Feb-23 00:00:00	10.57018216	0.623693596	11.17782307
21-Feb-23 01:00:00	10.47346973	0.61426327	11.10804942
21-Feb-23 02:00:00	10.64964634	0.703651219	11.37520319
21-Feb-23 03:00:00	10.6312107	0.54597434	11.1822434

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
21-Feb-23 04:00:00	10.61592176	0.480844932	11.13418465
21-Feb-23 05:00:00	10.38880104	0.48449692	10.88713614
21-Feb-23 06:00:00	10.56777536	0.485278291	11.05741583
21-Feb-23 07:00:00	10.9352968	0.58347937	11.5330733
21-Feb-23 08:00:00	10.89287975	0.631559926	11.51853848
21-Feb-23 09:00:00	10.91966777	0.580429124	11.49222413
21-Feb-23 10:00:00	10.64760913	0.615696922	11.2566987
21-Feb-23 11:00:00	10.55679337	0.61944919	11.16151561
21-Feb-23 12:00:00	10.66393423	0.613521451	11.2909059
21-Feb-23 13:00:00	10.61050887	0.705759618	11.29976352
21-Feb-23 14:00:00	10.60842352	0.539435202	11.15347544
21-Feb-23 15:00:00	10.55826457	0.481695747	11.05347166
21-Feb-23 16:00:00	10.43316878	0.483501166	10.91078968
21-Feb-23 17:00:00	10.40986199	0.483754464	10.87416108
21-Feb-23 18:00:00	10.3414695	0.627413159	10.98564524
21-Feb-23 19:00:00	10.33114825	0.546378294	10.87974421
21-Feb-23 20:00:00	10.34855247	0.610024865	10.98406912
21-Feb-23 21:00:00	10.44837215	0.613036862	11.03287645
21-Feb-23 22:00:00	10.67966339	0.61484739	11.30891811
21-Feb-23 23:00:00	10.62733703	0.68306513	11.31715694
22-Feb-23 00:00:00	10.61352693	0.631576742	11.24616586
22-Feb-23 01:00:00	10.63305993	0.577510903	11.19879967
22-Feb-23 02:00:00	10.62444239	0.614972277	11.23773162
22-Feb-23 03:00:00	10.69887235	0.614183345	11.31980345
22-Feb-23 04:00:00	10.67767514	0.614030688	11.29653387
22-Feb-23 05:00:00	10.79518657	0.73350002	11.52740134
22-Feb-23 06:00:00	10.78277037	0.552526592	11.3324853
22-Feb-23 07:00:00	10.73872126	0.613174192	11.35614057
22-Feb-23 08:00:00	10.55708011	0.612925705	11.16991202
22-Feb-23 09:00:00	10.58105305	0.614568569	11.18975237
22-Feb-23 10:00:00	10.36043162	0.702329166	11.06505023
22-Feb-23 11:00:00	10.31668764	0.590399439	10.93080794
22-Feb-23 12:00:00	10.36162525	0.52130711	10.90017027
22-Feb-23 13:00:00	10.36069865	0.480691623	10.83873658
22-Feb-23 14:00:00	10.45881176	0.48205117	10.94096488
22-Feb-23 15:00:00	10.32575311	0.509530866	10.8650438
22-Feb-23 16:00:00	10.3445824	0.679254394	11.01972376
22-Feb-23 17:00:00	10.34738578	0.543213544	10.90652556
22-Feb-23 18:00:00	10.27114905	0.48054865	10.74905505
22-Feb-23 19:00:00	10.69531001	0.481411861	11.19554562
22-Feb-23 20:00:00	10.45040184	0.482660413	10.92969857
22-Feb-23 21:00:00	10.3303913	0.696337855	11.01655277
22-Feb-23 22:00:00	10.35995775	0.563957123	10.93138096

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
22-Feb-23 23:00:00	10.32732736	0.489866878	10.80882359
23-Feb-23 00:00:00	10.37645578	0.480997881	10.85353661
23-Feb-23 01:00:00	10.69481431	0.480464834	11.19216104
23-Feb-23 02:00:00	11.28612322	0.601549265	11.90635782
23-Feb-23 03:00:00	11.26939337	0.611079774	11.88400335
23-Feb-23 04:00:00	11.26811687	0.610728282	11.86541834
23-Feb-23 05:00:00	10.71678003	0.615399081	11.32644468
23-Feb-23 06:00:00	10.65449995	0.61009243	11.2551427
23-Feb-23 07:00:00	10.5128562	0.611021727	11.12209834
23-Feb-23 08:00:00	10.50849173	0.709086269	11.22870048
23-Feb-23 09:00:00	10.49251374	0.572267133	11.08560626
23-Feb-23 10:00:00	10.41862239	0.617116902	11.02931123
23-Feb-23 11:00:00	10.46189875	0.615598678	11.09134135
23-Feb-23 12:00:00	10.33481211	0.613432724	10.96799299
23-Feb-23 13:00:00	10.33653217	0.708744638	11.02370089
23-Feb-23 14:00:00	10.32078907	0.577500423	10.92964734
23-Feb-23 15:00:00	10.33804366	0.400265596	10.81820646
23-Feb-23 16:00:00	10.40337907	0.456268143	10.84844125
23-Feb-23 17:00:00	10.5067207	0.482088382	10.98464856
23-Feb-23 18:00:00	10.50057189	0.562940103	11.07796057
23-Feb-23 19:00:00	10.51114898	0.63654735	11.13591725
23-Feb-23 20:00:00	10.493362	0.570600888	11.07053926
23-Feb-23 21:00:00	10.50700728	0.617394298	11.10010647
23-Feb-23 22:00:00	10.58610635	0.611933852	11.22881312
23-Feb-23 23:00:00	10.49221897	0.611777758	11.10366821
24-Feb-23 00:00:00	10.41238075	0.746957128	11.15550963
24-Feb-23 01:00:00	10.41972301	0.55822351	10.97309086
24-Feb-23 02:00:00	10.4177137	0.618974111	11.02617149
24-Feb-23 03:00:00	10.48252863	0.612327336	11.06665815
24-Feb-23 04:00:00	10.58410475	0.610537938	11.19327876
24-Feb-23 05:00:00	10.60352993	0.713562851	11.31802098
24-Feb-23 06:00:00	10.63345056	0.575053672	11.19635047
24-Feb-23 07:00:00	10.62623183	0.504584453	11.12670632
24-Feb-23 08:00:00	10.36011781	0.481664135	10.82352045
24-Feb-23 09:00:00	10.5479784	0.482862803	11.03695647
24-Feb-23 10:00:00	10.80542363	0.524948921	11.34055259
24-Feb-23 11:00:00	10.78467178	0.676326413	11.44814397
24-Feb-23 12:00:00	10.78034989	0.575439533	11.35786618
24-Feb-23 13:00:00	10.64024941	0.614076058	11.24712059
24-Feb-23 14:00:00	10.5810122	0.620324311	11.20019266
24-Feb-23 15:00:00	10.33850447	0.616523474	10.93849813
24-Feb-23 16:00:00	10.35832151	0.727263528	11.060734
24-Feb-23 17:00:00	10.33726078	0.581888439	10.91529402

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
24-Feb-23 18:00:00	10.315723	0.482413179	10.82015038
24-Feb-23 19:00:00	10.4889564	0.48099786	10.96843246
24-Feb-23 20:00:00	10.6014052	0.481602035	11.10358689
24-Feb-23 21:00:00	10.49716674	0.600551863	11.08425167
24-Feb-23 22:00:00	10.52835528	0.571186408	11.14268822
24-Feb-23 23:00:00	10.51534239	0.51833237	11.04986989
25-Feb-23 00:00:00	10.30719905	0.481266445	10.78627157
25-Feb-23 01:00:00	10.51582903	0.479777174	11.00352526
25-Feb-23 02:00:00	10.39289263	0.511596151	10.89498555
25-Feb-23 03:00:00	10.41025559	0.731835703	11.12662107
25-Feb-23 04:00:00	10.42882268	0.571849461	11.00844351
25-Feb-23 05:00:00	10.35345173	0.6118119	10.98895179
25-Feb-23 06:00:00	10.57402023	0.613480401	11.18548393
25-Feb-23 07:00:00	10.58778498	0.616164875	11.20392467
25-Feb-23 08:00:00	10.80305062	0.773412807	11.54771158
25-Feb-23 09:00:00	10.78029521	0.584582835	11.39167341
25-Feb-23 10:00:00	10.78196997	0.698957249	11.39939331
25-Feb-23 11:00:00	10.4518848	0.633468215	11.07226038
25-Feb-23 12:00:00	10.44502269	0.613198801	11.06823905
25-Feb-23 13:00:00	10.8010953	0.673509024	11.48652195
25-Feb-23 14:00:00	10.78360086	0.653516771	11.43650161
25-Feb-23 15:00:00	10.79132689	0.593785306	11.39650467
25-Feb-23 16:00:00	10.51945512	0.614527682	11.13273974
25-Feb-23 17:00:00	10.48796487	0.61137088	11.08869412
25-Feb-23 18:00:00	10.53913996	0.611614165	11.15181629
25-Feb-23 19:00:00	10.49271128	0.795638121	11.27798245
25-Feb-23 20:00:00	10.51494969	0.590128647	11.13770819
25-Feb-23 21:00:00	10.46981891	0.614665806	11.09309135
25-Feb-23 22:00:00	10.57633781	0.617557426	11.17665884
25-Feb-23 23:00:00	10.52509944	0.614139154	11.13411437
26-Feb-23 00:00:00	10.48527029	0.715805525	11.16555183
26-Feb-23 01:00:00	10.47478612	0.616911393	11.07936875
26-Feb-23 02:00:00	10.51650694	0.513164573	11.04200686
26-Feb-23 03:00:00	10.54054801	0.48269327	11.0194946
26-Feb-23 04:00:00	10.6373051	0.481139348	11.12859334
26-Feb-23 05:00:00	10.49684726	0.574548886	11.06063251
26-Feb-23 06:00:00	10.47684476	0.674569122	11.14996322
26-Feb-23 07:00:00	10.50303592	0.58092516	11.07363966
26-Feb-23 08:00:00	10.45802604	0.484007885	10.94671567
26-Feb-23 09:00:00	10.614708	0.483338634	11.09527461
26-Feb-23 10:00:00	10.71932485	0.480630073	11.2013758
26-Feb-23 11:00:00	10.79466788	0.719727347	11.52899578
26-Feb-23 12:00:00	10.75679419	0.587369497	11.32749414

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
26-Feb-23 13:00:00	10.68114487	0.482148975	11.17663839
26-Feb-23 14:00:00	10.54467413	0.483517385	11.03460471
26-Feb-23 15:00:00	10.63177639	0.483365071	11.13566948
26-Feb-23 16:00:00	10.36349037	0.631585203	10.9993053
26-Feb-23 17:00:00	10.32561694	0.608014028	10.93278744
26-Feb-23 18:00:00	10.34912655	0.61414091	10.97042888
26-Feb-23 19:00:00	10.34112591	0.61878669	10.92729431
26-Feb-23 20:00:00	10.65138409	0.617956618	11.2613878
26-Feb-23 21:00:00	10.51488898	0.645604516	11.18173356
26-Feb-23 22:00:00	10.47556872	0.696112059	11.17673521
26-Feb-23 23:00:00	10.52112696	0.567739608	11.09367281
27-Feb-23 00:00:00	10.29101495	0.618859728	10.94499976
27-Feb-23 01:00:00	10.49880902	0.613201809	11.11576154
27-Feb-23 02:00:00	10.7182436	0.612301836	11.38225084
27-Feb-23 03:00:00	10.68465005	0.744677402	11.41718185
27-Feb-23 04:00:00	10.73206933	0.545440311	11.29202112
27-Feb-23 05:00:00	10.66349098	0.48834782	11.16518513
27-Feb-23 06:00:00	10.46803326	0.481412312	10.94795412
27-Feb-23 07:00:00	10.65349134	0.482156391	11.13254275
27-Feb-23 08:00:00	11.01614889	0.626108009	11.65526258
27-Feb-23 09:00:00	11.01095822	0.575463053	11.61650043
27-Feb-23 10:00:00	10.99219489	0.590476766	11.6358684
27-Feb-23 11:00:00	10.53628227	0.613960862	11.16059706
27-Feb-23 12:00:00	10.4714676	0.617929098	11.06419574
27-Feb-23 13:00:00	10.23689625	0.615370171	10.83045117
27-Feb-23 14:00:00	10.22070932	0.767980728	10.96563631
27-Feb-23 15:00:00	10.21506283	0.528988002	10.72549449
27-Feb-23 16:00:00	10.21007702	0.48301363	10.7201714
27-Feb-23 17:00:00	10.53278261	0.484781524	11.014352
27-Feb-23 18:00:00	10.3416471	0.48412022	10.82526822
27-Feb-23 19:00:00	10.21896654	0.65823642	10.86102761
27-Feb-23 20:00:00	10.2056498	0.576747958	10.78589811
27-Feb-23 21:00:00	10.21857378	0.599071066	10.7940162
27-Feb-23 22:00:00	10.43275669	0.614680763	11.03472208
27-Feb-23 23:00:00	10.45952204	0.615313466	11.07733059
28-Feb-23 00:00:00	10.49136626	0.677607775	11.17613268
28-Feb-23 01:00:00	10.52199682	0.645229478	11.11991328
28-Feb-23 02:00:00	10.50270255	0.534076782	11.03628964
28-Feb-23 03:00:00	10.38428275	0.479792351	10.88295892
28-Feb-23 04:00:00	10.40284453	0.482050739	10.88794041
28-Feb-23 05:00:00	10.65832378	0.484488219	11.15227769
28-Feb-23 06:00:00	10.63075251	0.725221654	11.35085132
28-Feb-23 07:00:00	10.60538993	0.548655275	11.15271287

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
28-Feb-23 08:00:00	10.57821087	0.480553323	11.06921678
28-Feb-23 09:00:00	10.53192568	0.482306768	11.01634852
28-Feb-23 10:00:00	10.54229742	0.483061089	11.02627034
28-Feb-23 11:00:00	10.50700884	0.702474728	11.2089902
28-Feb-23 12:00:00	10.50247298	0.622097946	11.15501894
28-Feb-23 13:00:00	10.50718005	0.602543382	11.16508121
28-Feb-23 14:00:00	10.43580792	0.613367148	11.05137687
28-Feb-23 15:00:00	10.65498866	0.611675855	11.27417135
28-Feb-23 16:00:00	10.51143533	0.658029053	11.18999846
28-Feb-23 17:00:00	10.50550842	0.653862584	11.16414812
28-Feb-23 18:00:00	10.49323368	0.538848328	11.02782438
28-Feb-23 19:00:00	10.3597836	0.484196442	10.83110799
28-Feb-23 20:00:00	10.6304308	0.481196139	11.1175527
28-Feb-23 21:00:00	10.43033335	0.481375998	10.92684566
28-Feb-23 22:00:00	10.43557409	0.681354481	11.16085489
28-Feb-23 23:00:00	10.41784785	0.627890701	11.01186233
01-Mar-23 00:00:00	10.38204606	0.61216568	10.99659559
01-Mar-23 01:00:00	10.42183304	0.611145662	11.03115751
01-Mar-23 02:00:00	10.70367781	0.611194972	11.33464967
01-Mar-23 03:00:00	10.79743081	0.751505876	11.60610579
01-Mar-23 04:00:00	10.80155717	0.631322627	11.44830198
01-Mar-23 05:00:00	10.7901553	0.504561534	11.28695864
01-Mar-23 06:00:00	10.43537569	0.482963473	10.89948
01-Mar-23 07:00:00	10.65847588	0.485018045	11.15275221
01-Mar-23 08:00:00	10.62680149	0.51026603	11.12250063
01-Mar-23 09:00:00	10.61264186	0.727646331	11.31210359
01-Mar-23 10:00:00	10.63142011	0.53758038	11.2236704
01-Mar-23 11:00:00	10.44067807	0.482467769	10.93359852
01-Mar-23 12:00:00	10.49796396	0.485106722	10.99115223
01-Mar-23 13:00:00	10.32953003	0.483481457	10.82599941
01-Mar-23 14:00:00	10.35614959	0.710884922	11.04522483
01-Mar-23 15:00:00	10.35474973	0.584383711	11.00116475
01-Mar-23 16:00:00	10.32565096	0.614411008	10.9311392
01-Mar-23 17:00:00	10.34237915	0.614110327	10.95636362
01-Mar-23 18:00:00	10.68376843	0.614424622	11.31550037
01-Mar-23 19:00:00	10.91801431	0.687874029	11.58527308
01-Mar-23 20:00:00	10.87375047	0.594986861	11.50126446
01-Mar-23 21:00:00	10.93368864	0.511655074	11.45518282
01-Mar-23 22:00:00	10.54017385	0.482906441	11.02108182
01-Mar-23 23:00:00	10.60163667	0.483322947	11.08966197
02-Mar-23 00:00:00	10.43205145	0.483933122	10.90185679
02-Mar-23 01:00:00	10.4230388	0.719242551	11.13756895
02-Mar-23 02:00:00	10.41565434	0.57523264	10.97697294

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
02-Mar-23 03:00:00	10.30319537	0.472821781	10.71509817
02-Mar-23 04:00:00	10.37723292	0.411294879	10.77879437
02-Mar-23 05:00:00	10.40883774	0.398005316	10.81226876
02-Mar-23 06:00:00	10.42466068	0.652184137	11.06176159
02-Mar-23 07:00:00	10.60530557	0.599977967	11.22236391
02-Mar-23 08:00:00	11.02611505	0.600738674	11.59974437
02-Mar-23 09:00:00	10.66468302	0.616390948	11.27034246
02-Mar-23 10:00:00	10.73025417	0.616561902	11.34877168
02-Mar-23 11:00:00	10.75182343	0.700750121	11.45177216
02-Mar-23 12:00:00	10.73419343	0.664391114	11.41299073
02-Mar-23 13:00:00	10.72892724	0.622951415	11.34855599
02-Mar-23 14:00:00	10.56471062	0.612705783	11.19592711
02-Mar-23 15:00:00	10.97287305	0.613942125	11.5814542
02-Mar-23 16:00:00	10.6030345	0.616176133	11.22816679
02-Mar-23 17:00:00	10.51649215	0.762385049	11.25278942
02-Mar-23 18:00:00	10.53963104	0.594230304	11.16648833
02-Mar-23 19:00:00	10.54952664	0.482721935	11.02706312
02-Mar-23 20:00:00	10.69752826	0.482696263	11.18254852
02-Mar-23 21:00:00	10.81773721	0.483644966	11.28672171
02-Mar-23 22:00:00	10.8490884	0.699073074	11.53170829
02-Mar-23 23:00:00	10.83693277	0.569142001	11.40648487
03-Mar-23 00:00:00	10.81530846	0.597480208	11.38704146
03-Mar-23 01:00:00	10.45316913	0.611588156	11.06591744
03-Mar-23 02:00:00	10.70874532	0.61285466	11.33694716
03-Mar-23 03:00:00	10.62289974	0.650494646	11.29094232
03-Mar-23 04:00:00	10.66635206	0.703447109	11.38570674
03-Mar-23 05:00:00	10.67404988	0.540654505	11.2306658
03-Mar-23 06:00:00	10.5919661	0.482433873	11.09947263
03-Mar-23 07:00:00	10.71362093	0.482110266	11.20474821
03-Mar-23 08:00:00	10.75195556	0.481700653	11.24826136
03-Mar-23 09:00:00	10.76843278	0.703705966	11.48083915
03-Mar-23 10:00:00	10.72817336	0.579552044	11.31676036
03-Mar-23 11:00:00	10.7465823	0.614166546	11.38108211
03-Mar-23 12:00:00	10.6724533	0.614276512	11.2877175
03-Mar-23 13:00:00	10.71473095	0.613886734	11.33205993
03-Mar-23 14:00:00	10.69403479	0.708585175	11.39586658
03-Mar-23 15:00:00	10.66556411	0.617898176	11.30759415
03-Mar-23 16:00:00	10.66466469	0.617280961	11.27781737
03-Mar-23 17:00:00	10.49598079	0.614108799	11.09326326
03-Mar-23 18:00:00	10.77428638	0.611855865	11.39423633
03-Mar-23 19:00:00	10.66641744	0.613446374	11.27240512
03-Mar-23 20:00:00	10.62483353	0.736696081	11.37560527
03-Mar-23 21:00:00	10.69510667	0.589508309	11.34479822

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
03-Mar-23 22:00:00	10.63271719	1.009040833	11.63980007
03-Mar-23 23:00:00	10.66603163	1.404941797	12.10705332
04-Mar-23 00:00:00	10.68629429	1.403396507	12.11596499
04-Mar-23 01:00:00	10.6356375	1.402383327	12.07682831
04-Mar-23 02:00:00	10.66037273	4.712438689	15.38656443
04-Mar-23 03:00:00	15.45536078	31.14791221	46.59290536
04-Mar-23 04:00:00	14.15713167	31.14926868	45.29458809
04-Mar-23 05:00:00	14.24925121	31.16363568	45.41231505
04-Mar-23 06:00:00	14.2391928	31.07067977	45.30375587
04-Mar-23 07:00:00	14.23460285	31.18131807	45.42245794
04-Mar-23 08:00:00	20.33069256	31.16998086	51.46784599
04-Mar-23 09:00:00	22.05832036	2.436746498	25.50757588
04-Mar-23 10:00:00	22.09818925	0.890369233	22.99403837
04-Mar-23 11:00:00	19.65152714	0.700217078	20.35880481
04-Mar-23 12:00:00	10.98916541	0.70039479	11.69858917
04-Mar-23 13:00:00	10.8086728	0.703051086	11.51251348
04-Mar-23 14:00:00	10.74719016	0.70758842	11.4373378
04-Mar-23 15:00:00	10.76330792	0.557780224	11.33537371
04-Mar-23 16:00:00	10.73331647	0.504814145	11.22419167
04-Mar-23 17:00:00	10.68572092	0.482820473	11.16850328
04-Mar-23 18:00:00	10.71538787	0.481854478	11.20891068
04-Mar-23 19:00:00	10.76473104	0.523885816	11.28944744
04-Mar-23 20:00:00	10.76577449	0.617535993	11.40786152
04-Mar-23 21:00:00	10.73769543	0.672972536	11.38150342
04-Mar-23 22:00:00	10.66911236	0.700568388	11.36925286
04-Mar-23 23:00:00	10.83447043	0.700857905	11.52260199
05-Mar-23 00:00:00	10.87991079	0.702241498	11.58380085
05-Mar-23 01:00:00	10.97957277	0.676830738	11.65683413
05-Mar-23 02:00:00	10.99665615	0.623708367	11.61682924
05-Mar-23 03:00:00	10.9324042	0.616582449	11.54063027
05-Mar-23 04:00:00	10.97481055	0.611073729	11.58275461
05-Mar-23 05:00:00	10.84763055	0.611039102	11.44864474
05-Mar-23 06:00:00	10.98050367	0.694516649	11.67605019
05-Mar-23 07:00:00	10.96495657	0.635977491	11.67566565
05-Mar-23 08:00:00	10.93299815	0.620465982	11.58221152
05-Mar-23 09:00:00	10.77295028	0.614236015	11.37653695
05-Mar-23 10:00:00	10.88493289	0.612322474	11.51001798
05-Mar-23 11:00:00	10.63060395	0.656078311	11.30292318
05-Mar-23 12:00:00	10.6956216	0.732888007	11.42083555
05-Mar-23 13:00:00	10.65183375	0.612175292	11.29567535
05-Mar-23 14:00:00	10.52023951	0.613523054	11.13303386
05-Mar-23 15:00:00	10.87055715	0.615147721	11.49669502
05-Mar-23 16:00:00	11.03287607	0.633259567	11.67085049

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
05-Mar-23 17:00:00	10.98208668	0.86420568	11.74173737
05-Mar-23 18:00:00	10.9550394	0.617458045	11.60717593
05-Mar-23 19:00:00	10.9000464	0.613072091	11.53620079
05-Mar-23 20:00:00	10.81047599	0.612621288	11.43065947
05-Mar-23 21:00:00	10.83769062	0.614296531	11.44869645
05-Mar-23 22:00:00	10.96811856	0.874639202	11.69839297
05-Mar-23 23:00:00	10.94257296	0.775996161	11.66570455
06-Mar-23 00:00:00	10.94429046	0.653544279	11.58453276
06-Mar-23 01:00:00	10.772217	0.615097165	11.39308507
06-Mar-23 02:00:00	10.81578758	0.616438693	11.44391192
06-Mar-23 03:00:00	11.02026282	0.612898867	11.62873966
06-Mar-23 04:00:00	11.04759285	0.836744775	11.85209672
06-Mar-23 05:00:00	11.07167607	0.625474471	11.73983871
06-Mar-23 06:00:00	10.88569551	0.688334855	11.56197029
06-Mar-23 07:00:00	10.80270502	0.700729138	11.51113696
06-Mar-23 08:00:00	10.81250736	0.700324161	11.49973016
06-Mar-23 09:00:00	10.64950588	0.882681102	11.50182294
06-Mar-23 10:00:00	10.66476885	0.670175693	11.36203204
06-Mar-23 11:00:00	10.66117822	0.612114638	11.27003956
06-Mar-23 12:00:00	10.63175678	0.614158665	11.22742695
06-Mar-23 13:00:00	10.59758462	0.612774491	11.23326773
06-Mar-23 14:00:00	10.44100014	0.77366976	11.12184705
06-Mar-23 15:00:00	10.44812722	0.719113866	11.16099241
06-Mar-23 16:00:00	10.45834684	0.64798808	11.10566223
06-Mar-23 17:00:00	10.46984529	0.61658533	11.00532171
06-Mar-23 18:00:00	10.7791668	0.61352388	11.40618231
06-Mar-23 19:00:00	10.97981819	0.743496656	11.62093984
06-Mar-23 20:00:00	10.98554797	0.810157841	11.76957374
06-Mar-23 21:00:00	10.97036621	0.609184791	11.61135808
06-Mar-23 22:00:00	10.86465918	0.615067083	11.46551446
06-Mar-23 23:00:00	10.75907352	0.617820951	11.36155401
07-Mar-23 00:00:00	10.7074284	0.616736811	11.33507909
07-Mar-23 01:00:00	10.77441025	0.773454876	11.54059154
07-Mar-23 02:00:00	10.76941241	0.657421841	11.49658167
07-Mar-23 03:00:00	10.7542732	0.617243481	11.39482974
07-Mar-23 04:00:00	10.62070204	0.612618923	11.24045457
07-Mar-23 05:00:00	10.74599388	0.612414579	11.36450309
07-Mar-23 06:00:00	10.76330021	0.674274289	11.43956149
07-Mar-23 07:00:00	10.77756235	0.757441921	11.52704758
07-Mar-23 08:00:00	10.73669555	0.642336592	11.38770109
07-Mar-23 09:00:00	10.58172448	0.613181164	11.18969299
07-Mar-23 10:00:00	10.81455297	0.611586475	11.43518529
07-Mar-23 11:00:00	10.88986683	0.615065032	11.48645645

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
07-Mar-23 12:00:00	10.96502728	0.867119542	11.7889566
07-Mar-23 13:00:00	10.95480755	0.677778925	11.65405173
07-Mar-23 14:00:00	10.86106163	0.633116259	11.59463819
07-Mar-23 15:00:00	10.64432457	0.694658936	11.34988202
07-Mar-23 16:00:00	10.70296444	0.699300847	11.4139636
07-Mar-23 17:00:00	10.66712178	0.81311323	11.45053306
07-Mar-23 18:00:00	10.63229985	0.679125476	11.33439488
07-Mar-23 19:00:00	10.6789865	0.631909539	11.37419563
07-Mar-23 20:00:00	10.76467268	0.690369286	11.46314682
07-Mar-23 21:00:00	10.84478935	0.698263685	11.55872096
07-Mar-23 22:00:00	10.96340073	0.721759732	11.72507636
07-Mar-23 23:00:00	10.95905028	0.836448213	11.77378949
08-Mar-23 00:00:00	10.96666198	0.675806797	11.69028457
08-Mar-23 01:00:00	10.7718935	0.63548342	11.51745086
08-Mar-23 02:00:00	10.83444601	0.695263951	11.54263221
08-Mar-23 03:00:00	10.63971535	0.700637673	11.36549015
08-Mar-23 04:00:00	10.52777142	0.853285755	11.33808009
08-Mar-23 05:00:00	10.51021022	0.77275852	11.23121243
08-Mar-23 06:00:00	10.53938018	0.705421317	11.25202894
08-Mar-23 07:00:00	10.75891315	0.700889456	11.46341911
08-Mar-23 08:00:00	10.87578885	0.703274012	11.56833323
08-Mar-23 09:00:00	10.84043757	0.97088478	11.64084254
08-Mar-23 10:00:00	10.80613348	0.772428259	11.56470221
08-Mar-23 11:00:00	10.86329545	0.613668478	11.47694992
08-Mar-23 12:00:00	10.63728571	0.618750191	11.27763033
08-Mar-23 13:00:00	10.85060872	0.617564404	11.45818575
08-Mar-23 14:00:00	10.84365855	0.612548443	11.42570639
08-Mar-23 15:00:00	10.81659026	0.844324794	11.66569371
08-Mar-23 16:00:00	10.82640788	0.721728814	11.5627767
08-Mar-23 17:00:00	10.73336158	0.700040263	11.43988684
08-Mar-23 18:00:00	10.87158012	0.701876656	11.57358419
08-Mar-23 19:00:00	10.96789291	0.708383102	11.68151585
08-Mar-23 20:00:00	10.95488416	0.925238345	11.83029049
08-Mar-23 21:00:00	10.98085729	0.768364655	11.73252164
08-Mar-23 22:00:00	10.99167824	0.766478037	11.76685535
08-Mar-23 23:00:00	10.73773803	0.793227446	11.5250713
09-Mar-23 00:00:00	10.75581921	0.792858016	11.55596081
09-Mar-23 01:00:00	10.52495551	0.847725034	11.39619842
09-Mar-23 02:00:00	10.55904685	0.813879206	11.3823474
09-Mar-23 03:00:00	10.53495953	0.716740624	11.25749136
09-Mar-23 04:00:00	10.48013592	0.793237191	11.26228223
09-Mar-23 05:00:00	10.84264024	0.788701841	11.64648085
09-Mar-23 06:00:00	11.19774739	0.78814315	12.00000541

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
09-Mar-23 07:00:00	11.2264159	0.915530129	12.17232912
09-Mar-23 08:00:00	11.29961809	0.787609945	12.07469602
09-Mar-23 09:00:00	11.1111375	0.619636095	11.7995744
09-Mar-23 10:00:00	10.85284641	0.690011773	11.57246113
09-Mar-23 11:00:00	10.94303841	0.705826223	11.67248467
09-Mar-23 12:00:00	11.06576867	0.849546631	11.93191426
09-Mar-23 13:00:00	11.07024076	0.801009614	11.84328895
09-Mar-23 14:00:00	11.0173511	0.745185602	11.74599075
09-Mar-23 15:00:00	10.72860275	0.748987378	11.43242089
09-Mar-23 16:00:00	10.76750496	0.704418435	11.48193449
09-Mar-23 17:00:00	10.84062831	0.735381573	11.60089307
09-Mar-23 18:00:00	10.80682982	0.82740619	11.62500556
09-Mar-23 19:00:00	10.85663817	0.649432757	11.63368984
09-Mar-23 20:00:00	10.73504081	0.638037962	11.39509282
09-Mar-23 21:00:00	10.90278813	0.700559041	11.59533151
09-Mar-23 22:00:00	10.99720266	0.705736955	11.69842705
09-Mar-23 23:00:00	10.92985847	0.903130787	11.7976453
10-Mar-23 00:00:00	10.98940674	0.782972829	11.74891195
10-Mar-23 01:00:00	10.92049567	0.721884021	11.60872425
10-Mar-23 02:00:00	11.05300633	0.704881287	11.77368531
10-Mar-23 03:00:00	10.86513074	0.699915577	11.60177194
10-Mar-23 04:00:00	10.96039099	0.970729585	11.79758294
10-Mar-23 05:00:00	10.97549582	0.799890258	11.78318403
10-Mar-23 06:00:00	10.98428387	0.751950295	11.68823132
10-Mar-23 07:00:00	10.93607828	0.749022905	11.63339292
10-Mar-23 08:00:00	10.88258733	0.702728842	11.5778918
10-Mar-23 09:00:00	11.22177898	0.701056492	11.90694729
10-Mar-23 10:00:00	11.2727997	0.898073521	12.19316249
10-Mar-23 11:00:00	11.29601924	0.783067783	12.04303
10-Mar-23 12:00:00	8.338282678	0.722308786	9.070050822
10-Mar-23 13:00:00	2.00276396	0.705365705	2.720510205
10-Mar-23 14:00:00	1.743935261	0.700341988	2.447012199
10-Mar-23 15:00:00	1.695074091	0.747310743	2.420383533
10-Mar-23 16:00:00	1.693758414	0.772150314	2.473208314
10-Mar-23 17:00:00	1.688965546	0.61294812	2.338482208
10-Mar-23 18:00:00	1.314668989	0.678044657	2.029863728
10-Mar-23 19:00:00	1.270954167	0.701356614	1.932223205
10-Mar-23 20:00:00	1.305681992	0.700038405	1.996859529
10-Mar-23 21:00:00	1.301174402	0.69988693	2.004100626
10-Mar-23 22:00:00	1.301708612	0.699839473	2.011884212
10-Mar-23 23:00:00	1.179920132	0.768953097	1.973344896
11-Mar-23 00:00:00	1.108497461	0.793715584	1.879022612
11-Mar-23 01:00:00	1.071602815	0.792359873	1.857035764

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
11-Mar-23 02:00:00	1.082809698	0.755559409	1.798929433
11-Mar-23 03:00:00	1.081975636	0.765913665	1.887329239
11-Mar-23 04:00:00	1.073895816	0.758389205	1.774411162
11-Mar-23 05:00:00	1.013137215	0.707906529	1.705662664
11-Mar-23 06:00:00	1.020487163	0.702575574	1.700082372
11-Mar-23 07:00:00	0.999695399	0.700437665	1.727502902
11-Mar-23 08:00:00	1.000347853	0.701431435	1.783482987
11-Mar-23 09:00:00	0.992568629	0.701087771	1.728675394
11-Mar-23 10:00:00	0.995389587	0.70028677	1.709226481
11-Mar-23 11:00:00	1.038932204	0.700204158	1.780753977
11-Mar-23 12:00:00	1.082616864	0.71643132	1.799455357
11-Mar-23 13:00:00	1.085848399	0.791628185	1.877483132
11-Mar-23 14:00:00	1.082645138	0.790953745	1.880876809
11-Mar-23 15:00:00	1.046534694	0.793569112	1.819549113
11-Mar-23 16:00:00	0.989693016	0.79712826	1.783714275
11-Mar-23 17:00:00	1.000670973	0.788840262	1.796752699
11-Mar-23 18:00:00	1.001598561	0.73167266	1.735210013
11-Mar-23 19:00:00	0.994953344	0.788647691	1.784149798
11-Mar-23 20:00:00	1.001701289	0.717681539	1.762176151
11-Mar-23 21:00:00	1.001641608	0.782477395	1.824955789
11-Mar-23 22:00:00	1.009880225	0.791971004	1.831903603
11-Mar-23 23:00:00	0.998733377	0.797375619	1.740460593
12-Mar-23 00:00:00	0.995673321	0.744834381	1.732904685
12-Mar-23 01:00:00	0.998866763	0.901536706	1.890580626
12-Mar-23 03:00:00	0.977063792	0.923889238	1.912361681
12-Mar-23 04:00:00	0.962586275	0.932604564	1.909043858
12-Mar-23 05:00:00	0.996826813	0.910047665	1.886573458
12-Mar-23 06:00:00	0.993276473	0.796302989	1.787682354
12-Mar-23 07:00:00	0.998868324	0.795734847	1.791402904
12-Mar-23 08:00:00	0.999743775	0.789132971	1.78767831
12-Mar-23 09:00:00	0.980615771	0.788379967	1.784394463
12-Mar-23 10:00:00	1.002410551	0.788959135	1.779066701
12-Mar-23 11:00:00	1.000107795	0.82970691	1.825646869
12-Mar-23 12:00:00	0.997789653	0.757176389	1.754184123
12-Mar-23 13:00:00	1.000453698	0.698986705	1.778665724
12-Mar-23 14:00:00	0.958038519	0.761766058	1.76525496
12-Mar-23 15:00:00	1.004286009	0.791180392	1.786191668
12-Mar-23 16:00:00	1.004174558	0.814811035	1.830000943
12-Mar-23 17:00:00	0.99853009	0.803392486	1.800300704
12-Mar-23 18:00:00	1.002728862	0.867939477	1.864246635
12-Mar-23 19:00:00	0.980030523	0.919241667	1.914577802
12-Mar-23 20:00:00	0.963465591	0.918332304	1.908511375
12-Mar-23 21:00:00	0.996456087	0.915771313	1.910787427

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
12-Mar-23 22:00:00	0.99777272	0.802075098	1.798942056
12-Mar-23 23:00:00	0.99881976	0.860894129	1.861284708
13-Mar-23 00:00:00	1.000219818	0.924477935	1.912537611
13-Mar-23 01:00:00	0.9525536	0.920498878	1.888572275
13-Mar-23 02:00:00	0.953277965	0.919801325	1.872243398
13-Mar-23 03:00:00	0.911798124	0.862820597	1.736117661
13-Mar-23 04:00:00	0.914488745	0.819202569	1.73249801
13-Mar-23 05:00:00	0.908690453	0.794434635	1.714205036
13-Mar-23 06:00:00	0.967115372	0.7914811	1.772398999
13-Mar-23 07:00:00	0.958009634	0.789604902	1.701163709
13-Mar-23 08:00:00	0.909472081	0.794768926	1.708830208
13-Mar-23 09:00:00	0.909784933	0.796086664	1.70017279
13-Mar-23 10:00:00	0.909375131	0.875254317	1.784137651
13-Mar-23 11:00:00	0.95427737	0.91921699	1.886474133
13-Mar-23 12:00:00	1.006508382	0.924135764	1.907580471
13-Mar-23 13:00:00	0.926967549	0.921212747	1.834067472
13-Mar-23 14:00:00	0.910599585	0.821100612	1.72603737
13-Mar-23 15:00:00	0.909292272	0.821876537	1.731075188
13-Mar-23 16:00:00	0.922505311	0.788996251	1.696812669
13-Mar-23 17:00:00	0.98095374	0.789777491	1.741815986
13-Mar-23 18:00:00	0.988148395	0.790095593	1.757670426
13-Mar-23 19:00:00	0.995153908	0.821758192	1.835579963
13-Mar-23 20:00:00	0.995392083	0.824093124	1.826084297
13-Mar-23 21:00:00	0.993764904	0.811450702	1.810394848
13-Mar-23 22:00:00	0.983201792	0.790734797	1.791347592
13-Mar-23 23:00:00	1.00529983	0.789182552	1.791290259
14-Mar-23 00:00:00	0.999623395	0.79224418	1.79013949
14-Mar-23 01:00:00	0.998011104	0.791021734	1.795819925
14-Mar-23 02:00:00	0.995477989	0.87255483	1.868750454
14-Mar-23 03:00:00	1.020414001	0.919821	1.919846249
14-Mar-23 04:00:00	0.978162895	0.923828252	1.887122117
14-Mar-23 05:00:00	0.9949605	0.924652767	1.991823165
14-Mar-23 06:00:00	0.997445659	0.816365765	1.78637404
14-Mar-23 07:00:00	0.994424316	0.830133301	1.823762959
14-Mar-23 08:00:00	0.99264096	0.758115607	1.75407491
14-Mar-23 09:00:00	0.957060611	0.699006427	1.702285687
14-Mar-23 10:00:00	0.962124253	0.695247215	1.634046992
14-Mar-23 11:00:00	0.995589375	0.792293041	1.703493611
14-Mar-23 12:00:00	0.99616693	0.800470145	1.80206757
14-Mar-23 13:00:00	1.000302404	0.785286725	1.782136361
14-Mar-23 14:00:00	0.964918135	0.789804101	1.782209836
14-Mar-23 15:00:00	0.919338617	0.790370043	1.752141825
14-Mar-23 16:00:00	0.909479256	0.790394057	1.700342567

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
14-Mar-23 17:00:00	0.907939298	0.762897662	1.671772848
14-Mar-23 18:00:00	0.913947828	0.734169292	1.65086386
14-Mar-23 19:00:00	0.907397362	0.789282322	1.680214203
14-Mar-23 20:00:00	0.921887848	0.794608088	1.727247238
14-Mar-23 21:00:00	0.91085789	0.820777249	1.716514312
14-Mar-23 22:00:00	0.90923686	0.829235593	1.741636127
14-Mar-23 23:00:00	0.910187985	0.733794761	1.64446676
15-Mar-23 00:00:00	0.90959704	0.768990425	1.610336034
15-Mar-23 01:00:00	0.904455463	0.7066714	1.566436348
15-Mar-23 02:00:00	0.89365737	0.692858721	1.588661367
15-Mar-23 03:00:00	0.908605324	0.689012229	1.618745883
15-Mar-23 04:00:00	0.912672876	0.74009235	1.658709158
15-Mar-23 05:00:00	0.906749592	0.78242743	1.62210238
15-Mar-23 06:00:00	0.918055955	0.769046247	1.675596171
15-Mar-23 07:00:00	0.914809343	0.76452111	1.683579969
15-Mar-23 08:00:00	0.897136261	0.765770519	1.668044541
15-Mar-23 09:00:00	0.913629118	0.815973636	1.736758527
15-Mar-23 10:00:00	0.911205953	0.753286485	1.664144429
15-Mar-23 11:00:00	0.907360193	0.694661402	1.596387596
15-Mar-23 12:00:00	0.931304548	0.684100568	1.578271998
15-Mar-23 13:00:00	0.937220688	0.681581489	1.604790393
15-Mar-23 14:00:00	0.915413412	0.792074894	1.67759181
15-Mar-23 15:00:00	0.911603808	0.766290628	1.679619425
15-Mar-23 16:00:00	0.910176933	0.769212921	1.673739855
15-Mar-23 17:00:00	0.927258223	0.762092056	1.627253868
15-Mar-23 18:00:00	0.980695883	0.760666903	1.760662229
15-Mar-23 19:00:00	1.084505954	0.762900679	1.821179282
15-Mar-23 20:00:00	1.081167212	0.812354515	1.886115462
15-Mar-23 21:00:00	1.083106173	0.796657772	1.882118302
15-Mar-23 22:00:00	1.053446998	0.762741373	1.80450267
15-Mar-23 23:00:00	0.997009373	0.765989975	1.70743603
16-Mar-23 00:00:00	1.004073399	0.763897761	1.848246257
16-Mar-23 01:00:00	0.995572241	0.808154141	1.8483556
16-Mar-23 02:00:00	0.992112327	0.869411243	1.862265699
16-Mar-23 03:00:00	0.998673084	0.893531347	1.884915212
16-Mar-23 04:00:00	1.040113929	0.896302354	1.96142403
16-Mar-23 05:00:00	1.008624135	0.89405721	1.895781832
16-Mar-23 06:00:00	0.992650217	0.843610515	1.851940348
16-Mar-23 07:00:00	0.99542736	0.873111467	1.903545974
16-Mar-23 08:00:00	0.994735723	0.864289194	1.863907662
16-Mar-23 09:00:00	1.036806146	0.896555296	1.973475841
16-Mar-23 10:00:00	1.013002718	0.901534194	1.925805529
16-Mar-23 11:00:00	0.996311622	0.892537816	1.919574548

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
16-Mar-23 12:00:00	1.0014909	0.859562236	1.855470163
16-Mar-23 13:00:00	0.996112278	0.845713972	1.845414681
16-Mar-23 14:00:00	1.015335425	0.895408789	1.899382774
16-Mar-23 15:00:00	1.002985392	0.89179028	1.89906962
16-Mar-23 16:00:00	1.005923513	0.890217059	1.891198525
16-Mar-23 17:00:00	0.995665064	0.853607638	1.852270791
16-Mar-23 18:00:00	0.996674581	0.832092365	1.826340397
16-Mar-23 19:00:00	0.995468382	0.775946427	1.773342874
16-Mar-23 20:00:00	1.001234263	0.766578004	1.758957886
16-Mar-23 21:00:00	1.007019205	0.76659406	1.756879854
16-Mar-23 22:00:00	0.996261129	0.805948015	1.798247116
16-Mar-23 23:00:00	0.999033425	0.830124221	1.827462868
17-Mar-23 00:00:00	0.997890684	0.865248331	1.859429083
17-Mar-23 01:00:00	0.981042978	0.893841187	1.893000372
17-Mar-23 02:00:00	1.004661615	0.893314238	1.892301939
17-Mar-23 03:00:00	1.079494955	0.893325183	1.988739268
17-Mar-23 04:00:00	1.086475197	0.857709269	1.93756453
17-Mar-23 05:00:00	1.082416321	0.842957755	1.925104121
17-Mar-23 06:00:00	1.042587486	0.763023853	1.784752067
17-Mar-23 07:00:00	1.000710464	0.767620265	1.827915445
17-Mar-23 08:00:00	0.944890602	0.76815238	1.686821337
17-Mar-23 09:00:00	0.916795855	0.80121179	1.75894321
17-Mar-23 10:00:00	0.913429757	0.849069883	1.758450415
17-Mar-23 11:00:00	0.909462832	0.777664325	1.681005895
17-Mar-23 12:00:00	0.960013347	0.765263334	1.702967852
17-Mar-23 13:00:00	0.972631656	0.764188176	1.761368095
17-Mar-23 14:00:00	0.997956693	0.786229757	1.840579858
17-Mar-23 15:00:00	0.993945989	0.805861699	1.802511621
17-Mar-23 16:00:00	1.000899831	0.785511939	1.78367859
17-Mar-23 17:00:00	0.971341053	0.766208478	1.700980699
17-Mar-23 18:00:00	0.939077235	0.762916418	1.66450978
17-Mar-23 19:00:00	0.984563503	0.766587514	1.72922702
17-Mar-23 20:00:00	1.002646546	0.826035131	1.831199017
17-Mar-23 21:00:00	0.995959741	0.816166649	1.811954445
17-Mar-23 22:00:00	0.992771179	0.890609336	1.875785979
17-Mar-23 23:00:00	0.980733378	0.892952614	1.815973604
18-Mar-23 00:00:00	0.964116716	0.893164357	1.860247428
18-Mar-23 01:00:00	0.913730261	0.850336927	1.735029567
18-Mar-23 02:00:00	0.90809968	0.808654099	1.717003765
18-Mar-23 03:00:00	0.909641067	0.79941915	1.717588197
18-Mar-23 04:00:00	0.964928574	0.76584616	1.767575865
18-Mar-23 05:00:00	0.976046941	0.766793219	1.722787572
18-Mar-23 06:00:00	0.908293433	0.776005008	1.709628666

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
18-Mar-23 07:00:00	0.916319558	0.830699129	1.742541863
18-Mar-23 08:00:00	0.909760626	0.820404106	1.730110963
18-Mar-23 09:00:00	0.928112299	0.769876494	1.678698997
18-Mar-23 10:00:00	0.95749835	0.761061914	1.670946646
18-Mar-23 11:00:00	0.99075407	0.762749513	1.768111022
18-Mar-23 12:00:00	0.99745387	0.863942995	1.87568793
18-Mar-23 13:00:00	0.999369695	0.827975193	1.824571037
18-Mar-23 14:00:00	1.001249528	0.762109935	1.750178814
18-Mar-23 15:00:00	0.97706003	0.764002013	1.702020612
18-Mar-23 16:00:00	0.991164138	0.764231133	1.809444472
18-Mar-23 17:00:00	0.99942417	0.784245237	1.794583471
18-Mar-23 18:00:00	1.000107363	0.830111871	1.825644016
18-Mar-23 19:00:00	0.997945669	0.853424973	1.851603866
18-Mar-23 20:00:00	0.978048679	0.893657102	1.934813391
18-Mar-23 21:00:00	0.972798453	0.904433477	1.8306932
18-Mar-23 22:00:00	0.9931664	0.888714248	1.890278495
18-Mar-23 23:00:00	1.00161141	0.832147012	1.828258369
19-Mar-23 00:00:00	1.003667945	0.825641069	1.8217374
19-Mar-23 01:00:00	0.966749009	0.76832066	1.76725475
19-Mar-23 02:00:00	0.986178981	0.764356646	1.756472712
19-Mar-23 03:00:00	0.984334668	0.763452627	1.754163686
19-Mar-23 04:00:00	0.99877635	0.800209993	1.795829973
19-Mar-23 05:00:00	1.001156093	0.86529967	1.906756059
19-Mar-23 06:00:00	0.99458756	0.770816779	1.76273629
19-Mar-23 07:00:00	0.979506281	0.761935212	1.752495475
19-Mar-23 08:00:00	0.97444787	0.763534141	1.755115445
19-Mar-23 09:00:00	1.00053618	0.796467913	1.792470353
19-Mar-23 10:00:00	0.99843055	0.84339173	1.843510217
19-Mar-23 11:00:00	0.996147858	0.795223824	1.789044446
19-Mar-23 12:00:00	0.997343528	0.766184187	1.763255978
19-Mar-23 13:00:00	0.993542158	0.767869294	1.762673974
19-Mar-23 14:00:00	1.000634826	0.766130988	1.770471676
19-Mar-23 15:00:00	0.996026559	0.835748528	1.832456878
19-Mar-23 16:00:00	0.994058237	0.814391151	1.811155318
19-Mar-23 17:00:00	0.98179095	0.763975155	1.74471568
19-Mar-23 18:00:00	0.959226227	0.763098609	1.696171974
19-Mar-23 19:00:00	0.985390891	0.764055604	1.766663558
19-Mar-23 20:00:00	0.993814896	0.808752713	1.786443546
19-Mar-23 21:00:00	1.002419062	0.851140883	1.833316364
19-Mar-23 22:00:00	0.99753168	0.893876996	1.887880206
19-Mar-23 23:00:00	0.991603904	0.893086167	1.886416905
20-Mar-23 00:00:00	0.989974889	0.892475088	1.885885795
20-Mar-23 01:00:00	0.999493493	0.877407656	1.871838691

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
20-Mar-23 02:00:00	0.994593625	0.823380014	1.820344498
20-Mar-23 03:00:00	0.996606697	0.853892489	1.848841531
20-Mar-23 04:00:00	0.996944235	0.89010764	1.886778351
20-Mar-23 05:00:00	0.975319968	0.890766815	1.887202315
20-Mar-23 06:00:00	0.989666743	0.893375393	1.89020886
20-Mar-23 07:00:00	0.996069163	0.870609231	1.87183393
20-Mar-23 08:00:00	0.99645339	0.883082178	1.880228725
20-Mar-23 09:00:00	0.991869284	0.76609544	1.754967356
20-Mar-23 10:00:00	0.960318193	0.765551903	1.768392542
20-Mar-23 11:00:00	0.978308664	0.765235645	1.728058953
20-Mar-23 12:00:00	0.993246932	0.830386716	1.865450745
20-Mar-23 13:00:00	0.997877151	0.832767968	1.868731337
20-Mar-23 14:00:00	0.996958706	0.876070138	1.874278062
20-Mar-23 15:00:00	1.006254633	0.888369521	1.889731258
20-Mar-23 16:00:00	1.001211153	0.887655795	1.890233648
20-Mar-23 17:00:00	0.994162483	0.890143096	1.886020881
20-Mar-23 18:00:00	1.000402247	0.840634399	1.885695291
20-Mar-23 19:00:00	0.996984038	0.858938985	1.858217594
20-Mar-23 20:00:00	0.987905598	0.894893587	1.883054395
20-Mar-23 21:00:00	0.979792659	0.89263543	1.848688029
20-Mar-23 22:00:00	0.988641325	0.893027625	1.888946149
20-Mar-23 23:00:00	1.002420692	0.865173062	1.833610963
21-Mar-23 00:00:00	0.995179387	0.850223945	1.845801771
21-Mar-23 01:00:00	0.995910816	0.768488391	1.768562007
21-Mar-23 02:00:00	1.004294614	0.773819646	1.830438303
21-Mar-23 03:00:00	1.006514162	0.7740059	1.771927701
21-Mar-23 04:00:00	0.995736431	0.814933858	1.844734616
21-Mar-23 05:00:00	1.000341564	0.895231108	1.88933717
21-Mar-23 06:00:00	0.990781643	0.887360249	1.883155985
21-Mar-23 07:00:00	1.004361341	0.890445299	1.929034876
21-Mar-23 08:00:00	1.02066654	0.894801136	1.887957992
21-Mar-23 09:00:00	1.00228704	0.899731388	1.956183916
21-Mar-23 10:00:00	1.004093171	0.900443662	1.893787754
21-Mar-23 11:00:00	0.994830866	0.87135032	1.86598311
21-Mar-23 12:00:00	1.007220748	0.890134166	1.889726599
21-Mar-23 13:00:00	1.017376016	0.895429446	1.893911834
21-Mar-23 14:00:00	1.043250332	0.897439752	1.930292257
21-Mar-23 15:00:00	1.082674342	0.886267324	1.969299219
21-Mar-23 16:00:00	1.08551815	0.880227069	1.960765686
21-Mar-23 17:00:00	1.08299918	0.88584979	1.980994105
21-Mar-23 18:00:00	1.023088303	0.953364531	2.03760384
21-Mar-23 19:00:00	1.014399894	0.981275231	2.02051487
21-Mar-23 20:00:00	0.995825485	0.982910223	1.959636442

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
21-Mar-23 21:00:00	0.995942086	0.905512371	1.896974122
21-Mar-23 22:00:00	0.999103432	0.857008272	1.869034853
21-Mar-23 23:00:00	1.004746837	0.889906903	1.911969066
22-Mar-23 00:00:00	1.006551494	0.888707819	1.902960912
22-Mar-23 01:00:00	0.999253319	0.891476131	1.921394957
22-Mar-23 02:00:00	0.996103541	0.86503811	1.913715152
22-Mar-23 03:00:00	0.998380464	0.856511521	1.857960967
22-Mar-23 04:00:00	1.003579756	0.888774892	1.911042348
22-Mar-23 05:00:00	1.009953383	0.892256627	1.908027576
22-Mar-23 06:00:00	1.000896951	0.892882705	1.904043236
22-Mar-23 07:00:00	0.99879134	0.893228233	1.882408702
22-Mar-23 08:00:00	1.001987728	0.890091652	1.891710184
22-Mar-23 09:00:00	0.99992629	0.891124775	1.885952124
22-Mar-23 10:00:00	1.015689746	0.902096033	1.897508224
22-Mar-23 11:00:00	1.004532125	0.896686296	1.917629478
22-Mar-23 12:00:00	0.993612303	0.878398556	1.86144928
22-Mar-23 13:00:00	0.997124989	0.891291012	1.887498571
22-Mar-23 14:00:00	1.000648829	0.878700473	1.905407107
22-Mar-23 15:00:00	1.002528658	0.895334343	1.923724174
22-Mar-23 16:00:00	1.011414265	0.885446721	1.9118859
22-Mar-23 17:00:00	1.068680353	0.890763944	1.919562125
22-Mar-23 18:00:00	1.085600906	0.89240633	2.018900459
22-Mar-23 19:00:00	1.082573051	0.887536482	1.987387381
22-Mar-23 20:00:00	1.071892297	0.88933131	1.939362041
22-Mar-23 21:00:00	0.991496606	0.889733803	1.826717634
22-Mar-23 22:00:00	0.999120517	0.889623574	1.878398619
22-Mar-23 23:00:00	0.996746999	0.823136758	1.826775742
23-Mar-23 00:00:00	1.000095038	0.90018539	1.898929033
23-Mar-23 01:00:00	1.004809101	0.962242957	1.943527181
23-Mar-23 02:00:00	1.016942766	0.903886057	1.907192811
23-Mar-23 03:00:00	1.013926877	0.891351839	1.929152522
23-Mar-23 04:00:00	0.996964855	0.884845819	1.927062114
23-Mar-23 05:00:00	1.000711034	0.859943537	1.887499363
23-Mar-23 06:00:00	0.996393494	0.877752924	1.876747632
23-Mar-23 07:00:00	1.011905953	0.942161938	1.99544741
23-Mar-23 08:00:00	1.046041956	0.976125008	2.081554064
23-Mar-23 09:00:00	1.005583307	0.974915376	1.95660158
23-Mar-23 10:00:00	0.999971822	0.88266211	1.893544186
23-Mar-23 11:00:00	0.997095498	0.890357948	1.885749294
23-Mar-23 12:00:00	1.001275063	0.887906639	1.946557796
23-Mar-23 13:00:00	1.030455526	0.892337722	1.948565274
23-Mar-23 14:00:00	1.043301341	0.895066627	1.898038752
23-Mar-23 15:00:00	1.087870161	0.899373564	1.9827293

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
23-Mar-23 16:00:00	1.081821337	0.937506729	1.988107204
23-Mar-23 17:00:00	1.079592594	0.966454744	1.98236084
23-Mar-23 18:00:00	1.052134845	0.907402549	1.89510071
23-Mar-23 19:00:00	1.029676116	0.892714254	1.948673964
23-Mar-23 20:00:00	1.004436435	0.8925258	1.900528479
23-Mar-23 21:00:00	1.001998875	0.891438754	1.969030205
23-Mar-23 22:00:00	0.999072756	0.891004153	1.975607729
23-Mar-23 23:00:00	0.996906698	0.897043041	1.97613287
24-Mar-23 00:00:00	1.000986284	0.896071422	1.909138529
24-Mar-23 01:00:00	0.996833695	0.889562886	1.889531422
24-Mar-23 02:00:00	1.001373711	0.889423763	1.906964485
24-Mar-23 03:00:00	0.999778231	3.122304863	4.138342963
24-Mar-23 04:00:00	6.128001398	21.0839315	27.19496504
24-Mar-23 05:00:00	5.160558356	21.10294353	26.26672872
24-Mar-23 06:00:00	5.167900297	21.1246036	26.26580418
24-Mar-23 07:00:00	5.154496458	21.09070937	26.23290062
24-Mar-23 08:00:00	5.146300713	21.09225649	26.21221791
24-Mar-23 09:00:00	10.14343511	21.09963556	31.25169013
24-Mar-23 10:00:00	12.05008597	4.072175304	16.12602817
24-Mar-23 11:00:00	12.05964176	1.159413051	13.21867119
24-Mar-23 12:00:00	9.641739368	1.202535319	10.84183126
24-Mar-23 13:00:00	1.198785156	1.191031811	2.38591601
24-Mar-23 14:00:00	1.166739268	1.189356168	2.358448962
24-Mar-23 15:00:00	1.214258341	1.085767755	2.246228232
24-Mar-23 16:00:00	1.217075668	0.977018887	2.187922621
24-Mar-23 17:00:00	1.211572679	0.977079289	2.179475578
24-Mar-23 18:00:00	1.137888432	0.97840777	2.097271442
24-Mar-23 19:00:00	1.129814092	0.978977823	2.11851282
24-Mar-23 20:00:00	1.21333809	0.976144248	2.205064344
24-Mar-23 21:00:00	1.218526847	1.000448066	2.203254207
24-Mar-23 22:00:00	1.215182849	1.033156305	2.208905257
24-Mar-23 23:00:00	1.175867077	1.040167427	2.173947546
25-Mar-23 00:00:00	1.160815517	0.98017449	2.134001401
25-Mar-23 01:00:00	1.226582481	0.975479816	2.197014355
25-Mar-23 02:00:00	1.299839364	0.998028267	2.329319847
25-Mar-23 03:00:00	1.304520731	1.036021528	2.332452549
25-Mar-23 04:00:00	1.274280594	1.009628332	2.336651802
25-Mar-23 05:00:00	1.134253641	1.058576822	2.201471276
25-Mar-23 06:00:00	1.121647649	1.065223813	2.190980282
25-Mar-23 07:00:00	1.21232048	1.003244539	2.220936086
25-Mar-23 08:00:00	1.210805913	1.048115188	2.227061048
25-Mar-23 09:00:00	1.216024407	1.068187515	2.215122755
25-Mar-23 10:00:00	1.196909282	1.068370271	2.260723977

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
25-Mar-23 11:00:00	1.17835131	1.059010613	2.238133921
25-Mar-23 12:00:00	1.209572931	1.032331163	2.263010586
25-Mar-23 13:00:00	1.213778903	0.988626282	2.21846398
25-Mar-23 14:00:00	1.210549903	0.97900365	2.244361162
25-Mar-23 15:00:00	1.196301066	0.978375432	2.116507259
25-Mar-23 16:00:00	1.129006677	0.978109312	2.09999562
25-Mar-23 17:00:00	1.105265604	0.977789338	2.101455172
25-Mar-23 18:00:00	1.081459912	0.975006868	2.071907902
25-Mar-23 19:00:00	1.082895259	0.973637009	2.07259655
25-Mar-23 20:00:00	1.081602871	0.978227341	2.064499172
25-Mar-23 21:00:00	1.151885145	0.980449837	2.135541975
25-Mar-23 22:00:00	1.139686684	0.983421039	2.105570945
25-Mar-23 23:00:00	1.212823285	1.025468732	2.222992579
26-Mar-23 00:00:00	1.215552548	1.021390921	2.224618452
26-Mar-23 01:00:00	1.21314213	1.025054084	2.239300586
26-Mar-23 02:00:00	1.181113501	1.060942144	2.198077413
26-Mar-23 03:00:00	1.198564145	1.063272293	2.278501908
26-Mar-23 04:00:00	1.27841409	1.064537132	2.352447735
26-Mar-23 05:00:00	1.303462262	1.065276345	2.28851198
26-Mar-23 06:00:00	1.297442829	1.066400864	2.323530886
26-Mar-23 07:00:00	1.282073302	1.07020673	2.353537067
26-Mar-23 08:00:00	1.233622224	1.073069604	2.285448569
26-Mar-23 09:00:00	1.218135668	1.067176982	2.24749975
26-Mar-23 10:00:00	1.212961145	1.110142297	2.319535181
26-Mar-23 11:00:00	1.213634423	1.119560563	2.323915323
26-Mar-23 12:00:00	1.212182736	1.076459421	2.283757594
26-Mar-23 13:00:00	1.222877557	1.06029698	2.321788251
26-Mar-23 14:00:00	1.227312296	1.064299965	2.271172961
26-Mar-23 15:00:00	1.214087599	1.07592443	2.317613847
26-Mar-23 16:00:00	1.216275964	1.088081208	2.302085638
26-Mar-23 17:00:00	1.213218696	1.094932404	2.304503538
26-Mar-23 18:00:00	1.224603171	1.06196181	2.230560629
26-Mar-23 19:00:00	1.190880398	1.06505518	2.252136111
26-Mar-23 20:00:00	1.212633643	1.061084594	2.26882012
26-Mar-23 21:00:00	1.214707549	1.090431793	2.331005624
26-Mar-23 22:00:00	1.210838675	1.096592256	2.306153949
26-Mar-23 23:00:00	1.218772716	1.061072326	2.261704365
27-Mar-23 00:00:00	1.239546471	1.062972045	2.282010992
27-Mar-23 01:00:00	1.208359891	1.062776351	2.258489545
27-Mar-23 02:00:00	1.216333138	1.098926708	2.344711253
27-Mar-23 03:00:00	1.212652206	1.046735833	2.253916879
27-Mar-23 04:00:00	1.213296135	1.082247809	2.298670124
27-Mar-23 05:00:00	1.222860815	1.060110998	2.246464212

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
27-Mar-23 06:00:00	1.21148634	1.062607527	2.293620878
27-Mar-23 07:00:00	1.212380025	1.074886911	2.280174441
27-Mar-23 08:00:00	1.207889382	1.073172574	2.292178439
27-Mar-23 09:00:00	1.216916327	1.076863368	2.294358121
27-Mar-23 10:00:00	1.217357357	1.064475727	2.24934566
27-Mar-23 11:00:00	1.234057877	1.069986081	2.242588401
27-Mar-23 12:00:00	1.212313579	1.065108204	2.253161898
27-Mar-23 13:00:00	1.210415689	1.072745244	2.254347022
27-Mar-23 14:00:00	1.208773036	1.120036618	2.323856277
27-Mar-23 15:00:00	1.216866392	0.982534528	2.197985411
27-Mar-23 16:00:00	1.208163355	0.979650843	2.167805121
27-Mar-23 17:00:00	1.210512665	0.977991414	2.163483605
27-Mar-23 18:00:00	1.21360192	0.975751754	2.236401677
27-Mar-23 19:00:00	1.213474595	1.083653927	2.297288007
27-Mar-23 20:00:00	1.215152228	1.080021419	2.305468842
27-Mar-23 21:00:00	1.216656228	1.062009454	2.230771228
27-Mar-23 22:00:00	1.169482006	1.065513849	2.232574662
27-Mar-23 23:00:00	1.096529537	1.069714562	2.155896902
28-Mar-23 00:00:00	1.082665677	1.097723324	2.186556405
28-Mar-23 01:00:00	1.083958941	1.043039891	2.127752317
28-Mar-23 02:00:00	1.109204445	0.974133432	2.107099705
28-Mar-23 03:00:00	1.180713662	0.981975019	2.152029726
28-Mar-23 04:00:00	1.196179403	0.980665505	2.209199389
28-Mar-23 05:00:00	1.213165691	1.043800606	2.308502529
28-Mar-23 06:00:00	1.214002169	1.107518511	2.314592907
28-Mar-23 07:00:00	1.213018311	1.057999253	2.258497
28-Mar-23 08:00:00	1.212188979	0.995759126	2.158339628
28-Mar-23 09:00:00	1.170002811	0.974732637	2.149527166
28-Mar-23 10:00:00	1.214927094	0.980622351	2.217421284
28-Mar-23 11:00:00	1.214223557	1.085556891	2.306999616
28-Mar-23 12:00:00	1.218088203	1.071846167	2.287361328
28-Mar-23 13:00:00	1.186017434	1.057906111	2.220504897
28-Mar-23 14:00:00	1.143473374	1.060031975	2.211221642
28-Mar-23 15:00:00	1.271925416	1.061384665	2.332715455
28-Mar-23 16:00:00	1.301213479	1.047937234	2.314357894
28-Mar-23 17:00:00	1.303809019	1.00164303	2.331426056
28-Mar-23 18:00:00	1.641480313	1.062721745	2.701415406
28-Mar-23 19:00:00	3.078188587	1.063919828	4.138644457
28-Mar-23 20:00:00	3.23517051	1.065408289	4.324099435
28-Mar-23 21:00:00	3.253365066	1.095371607	4.393153517
28-Mar-23 22:00:00	3.248150428	1.07030393	4.314161433
28-Mar-23 23:00:00	3.251202226	1.053526098	4.209955699
29-Mar-23 00:00:00	3.38012535	1.001330712	4.36866625

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
29-Mar-23 01:00:00	3.468469832	0.986734891	4.452663157
29-Mar-23 02:00:00	3.42558074	1.027417354	4.46156206
29-Mar-23 03:00:00	3.421617905	1.063662767	4.461260319
29-Mar-23 04:00:00	3.421239018	1.096238573	4.496094916
29-Mar-23 05:00:00	3.480381542	1.060748625	4.556028852
29-Mar-23 06:00:00	3.598928617	1.067628474	4.644970053
29-Mar-23 07:00:00	3.565203389	1.062680605	4.623747349
29-Mar-23 08:00:00	3.548621443	1.143215545	4.688401077
29-Mar-23 09:00:00	3.549903322	1.061996341	4.566176203
29-Mar-23 10:00:00	3.562325411	1.058804981	4.623733521
29-Mar-23 11:00:00	3.727758951	1.058872318	4.776114278
29-Mar-23 12:00:00	3.714649863	1.063374368	4.768450949
29-Mar-23 13:00:00	3.725751525	1.12948943	4.805994378
29-Mar-23 14:00:00	3.737054136	1.081296378	4.82084261
29-Mar-23 15:00:00	3.731153387	1.087810872	4.791900237
29-Mar-23 16:00:00	3.661797537	1.066532135	4.66381515
29-Mar-23 17:00:00	3.669680701	1.064114344	4.712799708
29-Mar-23 18:00:00	3.714291639	1.068620293	4.78399184
29-Mar-23 19:00:00	3.722744319	1.133802242	4.843487713
29-Mar-23 20:00:00	3.728074021	1.085913251	4.777648369
29-Mar-23 21:00:00	3.688648012	1.061197869	4.754792747
29-Mar-23 22:00:00	3.682740728	1.06242309	4.768638747
29-Mar-23 23:00:00	3.729106673	1.062852874	4.801563365
30-Mar-23 00:00:00	3.726474477	1.121408996	4.841848184
30-Mar-23 01:00:00	3.730286037	1.063730423	4.749186118
30-Mar-23 02:00:00	3.730440524	1.064266635	4.778339931
30-Mar-23 03:00:00	3.663748529	1.066455835	4.702873851
30-Mar-23 04:00:00	3.684985161	1.067796961	4.740084966
30-Mar-23 05:00:00	3.646243014	1.083330501	4.739517742
30-Mar-23 06:00:00	3.641652571	1.026985377	4.691204627
30-Mar-23 07:00:00	3.638273193	1.050986684	4.74017689
30-Mar-23 08:00:00	3.70208776	1.064516143	4.753501862
30-Mar-23 09:00:00	3.833812502	1.070250028	4.886975196
30-Mar-23 10:00:00	3.935998665	1.065077829	4.97038224
30-Mar-23 11:00:00	3.939143764	1.11196465	5.039915818
30-Mar-23 12:00:00	3.94457674	1.046116912	4.962193949
30-Mar-23 13:00:00	3.838309173	0.982396237	4.795954333
30-Mar-23 14:00:00	3.775556776	0.982368195	4.772196134
30-Mar-23 15:00:00	3.718296991	0.991015315	4.693963658
30-Mar-23 16:00:00	3.635736664	1.166890327	4.803875213
30-Mar-23 17:00:00	3.645838102	1.081256937	4.711725977
30-Mar-23 18:00:00	3.639042	0.982470695	4.591237932
30-Mar-23 19:00:00	3.690103896	0.977526645	4.723592294

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
30-Mar-23 20:00:00	3.793248309	0.978190094	4.780106379
30-Mar-23 21:00:00	3.852614297	1.014374043	4.936878897
30-Mar-23 22:00:00	3.864357816	1.127445989	4.977987051
30-Mar-23 23:00:00	3.854858001	1.067998475	4.900967704
31-Mar-23 00:00:00	3.797939534	1.059070651	4.79242346
31-Mar-23 01:00:00	3.822973432	1.054995119	4.923224939
31-Mar-23 02:00:00	3.723917498	1.060213993	4.777620236
31-Mar-23 03:00:00	3.735151768	1.107144568	4.849932429
31-Mar-23 04:00:00	3.71875355	1.106743064	4.807226247
31-Mar-23 05:00:00	3.729466425	1.057504932	4.788456512
31-Mar-23 06:00:00	3.813305444	1.061863851	4.864025195
31-Mar-23 07:00:00	3.841289017	1.062618597	4.872516261
31-Mar-23 08:00:00	3.849237416	1.168127592	5.06774253
31-Mar-23 09:00:00	3.859229312	1.122083522	4.98610017
31-Mar-23 10:00:00	3.8519699	1.081296749	4.940925466
31-Mar-23 11:00:00	3.748624206	1.062407017	4.791513741
31-Mar-23 12:00:00	3.817475544	1.061317686	4.866954115
31-Mar-23 13:00:00	3.72749677	1.095103654	4.831140883
31-Mar-23 14:00:00	3.721543233	1.126168547	4.834634818
31-Mar-23 15:00:00	3.736578676	1.140986674	4.885511036
31-Mar-23 16:00:00	3.719518344	1.19238892	4.924277845
31-Mar-23 17:00:00	3.779686544	1.191330169	4.964186788
31-Mar-23 18:00:00	3.850158347	1.191000645	5.02441095
31-Mar-23 19:00:00	3.856398119	1.176571694	4.981966565
31-Mar-23 20:00:00	3.864399393	1.094009399	4.955488496
31-Mar-23 21:00:00	3.826416744	1.070890129	4.85392438
31-Mar-23 22:00:00	3.717093276	1.067839116	4.79869507
31-Mar-23 23:00:00	3.766675585	1.066252947	4.833467642
01-Apr-23 00:00:00	3.71706189	1.097476436	4.828206304
01-Apr-23 01:00:00	3.736719648	1.09913304	4.859568225
01-Apr-23 02:00:00	3.722684622	1.085022098	4.806783994
01-Apr-23 03:00:00	3.731857415	1.063717407	4.795545179
01-Apr-23 04:00:00	3.861525244	1.05771956	4.942116385
01-Apr-23 05:00:00	3.936019805	1.071886713	5.006529861
01-Apr-23 06:00:00	3.943091856	1.194355196	5.112868015
01-Apr-23 07:00:00	3.940992673	1.121003873	5.060642229
01-Apr-23 08:00:00	3.873082863	1.067168872	4.885585441
01-Apr-23 09:00:00	3.846955803	1.064094177	4.917727778
01-Apr-23 10:00:00	3.871847338	1.063723405	4.902848319
01-Apr-23 11:00:00	3.850574224	1.203007259	5.070251412
01-Apr-23 12:00:00	3.868740793	1.168722351	4.983438158
01-Apr-23 13:00:00	3.852993263	1.189821005	5.023365498
01-Apr-23 14:00:00	3.710426582	1.194495447	4.904475556

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
01-Apr-23 15:00:00	3.903259509	1.194403362	5.113258362
01-Apr-23 16:00:00	3.856780701	1.180836707	5.044768724
01-Apr-23 17:00:00	3.865004818	1.156225867	4.970855369
01-Apr-23 18:00:00	3.855894407	1.083255898	4.949043146
01-Apr-23 19:00:00	3.809945054	1.060188484	4.842801807
01-Apr-23 20:00:00	3.812938121	1.065420802	4.872332423
01-Apr-23 21:00:00	3.844076236	1.061056495	4.909153435
01-Apr-23 22:00:00	3.862955822	1.167824604	5.039104713
01-Apr-23 23:00:00	3.855701658	1.081949161	4.896093061
02-Apr-23 00:00:00	3.800397118	1.063576961	4.837543788
02-Apr-23 01:00:00	3.807721602	1.060292946	4.878595716
02-Apr-23 02:00:00	3.856158376	1.05972259	4.957503874
02-Apr-23 03:00:00	3.86912228	1.120321308	5.01178749
02-Apr-23 04:00:00	3.852447682	1.084585137	4.925635742
02-Apr-23 05:00:00	3.850482841	1.096864133	4.903969063
02-Apr-23 06:00:00	3.833039724	1.059988667	4.887761851
02-Apr-23 07:00:00	3.846273753	1.061321712	4.880673451
02-Apr-23 08:00:00	3.86405762	1.094283726	4.980697108
02-Apr-23 09:00:00	3.852606906	1.081787761	4.923485712
02-Apr-23 10:00:00	3.851556818	1.075557326	4.964963056
02-Apr-23 11:00:00	3.806172815	1.192647099	4.966243461
02-Apr-23 12:00:00	3.721039865	1.190256344	4.913281282
02-Apr-23 13:00:00	3.840474049	1.189604503	5.005282217
02-Apr-23 14:00:00	3.858543025	1.156295522	5.009660314
02-Apr-23 15:00:00	3.851532433	1.110830751	4.972036325
02-Apr-23 16:00:00	3.829410156	1.062650084	4.881270091
02-Apr-23 17:00:00	3.917882641	1.06440417	4.976571639
02-Apr-23 18:00:00	3.896230631	1.063700557	4.991333511
02-Apr-23 19:00:00	3.84927721	1.11491947	5.057321838
02-Apr-23 20:00:00	3.859290785	1.132562876	4.996699439
02-Apr-23 21:00:00	3.858579583	1.080244634	4.909501923
02-Apr-23 22:00:00	3.845715726	1.031561852	4.821824014
02-Apr-23 23:00:00	3.912349833	0.972935557	4.904890556
03-Apr-23 00:00:00	3.944001622	1.01078509	4.969474726
03-Apr-23 01:00:00	3.95027705	1.163381254	5.103479859
03-Apr-23 02:00:00	3.940236913	1.191776156	5.148787022
03-Apr-23 03:00:00	3.900088906	1.189095855	5.014526602
03-Apr-23 04:00:00	3.964200603	1.188776255	5.161821097
03-Apr-23 05:00:00	3.996004754	1.191178123	5.19157354
03-Apr-23 06:00:00	4.034704297	1.258394337	5.284692208
03-Apr-23 07:00:00	4.025133186	1.164293352	5.195470399
03-Apr-23 08:00:00	4.017831037	1.071733283	5.10638592
03-Apr-23 09:00:00	3.875662784	1.074466758	4.925985681

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
03-Apr-23 10:00:00	3.93113635	1.077905226	5.003607008
03-Apr-23 11:00:00	3.856362197	1.154634433	5.05302222
03-Apr-23 12:00:00	3.856072466	1.253738443	5.069423628
03-Apr-23 13:00:00	3.864867946	1.209889859	5.135762403
03-Apr-23 14:00:00	3.898277477	1.291173649	5.195161493
03-Apr-23 15:00:00	4.050633391	1.266571098	5.315641297
03-Apr-23 16:00:00	3.884295331	1.263843886	5.156776312
03-Apr-23 17:00:00	3.855194873	1.272717225	5.108861959
03-Apr-23 18:00:00	3.854940715	1.226522559	5.092698503
03-Apr-23 19:00:00	3.848829018	1.184458534	5.050484637
03-Apr-23 20:00:00	3.936449144	1.183482391	5.133415758
03-Apr-23 21:00:00	3.929433015	1.187868667	5.144584557
03-Apr-23 22:00:00	3.942989199	1.257776743	5.235091789
03-Apr-23 23:00:00	3.950420671	1.164567037	5.16872466
04-Apr-23 00:00:00	3.943832715	1.183638699	5.029327806
04-Apr-23 01:00:00	3.881731219	1.192082921	5.022712243
04-Apr-23 02:00:00	3.946103772	1.192002515	5.156701032
04-Apr-23 03:00:00	3.946305103	1.223200451	5.253233415
04-Apr-23 04:00:00	3.942036629	1.264435649	5.171113438
04-Apr-23 05:00:00	3.94179501	1.206775308	5.184946259
04-Apr-23 06:00:00	3.931505296	1.19265455	5.093652446
04-Apr-23 07:00:00	3.906902313	1.186758091	5.153492566
04-Apr-23 08:00:00	3.868599627	1.191850682	5.13848169
04-Apr-23 09:00:00	3.852683402	1.222321348	5.091709214
04-Apr-23 10:00:00	3.860980029	1.214610287	5.055930413
04-Apr-23 11:00:00	3.845126569	1.210517025	5.114413834
04-Apr-23 12:00:00	3.94238564	1.269792167	5.220662165
04-Apr-23 13:00:00	3.978015555	1.273673582	5.257187868
04-Apr-23 14:00:00	3.936541875	1.265410145	5.226646022
04-Apr-23 15:00:00	3.94230424	1.169111178	5.131186236
04-Apr-23 16:00:00	3.939331876	1.190050125	5.14501524
04-Apr-23 17:00:00	3.893704657	1.192503071	5.059393401
04-Apr-23 18:00:00	3.890201343	1.199195646	5.112728778
04-Apr-23 19:00:00	3.84841643	1.239649134	5.052624353
04-Apr-23 20:00:00	3.855020867	1.190212011	5.063311179
04-Apr-23 21:00:00	3.869703478	1.18893253	5.043690395
04-Apr-23 22:00:00	3.836685763	1.189314795	5.021189838
04-Apr-23 23:00:00	3.914325498	1.192422406	5.120195124
05-Apr-23 00:00:00	3.955926312	1.190868998	5.145689772
05-Apr-23 01:00:00	3.944603536	1.198617114	5.164150664
05-Apr-23 02:00:00	3.942548079	1.156680249	5.099828662
05-Apr-23 03:00:00	3.925266001	1.067539096	4.993240568
05-Apr-23 04:00:00	3.849416494	1.06174926	4.892134686

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
05-Apr-23 05:00:00	3.877678494	1.060851979	4.944154766
05-Apr-23 06:00:00	3.85772913	1.154171703	5.046944896
05-Apr-23 07:00:00	3.854096137	1.161674208	5.03174644
05-Apr-23 08:00:00	3.860975848	1.176543539	5.021025181
05-Apr-23 09:00:00	3.728854269	1.194040219	4.887925988
05-Apr-23 10:00:00	3.862370875	1.198428476	5.042225308
05-Apr-23 11:00:00	4.024365995	1.189560237	5.224809507
05-Apr-23 12:00:00	4.030369331	1.137239552	5.204038552
05-Apr-23 13:00:00	4.035061783	1.140054981	5.177001026
05-Apr-23 14:00:00	3.928113763	1.19367137	5.114851475
05-Apr-23 15:00:00	3.893217458	1.195972355	5.07865164
05-Apr-23 16:00:00	3.865509082	1.191257286	5.052276865
05-Apr-23 17:00:00	3.859712887	1.193452908	5.081769724
05-Apr-23 18:00:00	3.859053532	1.148751802	5.004200856
05-Apr-23 19:00:00	3.850173063	1.192021286	5.045874192
05-Apr-23 20:00:00	3.845900297	1.192006149	5.089495459
05-Apr-23 21:00:00	3.901978307	1.193408962	5.086877161
05-Apr-23 22:00:00	4.029662755	1.224036242	5.30373106
05-Apr-23 23:00:00	4.033200167	1.192104032	5.233405676
06-Apr-23 00:00:00	4.027987348	1.152770247	5.22046314
06-Apr-23 01:00:00	3.908340388	1.1923419	5.099395222
06-Apr-23 02:00:00	3.943047206	1.193375945	5.148477724
06-Apr-23 03:00:00	3.865885946	1.189004064	5.030186674
06-Apr-23 04:00:00	3.861236356	1.159347879	5.086502165
06-Apr-23 05:00:00	3.8523907	1.149695048	5.042530418
06-Apr-23 06:00:00	3.812771479	1.066961487	4.845358076
06-Apr-23 07:00:00	3.754693164	1.064480327	4.816559833
06-Apr-23 08:00:00	3.766504433	1.062405348	4.833030824
06-Apr-23 09:00:00	3.864005142	1.153730224	5.08780516
06-Apr-23 10:00:00	3.85314707	1.153917795	5.01365061
06-Apr-23 11:00:00	3.859579815	1.173718207	5.004075307
06-Apr-23 12:00:00	3.896649621	1.184717978	5.074474558
06-Apr-23 13:00:00	3.941090862	1.184904329	5.148059492
06-Apr-23 14:00:00	3.93895079	1.205707378	5.1243529
06-Apr-23 15:00:00	3.936271509	1.144336495	5.085384961
06-Apr-23 16:00:00	3.952794062	1.187668648	5.129264178
06-Apr-23 17:00:00	3.921349009	1.197019099	5.049181835
06-Apr-23 18:00:00	3.870565693	1.193214802	5.051145686
06-Apr-23 19:00:00	3.935102012	1.18791992	5.178076532
06-Apr-23 20:00:00	3.950732761	1.227678233	5.184624206
06-Apr-23 21:00:00	3.938413011	1.158360371	5.121861286
06-Apr-23 22:00:00	3.941906238	1.063599404	4.979571641
06-Apr-23 23:00:00	3.882379704	1.06559334	4.943627755

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
07-Apr-23 00:00:00	3.932556099	1.063942997	4.96794529
07-Apr-23 01:00:00	3.92736797	1.125202745	5.053249322
07-Apr-23 02:00:00	3.954903271	1.130676964	5.1176647
07-Apr-23 03:00:00	3.938871145	1.200213989	5.057464123
07-Apr-23 04:00:00	3.849459052	1.201531269	4.99242515
07-Apr-23 05:00:00	3.877929793	1.197323052	5.064721203
07-Apr-23 06:00:00	3.852000316	1.185357601	5.067430496
07-Apr-23 07:00:00	3.857446088	1.130303281	5.051702044
07-Apr-23 08:00:00	3.853542725	1.160153548	5.013760911
07-Apr-23 09:00:00	3.8949644	1.188979101	5.145806366
07-Apr-23 10:00:00	3.985383583	1.192333028	5.238911359
07-Apr-23 11:00:00	4.042557849	1.191756699	5.258213477
07-Apr-23 12:00:00	4.032298689	1.232465461	5.312197901
07-Apr-23 13:00:00	4.037617644	1.150490451	5.276548915
07-Apr-23 14:00:00	4.013116722	1.216355244	5.24804555
07-Apr-23 15:00:00	3.905860874	1.275118981	5.209719658
07-Apr-23 16:00:00	3.968697442	1.271973553	5.201531785
07-Apr-23 17:00:00	3.934530338	1.270813497	5.20363702
07-Apr-23 18:00:00	3.955576671	1.227132233	5.112577426
07-Apr-23 19:00:00	3.935306483	1.170967821	5.123775039
07-Apr-23 20:00:00	3.914702658	1.186709953	5.085398395
07-Apr-23 21:00:00	3.952994068	1.18418231	5.156286234
07-Apr-23 22:00:00	3.86372494	1.18933977	5.117304288
07-Apr-23 23:00:00	3.857927892	1.146173934	5.027618098
08-Apr-23 00:00:00	3.855430192	1.16629882	5.018704732
08-Apr-23 01:00:00	3.819980343	1.189151124	4.980701954
08-Apr-23 02:00:00	3.95371879	1.192665724	5.135643385
08-Apr-23 03:00:00	3.99463129	1.195764785	5.178058147
08-Apr-23 04:00:00	4.039032671	1.198483042	5.283669504
08-Apr-23 05:00:00	4.024888701	1.185341044	5.270586367
08-Apr-23 06:00:00	4.029600753	1.183564361	5.24959917
08-Apr-23 07:00:00	3.952083574	1.190322024	5.13838119
08-Apr-23 08:00:00	3.98830333	1.190210752	5.25811129
08-Apr-23 09:00:00	3.949988163	1.182679948	5.134112954
08-Apr-23 10:00:00	3.939129161	1.173798541	5.12912292
08-Apr-23 11:00:00	3.942918758	1.15359788	5.087879353
08-Apr-23 12:00:00	3.914569497	1.185497355	5.057011099
08-Apr-23 13:00:00	3.904387302	1.192934532	5.090812925
08-Apr-23 14:00:00	4.024287668	1.195512981	5.214696725
08-Apr-23 15:00:00	4.025943924	1.168304051	5.222058314
08-Apr-23 16:00:00	4.028654416	1.169036855	5.18233082
08-Apr-23 17:00:00	3.995251236	1.18897299	5.045570119
08-Apr-23 18:00:00	3.889338983	1.186339767	5.08380608

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
08-Apr-23 19:00:00	3.953401685	1.188861887	5.191679107
08-Apr-23 20:00:00	3.948712609	1.213780638	5.229973039
08-Apr-23 21:00:00	3.935085442	1.193186895	5.145956898
08-Apr-23 22:00:00	3.94663563	1.189762418	5.138085853
08-Apr-23 23:00:00	3.889458312	1.189055289	5.067945125
09-Apr-23 00:00:00	3.970498535	1.18906668	5.177885731
09-Apr-23 01:00:00	4.029104564	1.204700296	5.228332253
09-Apr-23 02:00:00	4.028861258	1.167910662	5.193472862
09-Apr-23 03:00:00	4.031636362	1.193526268	5.245835596
09-Apr-23 04:00:00	3.886244165	1.200106819	4.958923578
09-Apr-23 05:00:00	3.895898514	1.198102665	5.108176991
09-Apr-23 06:00:00	3.987551252	1.18198003	5.201809804
09-Apr-23 07:00:00	4.036338727	1.22625765	5.279918373
09-Apr-23 08:00:00	4.024164491	1.245419807	5.265231291
09-Apr-23 09:00:00	4.026319504	1.180589795	5.231946405
09-Apr-23 10:00:00	3.964124097	1.186910971	5.148375803
09-Apr-23 11:00:00	3.967881706	1.188349295	5.169028401
09-Apr-23 12:00:00	3.944672518	1.1909721	5.179402419
09-Apr-23 13:00:00	3.942118035	1.185032588	5.158467372
09-Apr-23 14:00:00	3.944759583	1.18671093	5.146854264
09-Apr-23 15:00:00	3.900628818	1.193811544	5.078389947
09-Apr-23 16:00:00	3.955455171	1.192472363	5.160045768
09-Apr-23 17:00:00	3.866101159	1.189495325	5.111233997
09-Apr-23 18:00:00	3.852844808	1.211975253	5.091428741
09-Apr-23 19:00:00	3.853900737	1.136452427	4.985352947
09-Apr-23 20:00:00	3.855877126	1.058613757	4.865761537
09-Apr-23 21:00:00	3.949479871	1.059363112	5.000079173
09-Apr-23 22:00:00	3.992387083	1.061613782	5.063208818
09-Apr-23 23:00:00	4.02886796	1.214082959	5.26798511
10-Apr-23 00:00:00	4.024425754	1.172168298	5.184200317
10-Apr-23 01:00:00	4.009418938	1.199030828	5.190676053
10-Apr-23 02:00:00	3.899733623	1.191067749	5.068674644
10-Apr-23 03:00:00	3.88979231	1.18825237	5.07394682
10-Apr-23 04:00:00	3.864254713	1.186024304	5.103791025
10-Apr-23 05:00:00	3.855072074	1.15059732	5.05911357
10-Apr-23 06:00:00	3.852561818	1.261757207	5.034979548
10-Apr-23 07:00:00	3.926639464	1.200880663	5.137808021
10-Apr-23 08:00:00	4.047061046	1.192907691	5.233696964
10-Apr-23 09:00:00	3.956039972	1.196212236	5.17825222
10-Apr-23 10:00:00	3.940797912	1.216369475	5.143991841
10-Apr-23 11:00:00	3.941989793	1.176091592	5.106871578
10-Apr-23 12:00:00	3.923015983	1.189414106	5.127628902
10-Apr-23 13:00:00	3.901115749	1.1919554	5.1037499

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
10-Apr-23 14:00:00	3.957534764	1.192812134	5.151264773
10-Apr-23 15:00:00	3.939090768	1.259301394	5.220775643
10-Apr-23 16:00:00	3.939326578	1.143963867	5.117839257
10-Apr-23 17:00:00	3.944873624	1.192967296	5.139451504
10-Apr-23 18:00:00	3.938731737	1.190196602	5.111968715
10-Apr-23 19:00:00	3.995492087	1.18954947	5.19023641
10-Apr-23 20:00:00	4.023761325	1.227986977	5.287515102
10-Apr-23 21:00:00	4.030487802	1.189972281	5.268598318
10-Apr-23 22:00:00	4.031861597	1.191257649	5.232909441
10-Apr-23 23:00:00	3.952971297	1.192338192	5.110235597
11-Apr-23 00:00:00	3.950201511	1.194476734	5.124241409
11-Apr-23 01:00:00	4.119033456	1.192259347	5.296422353
11-Apr-23 02:00:00	4.151778016	1.189806612	5.364086861
11-Apr-23 03:00:00	4.164511045	1.195567573	5.41341671
11-Apr-23 04:00:00	4.068726085	1.195368652	5.252110932
11-Apr-23 05:00:00	3.940490484	1.189387727	5.135929857
11-Apr-23 06:00:00	4.048106511	1.189527308	5.257678827
11-Apr-23 07:00:00	4.038579451	1.190287252	5.241136074
11-Apr-23 08:00:00	4.0316591	1.185116263	5.236960411
11-Apr-23 09:00:00	4.032617437	1.192139586	5.20120838
11-Apr-23 10:00:00	3.92811301	1.201762669	5.084358139
11-Apr-23 11:00:00	3.893534925	1.199218392	5.06713527
11-Apr-23 12:00:00	3.946122156	1.22065911	5.177111753
11-Apr-23 13:00:00	3.937411957	1.217086093	5.17327563
11-Apr-23 14:00:00	3.951054494	1.272431475	5.176367752
11-Apr-23 15:00:00	3.896633494	1.285115083	5.093244085
11-Apr-23 16:00:00	4.018231008	1.275797159	5.293922571
11-Apr-23 17:00:00	4.030448218	1.275563895	5.284268008
11-Apr-23 18:00:00	4.032372819	1.275521096	5.30192399
11-Apr-23 19:00:00	4.035597589	1.275691976	5.241126823
11-Apr-23 20:00:00	3.997924672	1.250106136	5.206117005
11-Apr-23 21:00:00	3.972594314	1.199449491	5.148021889
11-Apr-23 22:00:00	4.015793893	1.199182255	5.239901161
11-Apr-23 23:00:00	4.02196908	1.232933136	5.30297889
12-Apr-23 00:00:00	4.033792535	1.193785882	5.255748484
12-Apr-23 01:00:00	4.031392389	1.190879075	5.2234991
12-Apr-23 02:00:00	3.911528918	1.190241361	5.080342251
12-Apr-23 03:00:00	3.92545606	1.189681172	5.114251264
12-Apr-23 04:00:00	3.858381629	1.194616389	5.076715028
12-Apr-23 05:00:00	3.863933623	1.269164324	5.160387463
12-Apr-23 06:00:00	3.855318391	1.196116474	5.072370503
12-Apr-23 07:00:00	3.898681164	1.292072535	5.212702045
12-Apr-23 08:00:00	4.060570121	1.27357312	5.390442191

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
12-Apr-23 09:00:00	3.932965177	1.284699249	5.192092843
12-Apr-23 10:00:00	3.858819018	1.295021319	5.112009684
12-Apr-23 11:00:00	3.8499216	1.152374073	5.058424257
12-Apr-23 12:00:00	3.858917611	1.186227	5.091391007
12-Apr-23 13:00:00	3.948068049	1.189401215	5.179859308
12-Apr-23 14:00:00	4.012536367	1.19219023	5.216113377
12-Apr-23 15:00:00	4.028928598	1.213586393	5.289446578
12-Apr-23 16:00:00	4.027677218	1.220273773	5.270286242
12-Apr-23 17:00:00	4.031706333	1.189663132	5.233452519
12-Apr-23 18:00:00	3.945844491	1.187338769	5.115678467
12-Apr-23 19:00:00	3.937000606	1.189501077	5.16405711
12-Apr-23 20:00:00	4.010720889	1.188463366	5.187353346
12-Apr-23 21:00:00	4.033372296	1.234328698	5.297995929
12-Apr-23 22:00:00	4.028691226	1.190364325	5.259053792
12-Apr-23 23:00:00	4.035443955	1.262997184	5.350395726
13-Apr-23 00:00:00	4.037628492	1.361360665	5.417971086
13-Apr-23 01:00:00	4.026048475	1.357613688	5.389227404
13-Apr-23 02:00:00	4.023225599	1.357383851	5.389715332
13-Apr-23 03:00:00	4.039544609	2.599357148	6.634309318
13-Apr-23 04:00:00	8.949371523	23.67230506	32.62620958
13-Apr-23 05:00:00	8.19606124	23.66035705	31.85958703
13-Apr-23 06:00:00	8.182325257	23.722504	31.88611794
13-Apr-23 07:00:00	8.187161975	23.6963945	31.8840127
13-Apr-23 08:00:00	8.189649953	23.68179646	31.83703681
13-Apr-23 09:00:00	12.27875196	23.70091714	35.99024582
13-Apr-23 10:00:00	14.34094954	5.700348801	20.05409739
13-Apr-23 11:00:00	14.26919169	1.43019504	15.71978452
13-Apr-23 12:00:00	12.62929069	1.358885896	14.00027045
13-Apr-23 13:00:00	4.124077214	1.373318795	5.468090879
13-Apr-23 14:00:00	4.087096771	1.365759892	5.439175478
13-Apr-23 15:00:00	4.158231682	1.266917372	5.422416184
13-Apr-23 16:00:00	4.160741409	1.152228753	5.343319359
13-Apr-23 17:00:00	4.161863645	1.188852244	5.34633112
13-Apr-23 18:00:00	4.065331082	1.198836486	5.248339415
13-Apr-23 19:00:00	4.026393255	1.196505805	5.209759712
13-Apr-23 20:00:00	4.231868055	1.190601743	5.428282897
13-Apr-23 21:00:00	4.250809934	1.200958845	5.509810077
13-Apr-23 22:00:00	4.245540963	1.255094704	5.536392764
13-Apr-23 23:00:00	4.188129293	1.191919565	5.370833768
14-Apr-23 00:00:00	4.111996783	1.184656176	5.295984003
14-Apr-23 01:00:00	4.196490712	1.186231474	5.368774758
14-Apr-23 02:00:00	4.242176427	1.319576613	5.581532331
14-Apr-23 03:00:00	4.246528758	1.296586537	5.532382429

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
14-Apr-23 04:00:00	4.234613789	1.327369022	5.430791575
14-Apr-23 05:00:00	4.149459494	1.279576385	5.443109088
14-Apr-23 06:00:00	4.1278775	1.281048046	5.406750935
14-Apr-23 07:00:00	4.024537113	1.296042999	5.317654557
14-Apr-23 08:00:00	4.033177164	1.291164543	5.295108836
14-Apr-23 09:00:00	4.028294219	1.209724693	5.291813585
14-Apr-23 10:00:00	4.048685861	1.266252751	5.378950813
14-Apr-23 11:00:00	4.097277151	1.269777055	5.371417628
14-Apr-23 12:00:00	4.041383147	1.269866506	5.312824401
14-Apr-23 13:00:00	4.035923057	1.274645028	5.339270115
14-Apr-23 14:00:00	4.026746405	1.260017355	5.259504292
14-Apr-23 15:00:00	4.025869361	1.210405743	5.185253113
14-Apr-23 16:00:00	4.108200034	1.197085794	5.316415416
14-Apr-23 17:00:00	4.159075618	1.192172699	5.325947716
14-Apr-23 18:00:00	4.244192521	1.313959514	5.533163373
14-Apr-23 19:00:00	4.246071193	1.199687382	5.506905437
14-Apr-23 20:00:00	4.247388826	1.2499516	5.548479939
14-Apr-23 21:00:00	4.020098236	1.273390651	5.300419463
14-Apr-23 22:00:00	4.108962165	1.271294758	5.388215632
14-Apr-23 23:00:00	4.03362315	1.271304321	5.309884429
15-Apr-23 00:00:00	4.038018783	1.271761864	5.315380971
15-Apr-23 01:00:00	4.019771748	1.213937275	5.219233811
15-Apr-23 02:00:00	3.982431809	1.18835632	5.161714743
15-Apr-23 03:00:00	4.135815091	1.1917436	5.316080252
15-Apr-23 04:00:00	4.167141808	1.196172671	5.397233339
15-Apr-23 05:00:00	4.165833902	1.303906527	5.471281979
15-Apr-23 06:00:00	4.157414383	1.280708308	5.390261232
15-Apr-23 07:00:00	4.133731879	1.183738144	5.349215978
15-Apr-23 08:00:00	4.09265791	1.189106886	5.284499062
15-Apr-23 09:00:00	4.099777699	1.190810641	5.276813083
15-Apr-23 10:00:00	4.167111715	1.296040919	5.474478282
15-Apr-23 11:00:00	4.157157571	1.287181621	5.458534026
15-Apr-23 12:00:00	4.158839888	1.370714466	5.476659642
15-Apr-23 13:00:00	4.127452718	1.359783804	5.542889717
15-Apr-23 14:00:00	4.1184659	1.357506267	5.458966792
15-Apr-23 15:00:00	4.251691324	1.365385613	5.596567544
15-Apr-23 16:00:00	4.239693986	1.379767321	5.622849281
15-Apr-23 17:00:00	4.246998384	1.298798359	5.55929886
15-Apr-23 18:00:00	4.148089056	1.337929106	5.402681755
15-Apr-23 19:00:00	4.110392319	1.272632625	5.360196715
15-Apr-23 20:00:00	4.045518027	1.270315376	5.28289126
15-Apr-23 21:00:00	4.020858945	1.272784424	5.367031429
15-Apr-23 22:00:00	4.031865623	1.279587311	5.376457334

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
15-Apr-23 23:00:00	4.021117409	1.279849736	5.287661658
16-Apr-23 00:00:00	3.935472541	1.274322488	5.198514064
16-Apr-23 01:00:00	3.931366165	1.275670189	5.210276922
16-Apr-23 02:00:00	3.861785862	1.33562926	5.205498978
16-Apr-23 03:00:00	3.8532189	1.320351327	5.189751334
16-Apr-23 04:00:00	3.858239492	1.349826472	5.233590373
16-Apr-23 05:00:00	4.06382619	1.365866971	5.481349047
16-Apr-23 06:00:00	4.128266414	1.351687447	5.470003287
16-Apr-23 07:00:00	4.16762307	1.367628094	5.541610665
16-Apr-23 08:00:00	4.158892181	1.33650087	5.497020721
16-Apr-23 09:00:00	4.162541376	1.26433157	5.44830882
16-Apr-23 10:00:00	4.063928975	1.360156051	5.347679537
16-Apr-23 11:00:00	4.022577763	1.367146645	5.36317956
16-Apr-23 12:00:00	4.035010157	1.364038428	5.389725102
16-Apr-23 13:00:00	4.026054952	1.346443828	5.30228672
16-Apr-23 14:00:00	4.029229853	1.22454536	5.270010153
16-Apr-23 15:00:00	4.04375169	1.184988221	5.172898331
16-Apr-23 16:00:00	3.989637799	1.185444827	5.162836216
16-Apr-23 17:00:00	4.010270675	1.189294533	5.157547416
16-Apr-23 18:00:00	4.03541055	1.27428931	5.271985496
16-Apr-23 19:00:00	4.031866286	1.194696106	5.240491454
16-Apr-23 20:00:00	4.03518071	1.190829651	5.223826345
16-Apr-23 21:00:00	3.942221959	1.191409508	5.096793572
16-Apr-23 22:00:00	4.031474604	1.199203687	5.212226868
16-Apr-23 23:00:00	4.023603227	1.259475153	5.229166004
17-Apr-23 00:00:00	4.035974096	1.282280988	5.290916655
17-Apr-23 01:00:00	4.029147678	1.190503295	5.236178123
17-Apr-23 02:00:00	4.03448232	1.19327269	5.249433501
17-Apr-23 03:00:00	4.199995889	1.19805025	5.401244269
17-Apr-23 04:00:00	4.165271044	1.214110507	5.334983651
17-Apr-23 05:00:00	4.162328429	1.308202384	5.477665587
17-Apr-23 06:00:00	4.161910057	1.255323234	5.432581565
17-Apr-23 07:00:00	4.155790859	1.206757396	5.357159747
17-Apr-23 08:00:00	4.012568381	1.24209697	5.282840179
17-Apr-23 09:00:00	4.069286594	1.276780534	5.371039809
17-Apr-23 10:00:00	4.156032523	1.304326297	5.520335871
17-Apr-23 11:00:00	4.154943519	1.267454464	5.501573344
17-Apr-23 12:00:00	4.157960369	1.207632048	5.407634364
17-Apr-23 13:00:00	4.112453394	1.182115595	5.232823391
17-Apr-23 14:00:00	4.125493262	1.186952365	5.291337013
17-Apr-23 15:00:00	4.068927712	1.189277633	5.248592085
17-Apr-23 16:00:00	4.034256158	1.347446028	5.392665393
17-Apr-23 17:00:00	4.020298715	1.383259064	5.354905415

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
17-Apr-23 18:00:00	4.027412653	1.262469753	5.317877983
17-Apr-23 19:00:00	4.058037943	1.272049511	5.381882805
17-Apr-23 20:00:00	4.109156158	1.274865913	5.356992563
17-Apr-23 21:00:00	4.1612346	1.323729351	5.489111623
17-Apr-23 22:00:00	4.156943516	1.263493466	5.434941629
17-Apr-23 23:00:00	4.171996011	1.361581922	5.475501498
18-Apr-23 00:00:00	4.051879459	1.28990527	5.274333355
18-Apr-23 01:00:00	4.154991865	1.266546893	5.413042827
18-Apr-23 02:00:00	4.161613676	1.27646838	5.472658331
18-Apr-23 03:00:00	4.155072751	1.340696139	5.495264988
18-Apr-23 04:00:00	4.16568515	1.340289425	5.480559731
18-Apr-23 05:00:00	4.095132086	1.366858244	5.44238217
18-Apr-23 06:00:00	4.070370648	1.352786448	5.41932265
18-Apr-23 07:00:00	4.145711329	1.355774979	5.499488311
18-Apr-23 08:00:00	4.167173979	1.385779797	5.568560646
18-Apr-23 09:00:00	4.162351177	1.302363367	5.421029462
18-Apr-23 10:00:00	4.130436394	1.357685375	5.514451944
18-Apr-23 11:00:00	4.045226945	1.363717914	5.409041926
18-Apr-23 12:00:00	4.110672818	1.359816265	5.483745849
18-Apr-23 13:00:00	4.028670355	1.324531245	5.340702139
18-Apr-23 14:00:00	4.035311209	1.265115232	5.341821088
18-Apr-23 15:00:00	4.02900419	1.186105847	5.259949207
18-Apr-23 16:00:00	3.97740059	1.190794015	5.113934814
18-Apr-23 17:00:00	4.014716201	1.194496965	5.195891124
18-Apr-23 18:00:00	4.029201362	1.210482777	5.214811828
18-Apr-23 19:00:00	4.036839936	1.284643723	5.373738978
18-Apr-23 20:00:00	4.02733099	1.274255164	5.250371906
18-Apr-23 21:00:00	3.948695412	1.260890086	5.133346981
18-Apr-23 22:00:00	3.957032853	1.198223461	5.155575593
18-Apr-23 23:00:00	4.128228982	1.188279601	5.307944748
19-Apr-23 00:00:00	4.149353027	1.282814593	5.389793105
19-Apr-23 01:00:00	4.171251297	1.244489756	5.425941562
19-Apr-23 02:00:00	4.161572483	1.348726932	5.412549973
19-Apr-23 03:00:00	4.052890645	1.292692842	5.3191958
19-Apr-23 04:00:00	4.05093148	1.27873706	5.315924074
19-Apr-23 05:00:00	3.94720202	1.278510227	5.223022249
19-Apr-23 06:00:00	3.94298621	1.393343651	5.263601879
19-Apr-23 07:00:00	3.935639008	1.201844794	5.16428806
19-Apr-23 08:00:00	4.021512451	1.286021414	5.337106184
19-Apr-23 09:00:00	4.042966882	1.277419322	5.345835659
19-Apr-23 10:00:00	4.015599065	1.33647192	5.226918221
19-Apr-23 11:00:00	4.032327281	1.388303855	5.435567449
19-Apr-23 12:00:00	4.041196465	1.28161902	5.34263337

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
19-Apr-23 13:00:00	3.99914013	1.340977931	5.259217395
19-Apr-23 14:00:00	4.03440683	1.278869065	5.325749261
19-Apr-23 15:00:00	4.060623394	1.276789308	5.336260621
19-Apr-23 16:00:00	4.034598294	1.369772507	5.458479768
19-Apr-23 17:00:00	4.031752944	1.377260876	5.359363455
19-Apr-23 18:00:00	4.026127696	1.267146707	5.313561743
19-Apr-23 19:00:00	4.046462752	1.27650346	5.288446299
19-Apr-23 20:00:00	4.031293829	1.279389429	5.306641155
19-Apr-23 21:00:00	3.937350273	1.322810965	5.287869321
19-Apr-23 22:00:00	3.942829821	1.369420105	5.275066623
19-Apr-23 23:00:00	3.944599238	1.311345726	5.226429713
20-Apr-23 00:00:00	4.035870658	1.327126781	5.350460238
20-Apr-23 01:00:00	4.246138824	1.279070437	5.550335797
20-Apr-23 02:00:00	4.253744655	1.273652805	5.548009488
20-Apr-23 03:00:00	4.233196603	1.404182622	5.647775791
20-Apr-23 04:00:00	4.251842605	1.364286871	5.610697296
20-Apr-23 05:00:00	4.223411467	1.370826602	5.506651759
20-Apr-23 06:00:00	4.123359256	1.355256379	5.471928358
20-Apr-23 07:00:00	4.092305091	1.35413239	5.473554929
20-Apr-23 08:00:00	3.943136672	1.365171871	5.344482369
20-Apr-23 09:00:00	3.94585726	1.391584039	5.259612083
20-Apr-23 10:00:00	3.946680956	1.340266752	5.252291584
20-Apr-23 11:00:00	4.018309964	1.28589859	5.273348628
20-Apr-23 12:00:00	4.134872185	1.280511856	5.396647603
20-Apr-23 13:00:00	4.246403747	1.29138671	5.576237096
20-Apr-23 14:00:00	4.240912769	1.36718297	5.597331524
20-Apr-23 15:00:00	4.255755636	1.293434811	5.541359552
20-Apr-23 16:00:00	4.137245801	1.26975646	5.352403844
20-Apr-23 17:00:00	4.098391665	1.281266721	5.410274757
20-Apr-23 18:00:00	4.058353927	1.276302624	5.343151357
20-Apr-23 19:00:00	4.034131123	1.30668919	5.402603881
20-Apr-23 20:00:00	4.03478543	1.358391378	5.322628613
20-Apr-23 21:00:00	4.034670326	1.256442828	5.26002521
20-Apr-23 22:00:00	4.142127686	1.277892637	5.427751276
20-Apr-23 23:00:00	4.152800719	1.266922832	5.414097044
21-Apr-23 00:00:00	4.158701747	1.346416898	5.509237004
21-Apr-23 01:00:00	4.170436638	1.235914801	5.426636074
21-Apr-23 02:00:00	4.152963559	1.339485458	5.500591566
21-Apr-23 03:00:00	4.070231477	1.362353812	5.39025081
21-Apr-23 04:00:00	4.124476327	1.36388979	5.515218541
21-Apr-23 05:00:00	4.164656613	1.372795211	5.52922732
21-Apr-23 06:00:00	4.16169352	1.335701631	5.506678581
21-Apr-23 07:00:00	4.150229366	1.323568572	5.466186827

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
21-Apr-23 08:00:00	4.120746957	1.359140944	5.426939752
21-Apr-23 09:00:00	4.096068594	1.358027633	5.501409456
21-Apr-23 10:00:00	4.095245467	1.362676104	5.44256454
21-Apr-23 11:00:00	4.156770388	1.372218559	5.487524128
21-Apr-23 12:00:00	4.160167005	1.274479581	5.431872442
21-Apr-23 13:00:00	4.159140322	1.330815146	5.526994162
21-Apr-23 14:00:00	4.027231448	1.371123278	5.390470365
21-Apr-23 15:00:00	4.105478605	1.357469672	5.486001744
21-Apr-23 16:00:00	4.022943152	1.418576001	5.448878371
21-Apr-23 17:00:00	4.025418229	1.295658608	5.390476545
21-Apr-23 18:00:00	4.042698118	1.295209567	5.315567404
21-Apr-23 19:00:00	3.983293096	1.274714342	5.202212549
21-Apr-23 20:00:00	4.07697161	1.276267481	5.364140934
21-Apr-23 21:00:00	4.235701455	1.275168618	5.531128327
21-Apr-23 22:00:00	4.243075106	1.398091523	5.647525273
21-Apr-23 23:00:00	4.254119025	1.396112563	5.604618364
22-Apr-23 00:00:00	4.215068367	1.362338742	5.459067249
22-Apr-23 01:00:00	4.140293519	1.358717095	5.457273076
22-Apr-23 02:00:00	4.086759104	1.36419107	5.429472885
22-Apr-23 03:00:00	4.028905696	1.395179186	5.417477244
22-Apr-23 04:00:00	4.026995871	1.349243132	5.376822946
22-Apr-23 05:00:00	4.033784495	1.463431773	5.451226128
22-Apr-23 06:00:00	4.04474726	1.482257202	5.578845963
22-Apr-23 07:00:00	4.111989286	1.492746949	5.583379269
22-Apr-23 08:00:00	4.030401442	1.481712202	5.511373616
22-Apr-23 09:00:00	4.029853569	1.378051491	5.383342341
22-Apr-23 10:00:00	4.028560877	1.359108158	5.367142105
22-Apr-23 11:00:00	4.026020658	1.265381394	5.248355887
22-Apr-23 12:00:00	4.073083666	1.286075896	5.372311513
22-Apr-23 13:00:00	4.042033619	1.280659033	5.300163481
22-Apr-23 14:00:00	4.034623941	1.41805935	5.436475462
22-Apr-23 15:00:00	4.039442672	1.284592532	5.372193336
22-Apr-23 16:00:00	4.001228399	1.373038173	5.316541241
22-Apr-23 17:00:00	4.070492493	1.353294333	5.425663895
22-Apr-23 18:00:00	4.025338809	1.34875288	5.392685795
22-Apr-23 19:00:00	4.020785332	1.345084785	5.36851004
22-Apr-23 20:00:00	4.030203183	1.31965998	5.390670466
22-Apr-23 21:00:00	4.0331399	1.276090026	5.331835111
22-Apr-23 22:00:00	4.100482543	1.266014063	5.396343049
22-Apr-23 23:00:00	4.150403897	1.271920913	5.420067725
23-Apr-23 00:00:00	4.243033859	1.35252541	5.550719199
23-Apr-23 01:00:00	4.239413394	1.361192842	5.582254489
23-Apr-23 02:00:00	4.252516084	1.31813246	5.567745633

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
23-Apr-23 03:00:00	4.153568003	1.318215146	5.370353906
23-Apr-23 04:00:00	4.100022104	1.275349184	5.356319719
23-Apr-23 05:00:00	4.060745107	1.265635541	5.333960983
23-Apr-23 06:00:00	4.025920296	1.312580819	5.375992368
23-Apr-23 07:00:00	4.024356895	1.290958983	5.333140756
23-Apr-23 08:00:00	4.040720383	1.209054775	5.259011304
23-Apr-23 09:00:00	4.087799589	1.18873349	5.261919101
23-Apr-23 10:00:00	4.102789058	1.18813378	5.298092418
23-Apr-23 11:00:00	4.15922655	1.25099644	5.494917062
23-Apr-23 12:00:00	4.160104884	1.393222934	5.506491158
23-Apr-23 13:00:00	4.152583877	1.347448468	5.516382694
23-Apr-23 14:00:00	4.084196488	1.357789572	5.379473951
23-Apr-23 15:00:00	4.118752691	1.361736488	5.448510581
23-Apr-23 16:00:00	4.2304521	1.362420376	5.590628412
23-Apr-23 17:00:00	4.241282887	1.308268187	5.601848597
23-Apr-23 18:00:00	4.251342358	1.321179181	5.572067773
23-Apr-23 19:00:00	4.188571453	1.35397265	5.54553237
23-Apr-23 20:00:00	4.176076319	1.356214797	5.521788531
23-Apr-23 21:00:00	4.197346316	1.35747565	5.531348337
23-Apr-23 22:00:00	4.15905469	1.371575587	5.539044981
23-Apr-23 23:00:00	4.172864755	1.370375209	5.542760425
24-Apr-23 00:00:00	4.155195766	1.313371103	5.420353197
24-Apr-23 01:00:00	4.052766853	1.269294206	5.322473471
24-Apr-23 02:00:00	4.067924831	1.2809578	5.350823067
24-Apr-23 03:00:00	4.036308924	1.367119481	5.395136091
24-Apr-23 04:00:00	4.024498171	1.299187777	5.329398648
24-Apr-23 05:00:00	4.036501249	1.286080313	5.37441349
24-Apr-23 06:00:00	4.029542194	1.350902812	5.435791201
24-Apr-23 07:00:00	4.105778151	1.364248554	5.457855675
24-Apr-23 08:00:00	4.214810716	1.370333843	5.574982184
24-Apr-23 09:00:00	4.243821038	1.397888393	5.645746676
24-Apr-23 10:00:00	4.255402088	1.408331835	5.553610086
24-Apr-23 11:00:00	4.187485841	1.287653303	5.491448826
24-Apr-23 12:00:00	4.117528147	1.277849152	5.401726643
24-Apr-23 13:00:00	4.090633088	1.275149941	5.35951481
24-Apr-23 14:00:00	4.152635548	1.272883254	5.500640588
24-Apr-23 15:00:00	4.172144983	1.321899226	5.482895975
24-Apr-23 16:00:00	4.158703566	1.35980494	5.506950378
24-Apr-23 17:00:00	3.95974742	1.369266616	5.284825193
24-Apr-23 18:00:00	4.108885162	1.366691756	5.483531549
24-Apr-23 19:00:00	4.240718603	1.353716713	5.644668994
24-Apr-23 20:00:00	4.248727719	1.361261282	5.59886509
24-Apr-23 21:00:00	4.24711782	1.319468437	5.57057281

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
24-Apr-23 22:00:00	4.182821327	1.260565352	5.385781644
24-Apr-23 23:00:00	4.11330492	1.193805035	5.295968072
25-Apr-23 00:00:00	4.04667702	1.19024179	5.226722417
25-Apr-23 01:00:00	4.037440123	1.353635172	5.458765697
25-Apr-23 02:00:00	4.019245033	1.361683023	5.322458002
25-Apr-23 03:00:00	4.035827968	1.353867155	5.378807399
25-Apr-23 04:00:00	4.072755363	1.356504214	5.416064003
25-Apr-23 05:00:00	4.133473516	1.366071409	5.463509096
25-Apr-23 06:00:00	4.244452265	1.41592019	5.629928597
25-Apr-23 07:00:00	4.244095214	1.38105371	5.587510337
25-Apr-23 08:00:00	4.262547414	1.317644129	5.587910043
25-Apr-23 09:00:00	4.099423369	1.309458947	5.462085255
25-Apr-23 10:00:00	4.173111863	1.357750654	5.506893174
25-Apr-23 11:00:00	4.16356953	1.366536029	5.516113849
25-Apr-23 12:00:00	4.156945128	1.378351894	5.546469774
25-Apr-23 13:00:00	4.164750832	1.366808802	5.446112354
25-Apr-23 14:00:00	4.128090024	1.369656324	5.465414392
25-Apr-23 15:00:00	4.076558828	1.358402669	5.437165192
25-Apr-23 16:00:00	4.024261905	1.35944283	5.377222308
25-Apr-23 17:00:00	4.032686357	1.373327288	5.383557752
25-Apr-23 18:00:00	4.026174351	1.338787818	5.347255898
25-Apr-23 19:00:00	4.032527381	1.275522482	5.298734601
25-Apr-23 20:00:00	4.192799833	1.275245031	5.476081943
25-Apr-23 21:00:00	4.196124448	1.276684916	5.482954661
25-Apr-23 22:00:00	4.165479157	1.322349197	5.542402962
25-Apr-23 23:00:00	4.156458378	1.386622561	5.542970154
26-Apr-23 00:00:00	4.167445607	1.320703384	5.450939417
26-Apr-23 01:00:00	4.083367745	1.294252204	5.353400339
26-Apr-23 02:00:00	4.138443218	1.264435232	5.419549969
26-Apr-23 03:00:00	4.14943401	1.27666338	5.438805819
26-Apr-23 04:00:00	4.15304629	1.381179628	5.538645801
26-Apr-23 05:00:00	4.165664196	1.372851651	5.555105713
26-Apr-23 06:00:00	4.12809635	1.196422338	5.314410243
26-Apr-23 07:00:00	4.152593798	1.183860461	5.330043475
26-Apr-23 08:00:00	4.131660872	1.181980944	5.333370873
26-Apr-23 09:00:00	4.026097518	1.350867691	5.454657184
26-Apr-23 10:00:00	4.035336261	1.374202397	5.390136984
26-Apr-23 11:00:00	4.029021011	1.362765765	5.376643757
26-Apr-23 12:00:00	4.14001645	1.366471505	5.543376101
26-Apr-23 13:00:00	4.216214021	1.364848161	5.615947744
26-Apr-23 14:00:00	4.150145266	1.39438833	5.556280375
26-Apr-23 15:00:00	4.166743967	1.400782278	5.563652415
26-Apr-23 16:00:00	4.159841601	1.39294523	5.577966187

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
26-Apr-23 17:00:00	4.14758136	1.360495639	5.484297687
26-Apr-23 18:00:00	4.22359652	1.356653276	5.601927294
26-Apr-23 19:00:00	4.194366005	1.367346904	5.531698823
26-Apr-23 20:00:00	4.163237638	1.467768371	5.67490628
26-Apr-23 21:00:00	4.154673672	1.408651839	5.561862787
26-Apr-23 22:00:00	4.1522678	1.502442002	5.658626239
26-Apr-23 23:00:00	4.151930306	1.483776053	5.661368304
27-Apr-23 00:00:00	4.219353305	1.479428673	5.684529742
27-Apr-23 01:00:00	4.245138089	1.49715536	5.654580275
27-Apr-23 02:00:00	4.241726187	1.42312834	5.625175453
27-Apr-23 03:00:00	4.255346908	1.45434593	5.662662029
27-Apr-23 04:00:00	4.169476032	1.486937022	5.610323191
27-Apr-23 05:00:00	4.174733957	1.493364096	5.641468803
27-Apr-23 06:00:00	4.166637739	1.488215311	5.638776898
27-Apr-23 07:00:00	4.157600482	1.395875196	5.555595397
27-Apr-23 08:00:00	4.204603275	1.382550504	5.55737612
27-Apr-23 09:00:00	4.166235394	1.364855518	5.51497769
27-Apr-23 10:00:00	4.212008874	1.361245501	5.582895676
27-Apr-23 11:00:00	4.222154273	1.358053583	5.596493085
27-Apr-23 12:00:00	4.199325323	1.455385228	5.684108884
27-Apr-23 13:00:00	4.205012374	1.389604266	5.601242463
27-Apr-23 14:00:00	4.197245042	1.477354788	5.676264154
27-Apr-23 15:00:00	4.078522987	1.48776166	5.563559464
27-Apr-23 16:00:00	4.121253861	1.487520631	5.603676664
27-Apr-23 17:00:00	4.072178417	1.465566851	5.552277048
27-Apr-23 18:00:00	4.069248835	1.426908823	5.511384964
27-Apr-23 19:00:00	4.075316694	1.414912628	5.479926275
27-Apr-23 20:00:00	4.134916769	1.37108953	5.49830121
27-Apr-23 21:00:00	4.257734113	1.371192332	5.634126129
27-Apr-23 22:00:00	4.285002602	1.379396518	5.706278454
27-Apr-23 23:00:00	4.284181065	1.453363584	5.724495664
28-Apr-23 00:00:00	4.300263643	1.458189408	5.776875046
28-Apr-23 01:00:00	4.241183519	1.500641024	5.725058693
28-Apr-23 02:00:00	4.224602514	1.507107204	5.725572374
28-Apr-23 03:00:00	4.1172639	1.508671415	5.645253499
28-Apr-23 04:00:00	4.071703734	1.49398748	5.524688016
28-Apr-23 05:00:00	4.06890591	1.420397818	5.493599923
28-Apr-23 06:00:00	4.075590902	1.387284623	5.464985583
28-Apr-23 07:00:00	4.146918768	1.373971681	5.540236928
28-Apr-23 08:00:00	4.198459665	1.374401259	5.580130392
28-Apr-23 09:00:00	4.286228445	1.405975608	5.673103974
28-Apr-23 10:00:00	4.294636877	1.439401342	5.735975451
28-Apr-23 11:00:00	4.296393871	1.46887061	5.779067861

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
28-Apr-23 12:00:00	4.167977174	1.496756196	5.657435854
28-Apr-23 13:00:00	4.188793196	1.498540028	5.685322556
28-Apr-23 14:00:00	4.170402315	1.499910677	5.627528667
28-Apr-23 15:00:00	4.212288656	1.480673196	5.714172893
28-Apr-23 16:00:00	4.204416162	1.421416299	5.631884527
28-Apr-23 17:00:00	4.203022665	1.496873713	5.714248844
28-Apr-23 18:00:00	4.292498606	1.502492979	5.803095014
28-Apr-23 19:00:00	4.250097911	1.501174092	5.743395293
28-Apr-23 20:00:00	4.204337041	1.520058144	5.756505408
28-Apr-23 21:00:00	4.199797657	1.468741026	5.65876672
28-Apr-23 22:00:00	4.205192195	1.405864603	5.574127197
28-Apr-23 23:00:00	4.181840261	1.378533751	5.523296036
29-Apr-23 00:00:00	4.264790032	1.371082807	5.641181575
29-Apr-23 01:00:00	4.195052677	1.393054231	5.594461203
29-Apr-23 02:00:00	4.203532378	1.440090108	5.626270771
29-Apr-23 03:00:00	4.215646896	1.458788183	5.68401238
29-Apr-23 04:00:00	4.209734387	1.508995394	5.765577646
29-Apr-23 05:00:00	4.256773127	1.489552042	5.766949923
29-Apr-23 06:00:00	4.212533606	1.495713534	5.689469369
29-Apr-23 07:00:00	4.202772008	1.501191917	5.70367201
29-Apr-23 08:00:00	4.206812859	1.450746907	5.655249896
29-Apr-23 09:00:00	4.186608491	1.508283734	5.644570288
29-Apr-23 10:00:00	4.206681569	1.499213457	5.727115101
29-Apr-23 11:00:00	4.229064597	1.499184394	5.734776815
29-Apr-23 12:00:00	4.199380663	1.503546276	5.655177682
29-Apr-23 13:00:00	4.20325911	1.494002097	5.712616165
29-Apr-23 14:00:00	4.211175256	1.422692802	5.613584227
29-Apr-23 15:00:00	4.226057437	1.373803806	5.632567202
29-Apr-23 16:00:00	4.303702222	1.375803804	5.688668433
29-Apr-23 17:00:00	4.095614751	1.386016248	5.521088847
29-Apr-23 18:00:00	4.066532241	1.518670339	5.580976126
29-Apr-23 19:00:00	4.074324105	1.43819167	5.540983582
29-Apr-23 20:00:00	4.085331612	1.376019796	5.441862887
29-Apr-23 21:00:00	4.255287713	1.381354956	5.645538334
29-Apr-23 22:00:00	4.299365891	1.37713544	5.680256833
29-Apr-23 23:00:00	4.285333872	1.459958917	5.807692384
30-Apr-23 00:00:00	4.298483787	1.484638835	5.839276658
30-Apr-23 01:00:00	4.282700221	1.494524578	5.751275195
30-Apr-23 02:00:00	4.262050523	1.500055609	5.771301243
30-Apr-23 03:00:00	4.285003371	1.501835863	5.768715761
30-Apr-23 04:00:00	4.283599284	1.504777954	5.795223416
30-Apr-23 05:00:00	4.298729817	1.485233376	5.821453995
30-Apr-23 06:00:00	4.292113993	1.480029073	5.787841505

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
30-Apr-23 07:00:00	4.28283551	1.505093873	5.773225625
30-Apr-23 08:00:00	4.251970477	1.506232921	5.740075394
30-Apr-23 09:00:00	4.292501158	1.507896817	5.759547273
30-Apr-23 10:00:00	4.28330289	1.509736387	5.820795087
30-Apr-23 11:00:00	4.287164836	1.473653904	5.748370295
30-Apr-23 12:00:00	4.2379441	1.50477984	5.718860547
30-Apr-23 13:00:00	4.22355492	1.506055559	5.72559586
30-Apr-23 14:00:00	4.270406617	1.504289865	5.809537146
30-Apr-23 15:00:00	4.209587971	1.500398019	5.759073975
30-Apr-23 16:00:00	4.195348634	1.42712528	5.655413385
30-Apr-23 17:00:00	4.214831008	1.504279912	5.672865958
30-Apr-23 18:00:00	4.226758321	1.509470512	5.711395085
30-Apr-23 19:00:00	4.231011099	1.509476165	5.74788326
30-Apr-23 20:00:00	4.206388129	1.515901673	5.732701566
30-Apr-23 21:00:00	4.19714631	1.489163118	5.706723001
30-Apr-23 22:00:00	4.216681427	1.450599803	5.669227123
30-Apr-23 23:00:00	4.211388138	1.369745592	5.607872633
01-May-23 00:00:00	4.264159441	1.375065109	5.634671017
01-May-23 01:00:00	4.3824025	1.376125596	5.783688717
01-May-23 02:00:00	4.379914225	1.557088395	6.00195764
01-May-23 03:00:00	4.377752401	1.592782003	5.943475808
01-May-23 04:00:00	4.359843771	1.509853276	5.946238234
01-May-23 05:00:00	4.379727311	1.578669711	5.978021436
01-May-23 06:00:00	4.319776058	1.592650835	5.907543659
01-May-23 07:00:00	4.300708921	1.599028792	5.916061459
01-May-23 08:00:00	4.284930379	1.592166881	5.903673744
01-May-23 09:00:00	4.302662593	1.589505763	5.861352672
01-May-23 10:00:00	4.226180024	1.588166122	5.817678699
01-May-23 11:00:00	4.238017665	1.586418984	5.835076323
01-May-23 12:00:00	4.293625578	1.583001856	5.910337503
01-May-23 13:00:00	4.290234498	1.563910708	5.873696327
01-May-23 14:00:00	4.288803803	1.511843204	5.822988665
01-May-23 15:00:00	4.328388823	1.501879348	5.836243259
01-May-23 16:00:00	4.405499193	1.499467295	5.877792203
01-May-23 17:00:00	4.405516836	1.529062216	5.905479807
01-May-23 18:00:00	4.373615	1.581087181	5.995204065
01-May-23 19:00:00	4.384894186	1.571513935	5.97074887
01-May-23 20:00:00	4.368872563	1.66987741	5.927880269
01-May-23 21:00:00	4.328553465	1.622810491	5.94498017
01-May-23 22:00:00	4.375961436	1.600520325	5.953196305
01-May-23 23:00:00	4.375840108	1.581545607	6.00041772
02-May-23 00:00:00	4.378705343	1.598720705	5.940710892
02-May-23 01:00:00	4.384801997	1.548520433	5.951182763

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
02-May-23 02:00:00	4.311577042	1.600087309	5.878393556
02-May-23 03:00:00	4.412079652	1.582603155	6.042174378
02-May-23 04:00:00	4.286267069	1.583847721	5.885258675
02-May-23 05:00:00	4.298335314	1.59178718	5.947164249
02-May-23 06:00:00	4.279238562	1.586646653	5.917632961
02-May-23 07:00:00	4.29606194	1.583184886	5.906418249
02-May-23 08:00:00	4.412854989	1.580480136	6.017675223
02-May-23 09:00:00	4.372169998	1.58577315	5.928172059
02-May-23 10:00:00	4.389062855	1.597088985	5.998954071
02-May-23 11:00:00	4.373774405	1.591684986	5.969690249
02-May-23 12:00:00	4.382717069	1.63396674	6.067615403
02-May-23 13:00:00	4.4486444	1.687291841	6.116910617
02-May-23 14:00:00	4.469262415	1.675171586	6.15249006
02-May-23 15:00:00	4.375079817	1.707256675	6.090223053
02-May-23 16:00:00	4.378313815	1.611558276	5.984303681
02-May-23 17:00:00	4.380120436	1.596509163	6.008882417
02-May-23 18:00:00	4.390072681	1.681011357	6.050709243
02-May-23 19:00:00	4.413208087	1.678395916	6.069536852
02-May-23 20:00:00	4.391908275	1.683028563	6.071843074
02-May-23 21:00:00	4.37447529	1.700903999	5.976071583
02-May-23 22:00:00	4.387684584	1.630909166	5.996298426
02-May-23 23:00:00	4.367769374	1.732255695	6.166600791
03-May-23 00:00:00	4.392877128	1.887595944	6.28429416
03-May-23 01:00:00	4.369461338	1.901571129	6.286085853
03-May-23 02:00:00	4.380897231	1.897710147	6.26421488
03-May-23 03:00:00	4.391682784	3.186798493	6.255545463
03-May-23 04:00:00	9.683367252	24.93863434	34.6368281
03-May-23 05:00:00	8.818385707	24.97425913	33.80522219
03-May-23 06:00:00	8.784182549	24.98651278	33.80156771
03-May-23 07:00:00	8.819616795	24.95160707	33.78078651
03-May-23 08:00:00	8.796357261	24.97572094	33.75847202
03-May-23 09:00:00	13.13263681	24.98761457	38.09639159
03-May-23 10:00:00	15.27905819	6.210578899	22.70684433
03-May-23 11:00:00	15.26466862	1.860152749	17.13314313
03-May-23 12:00:00	14.13725146	1.803221707	15.94664431
03-May-23 13:00:00	4.621128294	1.808310606	6.444208092
03-May-23 14:00:00	4.582484245	1.80121282	6.390768507
03-May-23 15:00:00	4.60338414	1.727477213	6.282312957
03-May-23 16:00:00	4.58994574	1.692517913	6.199111793
03-May-23 17:00:00	4.603914526	1.637069435	6.203598547
03-May-23 18:00:00	4.45809118	1.578373905	5.980478301
03-May-23 19:00:00	4.462567939	1.589121507	6.062883801
03-May-23 20:00:00	4.500950098	1.661746531	6.086557004

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
03-May-23 21:00:00	4.503565947	1.613312848	6.111748152
03-May-23 22:00:00	4.514380455	1.588820934	6.165831063
03-May-23 23:00:00	4.47887169	1.687414263	6.130910868
04-May-23 00:00:00	4.444170025	1.667728672	6.10288715
04-May-23 01:00:00	4.342332125	1.654509199	6.033946832
04-May-23 02:00:00	4.280100319	1.67370407	5.928037802
04-May-23 03:00:00	4.299226867	1.677596796	5.945264181
04-May-23 04:00:00	4.299330976	1.677719229	5.951006565
04-May-23 05:00:00	4.403494835	1.675872902	6.059652964
04-May-23 06:00:00	4.51922226	1.675544536	6.173960606
04-May-23 07:00:00	4.503400511	1.707087264	6.223678522
04-May-23 08:00:00	4.51253189	1.661181609	6.209755765
04-May-23 09:00:00	4.511769825	1.713623724	6.188801765
04-May-23 10:00:00	4.422994269	1.679808194	6.044911536
04-May-23 11:00:00	4.523522801	1.675271261	6.194710968
04-May-23 12:00:00	4.586509493	1.672174428	6.263504067
04-May-23 13:00:00	4.600196282	1.693211366	6.301900999
04-May-23 14:00:00	4.604407258	1.748860185	6.339439465
04-May-23 15:00:00	4.563297311	1.804860353	6.353280077
04-May-23 16:00:00	4.462792026	1.805593464	6.267280704
04-May-23 17:00:00	4.491319709	1.806146304	6.321857717
04-May-23 18:00:00	4.509188228	1.758267063	6.23261262
04-May-23 19:00:00	4.507656442	1.659690532	6.225671547
04-May-23 20:00:00	4.50934762	1.792959884	6.304605007
04-May-23 21:00:00	4.444317791	1.800471296	6.236324146
04-May-23 22:00:00	4.493057675	1.802551866	6.283302969
04-May-23 23:00:00	4.515321771	1.790854646	6.32874178
05-May-23 00:00:00	4.514715566	1.67461166	6.215852852
05-May-23 01:00:00	4.504577398	1.705522828	6.162417637
05-May-23 02:00:00	4.431108572	1.670468823	6.062475964
05-May-23 03:00:00	4.461039808	1.672729437	6.15537266
05-May-23 04:00:00	4.389855676	1.674738958	6.034942651
05-May-23 05:00:00	4.388304525	1.714526753	6.119985418
05-May-23 06:00:00	4.371972693	1.680652165	6.037964106
05-May-23 07:00:00	4.361547563	1.677677664	6.036854155
05-May-23 08:00:00	4.472171995	1.682521009	6.161480518
05-May-23 09:00:00	4.492501179	1.682001411	6.148892759
05-May-23 10:00:00	4.509139308	1.738432614	6.199721972
05-May-23 11:00:00	4.504922655	1.587614523	6.160323738
05-May-23 12:00:00	4.515476642	1.779984061	6.28213191
05-May-23 13:00:00	4.427316268	1.811405419	6.19271242
05-May-23 14:00:00	4.40448459	1.799532302	6.195923699
05-May-23 15:00:00	4.509973367	1.788322117	6.28477268

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
05-May-23 16:00:00	4.503189935	1.605752534	6.185230335
05-May-23 17:00:00	4.5254115	1.648829389	6.177098607
05-May-23 18:00:00	4.430798822	1.686750889	6.09896228
05-May-23 19:00:00	4.379401551	1.670534543	6.062353037
05-May-23 20:00:00	4.410344945	1.669636393	6.095722357
05-May-23 21:00:00	4.378020234	1.660574077	6.046239414
05-May-23 22:00:00	4.38644335	1.60152185	5.980000306
05-May-23 23:00:00	4.371470531	1.584108207	5.927007107
06-May-23 00:00:00	4.491181135	1.587712908	6.075120899
06-May-23 01:00:00	4.460645225	1.590816855	6.067717261
06-May-23 02:00:00	4.38116826	1.705405228	6.05136081
06-May-23 03:00:00	4.37890776	1.671288625	6.053066291
06-May-23 04:00:00	4.382405043	1.620658207	6.079031029
06-May-23 05:00:00	4.301489247	1.675565128	5.950150251
06-May-23 06:00:00	4.28773978	1.675445815	6.015130546
06-May-23 07:00:00	4.368929836	1.698567004	6.046866928
06-May-23 08:00:00	4.392710677	1.675875352	6.058134079
06-May-23 09:00:00	4.373229133	1.620883783	6.006198821
06-May-23 10:00:00	4.11948739	1.587697244	5.708117247
06-May-23 11:00:00	2.379902085	1.586595571	3.974039356
06-May-23 12:00:00	2.153691173	1.586706686	3.746554957
06-May-23 13:00:00	2.146971856	1.587461654	3.788961208
06-May-23 14:00:00	2.144011643	1.689262257	3.765466392
06-May-23 15:00:00	2.148492278	1.688189599	3.783625986
06-May-23 16:00:00	1.933620863	1.690899785	3.608566046
06-May-23 17:00:00	1.928967853	1.664201091	3.549290796
06-May-23 18:00:00	1.924247349	1.66353782	3.538697653
06-May-23 19:00:00	1.932717356	1.64442245	3.552837088
06-May-23 20:00:00	1.925054365	1.532287066	3.50449557
06-May-23 21:00:00	1.836465368	1.534446792	3.373145191
06-May-23 22:00:00	1.716875811	1.582165732	3.305815501
06-May-23 23:00:00	1.710384925	1.586115632	3.29669261
07-May-23 00:00:00	1.705923733	1.591553171	3.305335665
07-May-23 01:00:00	1.7052586	1.608047659	3.332368396
07-May-23 02:00:00	1.72837735	1.597449954	3.359907249
07-May-23 03:00:00	1.712212198	1.575727151	3.297367904
07-May-23 04:00:00	1.718197664	1.586716423	3.327066405
07-May-23 05:00:00	1.709789777	1.591786742	3.356410639
07-May-23 06:00:00	1.703900213	1.624524225	3.332691865
07-May-23 07:00:00	1.709285323	1.633768857	3.352865179
07-May-23 08:00:00	1.690605852	1.6690753	3.431372735
07-May-23 09:00:00	1.644050658	1.67768333	3.345871859
07-May-23 10:00:00	1.70760972	1.68138907	3.319356978

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
07-May-23 11:00:00	1.705105318	1.514726894	3.263920528
07-May-23 12:00:00	1.712143911	1.577506012	3.330743815
07-May-23 13:00:00	1.670524743	1.595928768	3.26479845
07-May-23 14:00:00	1.660545839	1.59585464	3.223678027
07-May-23 15:00:00	1.685445143	1.582314196	3.242109378
07-May-23 16:00:00	1.70806366	1.585515074	3.295666317
07-May-23 17:00:00	1.70870713	1.593877231	3.301879583
07-May-23 18:00:00	1.704915729	1.585631207	3.298880309
07-May-23 19:00:00	1.655141354	1.583451867	3.254249718
07-May-23 20:00:00	1.665249639	1.590527762	3.290551318
07-May-23 21:00:00	1.61944937	1.628493202	3.234288251
07-May-23 22:00:00	1.620113088	1.601273298	3.225754216
07-May-23 23:00:00	1.623762184	1.58829696	3.237921423
08-May-23 00:00:00	1.643617955	1.590721416	3.27656252
08-May-23 01:00:00	1.650242885	1.581800747	3.219561312
08-May-23 02:00:00	1.615741558	1.583365762	3.210844342
08-May-23 03:00:00	1.617080013	1.59099438	3.213533345
08-May-23 04:00:00	1.624293976	1.597584615	3.213178158
08-May-23 05:00:00	1.643620612	1.600165629	3.226973255
08-May-23 06:00:00	1.651246488	1.585215175	3.229765581
08-May-23 07:00:00	1.624448884	1.587756836	3.205550162
08-May-23 08:00:00	1.62322923	1.600356938	3.236098055
08-May-23 09:00:00	1.61829714	1.594602009	3.218244712
08-May-23 10:00:00	1.6230933	1.589568388	3.19871253
08-May-23 11:00:00	1.670813991	1.584292573	3.220889383
08-May-23 12:00:00	1.668178439	1.588377452	3.249983118
08-May-23 13:00:00	1.620065434	1.600085326	3.201369548
08-May-23 14:00:00	1.622238032	1.591115415	3.203726807
08-May-23 15:00:00	1.623314963	1.584877813	3.200235224
08-May-23 16:00:00	1.631675727	1.587678665	3.233704336
08-May-23 17:00:00	1.641641882	1.588029158	3.248277547
08-May-23 18:00:00	1.619310558	1.58755156	3.186115331
08-May-23 19:00:00	1.622365849	1.595684638	3.229173189
08-May-23 20:00:00	1.6182636	1.584244996	3.197155462
08-May-23 21:00:00	1.63332667	1.671158493	3.298543875
08-May-23 22:00:00	1.636732803	1.675894919	3.282264359
08-May-23 23:00:00	1.61454042	1.671646202	3.283790014
09-May-23 00:00:00	1.622657067	1.614640145	3.178632845
09-May-23 01:00:00	1.621641548	1.515748981	3.242208143
09-May-23 02:00:00	1.622354537	1.677180473	3.215314579
09-May-23 03:00:00	1.633366906	1.599157842	3.253754515
09-May-23 04:00:00	1.66564351	1.581476037	3.247050365
09-May-23 05:00:00	1.711150977	1.592252459	3.30386514

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
09-May-23 06:00:00	1.706910961	1.591967591	3.314446096
09-May-23 07:00:00	1.710036359	1.591352105	3.321344376
09-May-23 08:00:00	1.676680896	1.591916654	3.23351962
09-May-23 09:00:00	1.659975774	1.592374221	3.283731079
09-May-23 10:00:00	1.635795063	1.593212934	3.210841119
09-May-23 11:00:00	1.61648887	1.587631819	3.246681801
09-May-23 12:00:00	1.624028901	1.583492724	3.237436933
09-May-23 13:00:00	1.62335176	1.593857589	3.171392197
09-May-23 14:00:00	1.625014093	1.598649629	3.19698399
09-May-23 15:00:00	1.631979916	1.604525062	3.215870619
09-May-23 16:00:00	1.619171274	1.539435925	3.19765296
09-May-23 17:00:00	1.625170448	1.662590742	3.212852086
09-May-23 18:00:00	1.618415109	1.657871145	3.212899302
09-May-23 19:00:00	1.579919858	1.617496707	3.157349879
09-May-23 20:00:00	1.607480208	1.587331923	3.206032276
09-May-23 21:00:00	1.623676109	1.584413037	3.227864281
09-May-23 22:00:00	1.620616531	1.61582152	3.220595694
09-May-23 23:00:00	1.623754644	1.678855042	3.212303668
10-May-23 00:00:00	1.644373993	1.626387305	3.243624385
10-May-23 01:00:00	1.625960569	1.595180893	3.204549644
10-May-23 02:00:00	1.671122904	1.590083366	3.300286401
10-May-23 03:00:00	1.704552011	1.499729356	3.313741016
10-May-23 04:00:00	1.713087307	1.588519812	3.318567991
10-May-23 05:00:00	1.696890076	1.58496592	3.212021351
10-May-23 06:00:00	1.604145522	1.586151695	3.200487661
10-May-23 07:00:00	1.607362542	1.595238058	3.232446875
10-May-23 08:00:00	1.531513492	1.59183259	3.096640587
10-May-23 09:00:00	1.536467023	1.585485339	3.054725424
10-May-23 10:00:00	1.530754301	1.522450868	3.054913568
10-May-23 11:00:00	1.60122378	1.502517033	3.111490313
10-May-23 12:00:00	1.61604623	1.513472263	3.114165831
10-May-23 13:00:00	1.619542698	1.543476105	3.110464096
10-May-23 14:00:00	1.621743547	1.586987972	3.215178728
10-May-23 15:00:00	1.618152148	1.589887611	3.201884747
10-May-23 16:00:00	1.632948054	1.593192697	3.239632183
10-May-23 17:00:00	1.624501142	1.601445158	3.161787817
10-May-23 18:00:00	1.555430684	1.592768884	3.182157914
10-May-23 19:00:00	1.535312507	1.578629136	3.152888076
10-May-23 20:00:00	1.531484402	1.523299177	3.059872311
10-May-23 21:00:00	1.534336305	1.52158246	3.132769017
10-May-23 22:00:00	1.612400002	1.589061109	3.179964002
10-May-23 23:00:00	1.621528096	1.590468264	3.245656902
11-May-23 00:00:00	1.619653033	1.583377361	3.215459998

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
11-May-23 01:00:00	1.615269226	1.59873271	3.20330949
11-May-23 02:00:00	1.625829558	1.600866914	3.217639738
11-May-23 03:00:00	1.598839674	1.58821853	3.197466458
11-May-23 04:00:00	1.590853347	1.584391189	3.183640869
11-May-23 05:00:00	1.610220167	1.580374956	3.173599421
11-May-23 06:00:00	1.618230726	1.591017747	3.204239231
11-May-23 07:00:00	1.618669514	1.592428303	3.218153
11-May-23 08:00:00	1.625279199	1.583409953	3.202555497
11-May-23 09:00:00	1.603816483	1.583926916	3.200819874
11-May-23 10:00:00	1.577040487	1.585932136	3.1681841
11-May-23 11:00:00	1.528820135	1.588084332	3.121010335
11-May-23 12:00:00	1.536727832	1.605253196	3.141768373
11-May-23 13:00:00	1.533259802	1.6653361	3.195685095
11-May-23 14:00:00	1.628017235	1.675123	3.314601112
11-May-23 15:00:00	1.728686982	1.681610227	3.435510569
11-May-23 16:00:00	1.841059539	1.675187439	3.516259527
11-May-23 17:00:00	1.839537985	1.625351038	3.44387918
11-May-23 18:00:00	1.840352504	1.583186988	3.485178042
11-May-23 19:00:00	1.746350328	1.593160706	3.345573505
11-May-23 20:00:00	1.659337097	1.591132187	3.259011348
11-May-23 21:00:00	1.627202113	1.608264246	3.190885913
11-May-23 22:00:00	1.618044191	1.62173839	3.250020969
11-May-23 23:00:00	1.623587092	1.644387317	3.275010043
12-May-23 00:00:00	1.632556167	1.586384797	3.234593718
12-May-23 01:00:00	1.645950039	1.592532599	3.234091277
12-May-23 02:00:00	1.643448472	1.592260051	3.266390634
12-May-23 03:00:00	1.619480219	1.599536781	3.224886668
12-May-23 04:00:00	1.623103597	1.592864047	3.23202709
12-May-23 05:00:00	1.616033748	1.610766847	3.244870603
12-May-23 06:00:00	1.62069858	1.682537809	3.292126878
12-May-23 07:00:00	1.601339704	1.6743562	3.289959458
12-May-23 08:00:00	1.705837627	1.65694948	3.374668703
12-May-23 09:00:00	1.714223693	1.596808443	3.294460789
12-May-23 10:00:00	1.704160535	1.558382201	3.274043251
12-May-23 11:00:00	1.656421401	1.50486012	3.113909021
12-May-23 12:00:00	1.600467384	1.498770733	3.111094438
12-May-23 13:00:00	1.570772509	1.513652016	3.067055484
12-May-23 14:00:00	1.532105121	1.591020111	3.126040042
12-May-23 15:00:00	1.529539106	1.56013968	3.167863989
12-May-23 16:00:00	1.543935941	1.503268838	3.059113874
12-May-23 17:00:00	1.600742824	1.502414481	3.035015241
12-May-23 18:00:00	1.582625184	1.50412128	3.106191282
12-May-23 19:00:00	1.529532909	1.511518685	3.035304785

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
12-May-23 20:00:00	1.533129964	1.575419691	3.092911349
12-May-23 21:00:00	1.532515177	1.664517959	3.123156226
12-May-23 22:00:00	1.583139916	1.633004181	3.20709163
12-May-23 23:00:00	1.604226801	1.591871707	3.208263914
13-May-23 00:00:00	1.536003411	1.582575025	3.129577923
13-May-23 01:00:00	1.53099976	1.583874019	3.072653426
13-May-23 02:00:00	1.535262691	1.593374421	3.123494148
13-May-23 03:00:00	1.550977157	1.506126671	3.048963124
13-May-23 04:00:00	1.607259747	1.497423124	3.073942469
13-May-23 05:00:00	1.601584214	1.504915439	3.098779693
13-May-23 06:00:00	1.624390218	1.567657675	3.183577242
13-May-23 07:00:00	1.620135137	1.498512282	3.144020809
13-May-23 08:00:00	1.620848636	1.552595224	3.216766675
13-May-23 09:00:00	1.604811711	1.586874326	3.175827083
13-May-23 10:00:00	1.608252267	1.585134749	3.159556969
13-May-23 11:00:00	1.623460075	1.586939923	3.220451355
13-May-23 12:00:00	1.620723406	1.592839851	3.181408273
13-May-23 13:00:00	1.622605456	1.54454559	3.119927168
13-May-23 14:00:00	1.59877663	1.502079169	3.111731953
13-May-23 15:00:00	1.574462036	1.516559888	3.080493017
13-May-23 16:00:00	1.529578553	1.515713771	3.033862842
13-May-23 17:00:00	1.53165208	1.495266899	3.094385718
13-May-23 18:00:00	1.535477489	1.56740892	3.0526013
13-May-23 19:00:00	1.536286549	1.557984734	3.047344875
13-May-23 20:00:00	1.560876462	1.505566569	3.045776606
13-May-23 21:00:00	1.579864416	1.50496156	3.088941002
13-May-23 22:00:00	1.623075591	1.497324596	3.152815379
13-May-23 23:00:00	1.620691611	1.514148513	3.091293634
14-May-23 00:00:00	1.616606222	1.571703496	3.131875765
14-May-23 01:00:00	1.5837173	1.586507646	3.163951131
14-May-23 02:00:00	1.563870794	1.587979797	3.153999433
14-May-23 03:00:00	1.534746461	1.555637614	3.102766085
14-May-23 04:00:00	1.529403594	1.54003946	3.060030047
14-May-23 05:00:00	1.536346495	1.599630431	3.086450516
14-May-23 06:00:00	1.571744157	1.590201785	3.205996018
14-May-23 07:00:00	1.56461917	1.586072242	3.161046921
14-May-23 08:00:00	1.608452843	1.594770914	3.174435191
14-May-23 09:00:00	1.617673463	1.592845355	3.204340067
14-May-23 10:00:00	1.624392578	1.579805195	3.214575884
14-May-23 11:00:00	1.615396168	1.5068157	3.144265334
14-May-23 12:00:00	1.5845833	1.576470493	3.139014367
14-May-23 13:00:00	1.584023058	1.594453184	3.175342202
14-May-23 14:00:00	1.528751554	1.590863524	3.137257814

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
14-May-23 15:00:00	1.535436948	1.586799264	3.09745166
14-May-23 16:00:00	1.530041118	1.650858823	3.20574852
14-May-23 17:00:00	1.588150614	1.674218559	3.244410849
14-May-23 18:00:00	1.605397469	1.674458178	3.275718451
14-May-23 19:00:00	1.621214125	1.59199843	3.275771907
14-May-23 20:00:00	1.620637238	1.494785661	3.149121412
14-May-23 21:00:00	1.618595243	1.541619656	3.200618618
14-May-23 22:00:00	1.618837015	1.588358865	3.195858367
14-May-23 23:00:00	1.594479475	1.590412505	3.133188283
15-May-23 00:00:00	1.550363048	1.603077482	3.11826577
15-May-23 01:00:00	1.5378503	1.562179477	3.106483046
15-May-23 02:00:00	1.532391542	1.508242863	3.117631167
15-May-23 03:00:00	1.540621678	1.573583053	3.124885594
15-May-23 04:00:00	1.580437382	1.594620075	3.174052231
15-May-23 05:00:00	1.564572652	1.58650128	3.123202646
15-May-23 06:00:00	1.533436504	1.586186135	3.133802379
15-May-23 07:00:00	1.531868928	1.516105394	3.085353547
15-May-23 08:00:00	1.537660252	1.584627167	3.06390812
15-May-23 09:00:00	1.564049111	1.523556629	3.088809665
15-May-23 10:00:00	1.575105376	1.503846816	3.066021143
15-May-23 11:00:00	1.612733722	1.499888759	3.12070686
15-May-23 12:00:00	1.624307334	1.55599315	3.208097397
15-May-23 13:00:00	1.616798586	1.532492419	3.166088859
15-May-23 14:00:00	1.615243988	1.679991126	3.232592157
15-May-23 15:00:00	1.59572651	1.677051425	3.283265219
15-May-23 16:00:00	1.606052786	1.672554433	3.294235452
15-May-23 17:00:00	1.620066492	1.605570796	3.246670128
15-May-23 18:00:00	1.620147951	1.556184928	3.169686323
15-May-23 19:00:00	1.620704638	1.579833949	3.137108851
15-May-23 20:00:00	1.602394941	1.523075145	3.153557587
15-May-23 21:00:00	1.61477636	1.50420926	3.090588331
15-May-23 22:00:00	1.623251723	1.498839936	3.139667511
15-May-23 23:00:00	1.619905428	1.553746718	3.172728129
16-May-23 00:00:00	1.61979449	1.520573815	3.131630659
16-May-23 01:00:00	1.606060101	1.596347308	3.184371788
16-May-23 02:00:00	1.583183858	1.582551183	3.184312116
16-May-23 03:00:00	1.553960409	1.584081173	3.12373634
16-May-23 04:00:00	1.526867459	1.575812246	3.117972996
16-May-23 05:00:00	1.536191185	1.586848569	3.130070257
16-May-23 06:00:00	1.549569685	1.587028384	3.138725437
16-May-23 07:00:00	1.586210655	1.593455863	3.146750625
16-May-23 08:00:00	1.592968203	1.592976475	3.127639788
16-May-23 09:00:00	1.616540746	1.582648746	3.200603746

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
16-May-23 10:00:00	1.623056915	1.583919954	3.154130379
16-May-23 11:00:00	1.620921029	1.587235093	3.20672063
16-May-23 12:00:00	1.603738181	1.590578651	3.147435425
16-May-23 13:00:00	1.587789092	1.59028306	3.159692883
16-May-23 14:00:00	1.534277366	1.584741147	3.120257171
16-May-23 15:00:00	1.535913058	1.483928526	3.113506079
16-May-23 16:00:00	1.531465067	1.515514779	3.106455114
16-May-23 17:00:00	1.586084603	1.584457743	3.204322882
16-May-23 18:00:00	1.624639821	1.599752986	3.23187383
16-May-23 19:00:00	1.633576009	1.603184801	3.201564868
16-May-23 20:00:00	1.618938982	1.547442099	3.174912596
16-May-23 21:00:00	1.62139727	1.598943353	3.213299195
16-May-23 22:00:00	1.627406793	1.585653917	3.20582623
16-May-23 23:00:00	1.583649761	1.582433248	3.142598735
17-May-23 00:00:00	1.588683718	1.588343374	3.200696369
17-May-23 01:00:00	1.532370325	1.595447612	3.088307785
17-May-23 02:00:00	1.535230299	1.50948302	3.054532114
17-May-23 03:00:00	1.528959296	1.588774016	3.105555678
17-May-23 04:00:00	1.585538073	1.594870333	3.226732344
17-May-23 05:00:00	1.603423019	1.58426819	3.163740305
17-May-23 06:00:00	1.621291327	1.590685016	3.206193323
17-May-23 07:00:00	1.622364832	1.574013472	3.150438153
17-May-23 08:00:00	1.62420537	1.538833294	3.218444486
17-May-23 09:00:00	1.6139669	1.605958915	3.188300387
17-May-23 10:00:00	1.590664652	1.582322216	3.156976599
17-May-23 11:00:00	1.560689463	1.582051921	3.125720533
17-May-23 12:00:00	1.534229612	1.592204078	3.125248386
17-May-23 13:00:00	1.529497652	1.538807621	3.031626491
17-May-23 14:00:00	1.535329446	1.500422204	3.066246761
17-May-23 15:00:00	1.619180817	1.499910527	3.163535499
17-May-23 16:00:00	1.604557912	1.504440117	3.104909011
17-May-23 17:00:00	1.624471638	1.514990612	3.123639297
17-May-23 18:00:00	1.622634987	1.559679101	3.180719709
17-May-23 19:00:00	1.616516286	1.590889144	3.184532709
17-May-23 20:00:00	1.624189043	1.586940396	3.244560302
17-May-23 21:00:00	1.627323879	1.589119351	3.287683021
17-May-23 22:00:00	1.818169276	1.595881401	3.415555183
17-May-23 23:00:00	1.835419986	1.593197534	3.482471888
18-May-23 00:00:00	1.845515059	1.631967081	3.491331897
18-May-23 01:00:00	1.790738112	1.807281335	3.575871264
18-May-23 02:00:00	1.658557845	1.807208648	3.448546992
18-May-23 03:00:00	1.604511506	1.805214453	3.437883801
18-May-23 04:00:00	1.536323002	1.664742074	3.247390067

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
18-May-23 05:00:00	1.534660159	1.646407292	3.119075835
18-May-23 06:00:00	1.53466785	1.581635483	3.167732553
18-May-23 07:00:00	1.64182819	1.581723153	3.272411782
18-May-23 08:00:00	1.625730554	1.585728327	3.26108249
18-May-23 09:00:00	1.620691316	1.593622204	3.20891582
18-May-23 10:00:00	1.619467126	1.59113499	3.264618026
18-May-23 11:00:00	1.622700064	1.468120365	3.078885054
18-May-23 12:00:00	1.601276219	1.371986465	2.979420342
18-May-23 13:00:00	1.584117611	1.379927053	2.959529448
18-May-23 14:00:00	1.537847896	1.377704873	2.931377214
18-May-23 15:00:00	1.531181686	1.529202847	3.109491661
18-May-23 16:00:00	1.534259441	1.644201156	3.155058902
18-May-23 17:00:00	1.548231953	1.655640737	3.079099683
18-May-23 18:00:00	1.598861694	1.594410034	3.225362125
18-May-23 19:00:00	1.613628374	1.587984204	3.207433844
18-May-23 20:00:00	1.624601524	1.594459613	3.21404388
18-May-23 21:00:00	1.621657102	1.58832657	3.187357259
18-May-23 22:00:00	1.623379683	1.584854333	3.255484299
18-May-23 23:00:00	1.632324464	1.585211345	3.208837615
19-May-23 00:00:00	1.650761631	1.588825027	3.211748062
19-May-23 01:00:00	1.534084413	1.595860231	3.164928302
19-May-23 02:00:00	1.533825462	1.584156922	3.089189564
19-May-23 03:00:00	1.532526497	1.579793986	3.107659046
19-May-23 04:00:00	1.574329747	1.592981594	3.153015693
19-May-23 05:00:00	1.624154431	1.596737742	3.240654753
19-May-23 06:00:00	1.567871534	1.600034743	3.155604177
19-May-23 07:00:00	1.533246825	1.591971114	3.125542952
19-May-23 08:00:00	1.534951168	1.587501812	3.129541286
19-May-23 09:00:00	1.539391983	1.588322147	3.117211759
19-May-23 10:00:00	1.641971926	1.588124951	3.229098256
19-May-23 11:00:00	1.630345212	1.587477921	3.233680609
19-May-23 12:00:00	1.620994987	1.589781983	3.227398141
19-May-23 13:00:00	1.621958857	1.657343368	3.225772959
19-May-23 14:00:00	1.618629873	1.670292576	3.286926817
19-May-23 15:00:00	1.685097123	1.68679928	3.428019819
19-May-23 16:00:00	1.67493705	1.682977299	3.370034827
19-May-23 17:00:00	1.630321602	1.672921226	3.331721306
19-May-23 18:00:00	1.618891164	1.586766998	3.258555322
19-May-23 19:00:00	1.621394279	1.701806142	3.27817464
19-May-23 20:00:00	1.640668684	1.811504567	3.433375569
19-May-23 21:00:00	1.654992991	1.79473781	3.459264516
19-May-23 22:00:00	1.639136281	1.797923326	3.425186634
19-May-23 23:00:00	1.620558187	1.726962917	3.28679151

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
20-May-23 00:00:00	1.620148513	1.672653019	3.287457585
20-May-23 01:00:00	1.614203742	1.670110255	3.309014559
20-May-23 02:00:00	1.67435303	1.682947606	3.32087467
20-May-23 03:00:00	1.646899614	1.690343654	3.284360543
20-May-23 04:00:00	1.534125593	1.665487057	3.145483116
20-May-23 05:00:00	1.533059571	1.627154741	3.139451385
20-May-23 06:00:00	1.535041167	1.537234172	3.129305228
20-May-23 07:00:00	1.584366988	1.600298059	3.230068646
20-May-23 08:00:00	1.650547451	1.581656796	3.241244678
20-May-23 09:00:00	1.691424582	1.611257557	3.271812833
20-May-23 10:00:00	1.701600603	1.624917905	3.304563856
20-May-23 11:00:00	1.7122746	1.55186628	3.296352832
20-May-23 12:00:00	1.686472412	1.505480003	3.196315424
20-May-23 13:00:00	1.661460068	1.501370833	3.216268387
20-May-23 14:00:00	1.632798437	1.503543119	3.20278487
20-May-23 15:00:00	1.621319722	1.555523782	3.272211779
20-May-23 16:00:00	1.623328985	1.541410738	3.222852325
20-May-23 17:00:00	1.621859237	1.666055635	3.293457086
20-May-23 18:00:00	1.655822318	1.675670574	3.306019147
20-May-23 19:00:00	1.647727887	1.679159772	3.332029823
20-May-23 20:00:00	1.619842953	1.670106512	3.272796297
20-May-23 21:00:00	1.623375915	1.642567861	3.225459687
20-May-23 22:00:00	1.621719347	1.583965196	3.242307716
20-May-23 23:00:00	1.651091495	1.589810799	3.316825366
21-May-23 00:00:00	1.690715704	1.593895209	3.259893322
21-May-23 01:00:00	1.641174237	1.585555416	3.209264469
21-May-23 02:00:00	1.619348078	1.612277372	3.263128584
21-May-23 03:00:00	1.615182385	1.632547439	3.202191042
21-May-23 04:00:00	1.625608246	1.676380253	3.213738141
21-May-23 05:00:00	1.624426299	1.604651433	3.265573601
21-May-23 06:00:00	1.694778623	1.583589558	3.290440202
21-May-23 07:00:00	1.709232752	1.609348596	3.334619012
21-May-23 08:00:00	1.70559197	1.675905108	3.361880448
21-May-23 09:00:00	1.705297841	1.622083174	3.345044287
21-May-23 10:00:00	1.662487083	1.586464276	3.261245357
21-May-23 11:00:00	1.630161828	1.594746765	3.251897579
21-May-23 12:00:00	1.623386284	1.58730257	3.217272779
21-May-23 13:00:00	1.62301254	1.609987639	3.239397084
21-May-23 14:00:00	1.622918198	1.633964703	3.259805936
21-May-23 15:00:00	1.628693794	1.67102286	3.306982597
21-May-23 16:00:00	1.622774386	1.666781699	3.310224118
21-May-23 17:00:00	1.629978657	1.670060635	3.349170966
21-May-23 18:00:00	1.625127034	1.671591991	3.232883759

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
21-May-23 19:00:00	1.617102689	1.631433221	3.177643432
21-May-23 20:00:00	1.62096913	1.516142223	3.201382717
21-May-23 21:00:00	1.622573872	1.566267744	3.217465521
21-May-23 22:00:00	1.633885052	1.588077943	3.261628232
21-May-23 23:00:00	1.622945057	1.582275907	3.222238399
22-May-23 00:00:00	1.619036688	1.586454459	3.199537688
22-May-23 01:00:00	1.621619138	1.580704853	3.230370089
22-May-23 02:00:00	1.654725881	1.588837143	3.290462677
22-May-23 03:00:00	1.657691106	1.583036862	3.238473132
22-May-23 04:00:00	1.63676804	1.594115172	3.222654938
22-May-23 05:00:00	1.618304819	1.596535305	3.243813977
22-May-23 06:00:00	1.617921108	1.596461564	3.247871208
22-May-23 07:00:00	1.626393484	1.686725028	3.322030828
22-May-23 08:00:00	1.631587121	1.668742502	3.340994822
22-May-23 09:00:00	1.630132695	1.668546899	3.36839752
22-May-23 10:00:00	1.617975606	1.6708732	3.296791579
22-May-23 11:00:00	1.624242175	1.60430306	3.230192577
22-May-23 12:00:00	1.614593121	1.661846316	3.245301712
22-May-23 13:00:00	1.609590967	1.601716822	3.227214206
22-May-23 14:00:00	1.619076702	1.592018402	3.207970248
22-May-23 15:00:00	1.710357242	1.597319879	3.300488885
22-May-23 16:00:00	1.708638828	1.589312454	3.317928372
22-May-23 17:00:00	1.708713441	1.583395529	3.279654357
22-May-23 18:00:00	1.668279568	1.582608211	3.25193601
22-May-23 19:00:00	1.616756947	1.585026634	3.211576223
22-May-23 20:00:00	1.624847266	1.59089393	3.214457941
22-May-23 21:00:00	1.617119624	1.588554432	3.152701767
22-May-23 22:00:00	1.617598923	1.588424325	3.199789106
22-May-23 23:00:00	1.624691414	1.600748181	3.257874568
23-May-23 00:00:00	1.620561759	1.624199879	3.318847577
23-May-23 01:00:00	1.6203639	1.672003434	3.288583129
23-May-23 02:00:00	1.620083875	1.672564805	3.288995345
23-May-23 03:00:00	1.620678193	1.672132969	3.309851585
23-May-23 04:00:00	5.822591838	21.56188032	26.27851029
23-May-23 05:00:00	5.129400889	21.49983014	26.63296816
23-May-23 06:00:00	5.119064728	21.53225598	26.6559692
23-May-23 07:00:00	5.123931037	21.51815802	26.63374959
23-May-23 08:00:00	5.125500785	21.50931003	26.63170122
23-May-23 09:00:00	9.369429509	21.51496527	30.87415992
23-May-23 10:00:00	12.10995197	6.72267337	18.85054779
23-May-23 11:00:00	12.06269821	1.875880837	13.92249801
23-May-23 12:00:00	10.9703973	1.682619524	12.63738383
23-May-23 13:00:00	1.853545262	1.675990224	3.535064119

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
23-May-23 14:00:00	1.803424848	1.671507549	3.491542949
23-May-23 15:00:00	1.83971728	1.664008464	3.498466761
23-May-23 16:00:00	1.83784649	1.716299292	3.525769836
23-May-23 17:00:00	1.84301536	1.677972562	3.531435026
23-May-23 18:00:00	1.774038215	1.68545224	3.424931648
23-May-23 19:00:00	1.764884392	1.690088848	3.441366218
23-May-23 20:00:00	1.720196452	1.680974867	3.403886411
23-May-23 21:00:00	1.708162626	1.705207229	3.360921944
23-May-23 22:00:00	1.708876504	1.708739638	3.410137804
23-May-23 23:00:00	1.71645123	1.687846899	3.374695272
24-May-23 00:00:00	1.698487573	1.670869956	3.362186856
24-May-23 01:00:00	1.689663816	1.671780952	3.387521704
24-May-23 02:00:00	1.708710958	1.699798162	3.395092167
24-May-23 03:00:00	1.708048415	1.701123421	3.404828363
24-May-23 04:00:00	1.703123994	1.791054269	3.504152278
24-May-23 05:00:00	1.756678773	1.80719276	3.573219577
24-May-23 06:00:00	1.759740187	1.809446136	3.571415239
24-May-23 07:00:00	1.707966977	1.758739198	3.459100458
24-May-23 08:00:00	1.706630932	1.706399737	3.42174538
24-May-23 09:00:00	1.705109835	1.677540569	3.373466955
24-May-23 10:00:00	1.699199118	1.671783591	3.415934669
24-May-23 11:00:00	1.701650282	1.670925001	3.383115557
24-May-23 12:00:00	1.635652502	1.673637358	3.28364532
24-May-23 13:00:00	1.626549482	1.738751095	3.296347725
24-May-23 14:00:00	1.620237688	1.591349244	3.305352974
24-May-23 15:00:00	1.648364954	1.687187358	3.320078278
24-May-23 16:00:00	1.7099385	1.680210513	3.397284508
24-May-23 17:00:00	1.711983614	1.66552157	3.372569574
24-May-23 18:00:00	1.707221001	1.67523238	3.364218076
24-May-23 19:00:00	1.706085407	1.712716488	3.384436667
24-May-23 20:00:00	1.707897511	1.640720146	3.378834605
24-May-23 21:00:00	1.679505772	1.688673258	3.351894369
24-May-23 22:00:00	1.682965325	1.670465655	3.373323168
24-May-23 23:00:00	1.706524666	1.639408878	3.36862395
25-May-23 00:00:00	1.71025561	1.613851754	3.310758284
25-May-23 01:00:00	1.706103351	1.676555326	3.369204963
25-May-23 02:00:00	1.729244745	1.666114978	3.442138058
25-May-23 03:00:00	1.721029262	1.678910243	3.402954923
25-May-23 04:00:00	1.810154074	1.683349742	3.486380564
25-May-23 05:00:00	1.841555668	1.71602515	3.58065476
25-May-23 06:00:00	1.838796533	1.699924476	3.531405109
25-May-23 07:00:00	1.815852231	1.673388799	3.409565156
25-May-23 08:00:00	1.725005991	1.667501426	3.383477198

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
25-May-23 09:00:00	1.748146269	1.671088862	3.437155816
25-May-23 10:00:00	1.710123863	1.682992813	3.420280367
25-May-23 11:00:00	1.706371641	1.707814364	3.424586574
25-May-23 12:00:00	1.708623499	1.688319266	3.41385891
25-May-23 13:00:00	1.723750187	1.669859966	3.434813123
25-May-23 14:00:00	1.745143049	1.670814025	3.412104938
25-May-23 15:00:00	1.711920006	1.676267761	3.379270673
25-May-23 16:00:00	1.705534618	1.712586606	3.305247177
25-May-23 17:00:00	1.704008453	1.634453504	3.33834222
25-May-23 18:00:00	1.699459129	1.658143746	3.351442207
25-May-23 19:00:00	1.664479699	1.688617865	3.348400454
25-May-23 20:00:00	1.642835187	1.66528809	3.299702211
25-May-23 21:00:00	1.62003557	1.634515369	3.283650494
25-May-23 22:00:00	1.620554349	1.603359456	3.271263295
25-May-23 23:00:00	1.621327992	1.591228751	3.232864141
26-May-23 00:00:00	1.684492038	1.685337232	3.340905507
26-May-23 01:00:00	1.674351242	1.673957556	3.364645712
26-May-23 02:00:00	1.705025216	1.679031425	3.339554127
26-May-23 03:00:00	1.710727824	1.688423126	3.32261973
26-May-23 04:00:00	1.70551006	1.608034162	3.339241707
26-May-23 05:00:00	1.682917466	1.577654143	3.309240094
26-May-23 06:00:00	1.681717714	1.588065179	3.282063747
26-May-23 07:00:00	1.705072218	1.586855474	3.29287352
26-May-23 08:00:00	1.708157473	1.673880989	3.371322334
26-May-23 09:00:00	1.713350942	1.721645324	3.401730984
26-May-23 10:00:00	1.704027308	1.687978729	3.381759938
26-May-23 11:00:00	1.714253545	1.669200037	3.40126272
26-May-23 12:00:00	1.700108349	1.669204593	3.387841304
26-May-23 13:00:00	1.708632184	1.677364971	3.380957674
26-May-23 14:00:00	1.705735062	1.681591998	3.402725199
26-May-23 15:00:00	1.706771887	1.61888795	3.34646831
26-May-23 16:00:00	1.698532661	1.588700549	3.347281377
26-May-23 17:00:00	1.690077821	1.582130736	3.257847786
26-May-23 18:00:00	1.707209181	1.654456297	3.32285183
26-May-23 19:00:00	1.709809999	1.690766695	3.36273049
26-May-23 20:00:00	1.705866072	1.63306884	3.299365314
26-May-23 21:00:00	1.713597406	1.603352702	3.295453227
26-May-23 22:00:00	1.725900233	1.58174867	3.329401652
26-May-23 23:00:00	1.56842643	1.642961705	3.174530778
27-May-23 00:00:00	1.534717343	1.67406385	3.140827394
27-May-23 01:00:00	1.533175906	1.591385331	3.140027793
27-May-23 02:00:00	1.561430301	1.590165978	3.165226371
27-May-23 03:00:00	1.631090813	1.589138548	3.241571183

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
27-May-23 04:00:00	1.649899026	1.581097741	3.265929715
27-May-23 05:00:00	1.622923711	1.583745058	3.250991495
27-May-23 06:00:00	1.618984984	1.589996483	3.239507235
27-May-23 07:00:00	1.618958095	1.595877139	3.20140553
27-May-23 08:00:00	1.621002137	1.595694443	3.23290118
27-May-23 09:00:00	1.665037069	1.58298214	3.247810147
27-May-23 10:00:00	1.707730187	1.677931377	3.317576854
27-May-23 11:00:00	1.703002396	1.668006015	3.367265582
27-May-23 12:00:00	1.711795264	1.604344735	3.377357679
27-May-23 13:00:00	1.68018649	1.681240247	3.335303773
27-May-23 14:00:00	1.693931474	1.676853127	3.38520057
27-May-23 15:00:00	1.703837037	1.66603535	3.403753018
27-May-23 16:00:00	1.708165182	1.674481463	3.333345392
27-May-23 17:00:00	1.705096185	1.679308308	3.384385705
27-May-23 18:00:00	1.71719939	1.677340396	3.397111138
27-May-23 19:00:00	1.706442396	1.670371921	3.382376947
27-May-23 20:00:00	1.71293029	1.669586007	3.388356353
27-May-23 21:00:00	1.708924132	1.683258738	3.450838862
27-May-23 22:00:00	1.708943201	1.709052331	3.417446759
27-May-23 23:00:00	1.709134824	1.683063216	3.399335464
28-May-23 00:00:00	1.715894043	1.675111763	3.422200063
28-May-23 01:00:00	1.704052852	1.67767566	3.395022649
28-May-23 02:00:00	1.708281017	1.680467973	3.335834111
28-May-23 03:00:00	1.705067677	1.657889022	3.37201152
28-May-23 04:00:00	1.708610727	1.698655259	3.393078248
28-May-23 05:00:00	1.70311365	1.675387979	3.396111528
28-May-23 06:00:00	1.684500436	1.671604991	3.387517728
28-May-23 07:00:00	1.766477651	1.670845985	3.48613514
28-May-23 08:00:00	1.845145894	1.683082352	3.506197341
28-May-23 09:00:00	1.837417033	1.634303936	3.511607755
28-May-23 10:00:00	1.842287024	1.643584136	3.490536764
28-May-23 11:00:00	1.670681609	1.67981863	3.309874482
28-May-23 12:00:00	1.683778109	1.679888639	3.377048526
28-May-23 13:00:00	1.621261689	1.694421266	3.312739663
28-May-23 14:00:00	1.620933414	1.641673326	3.249917428
28-May-23 15:00:00	1.621255524	1.696924538	3.30127928
28-May-23 16:00:00	1.649164167	1.676343563	3.316985718
28-May-23 17:00:00	1.678803192	1.666659077	3.356906714
28-May-23 18:00:00	1.629174236	1.675345046	3.344645675
28-May-23 19:00:00	1.619990501	1.677784836	3.286839823
28-May-23 20:00:00	1.615215888	1.677225533	3.245263481
28-May-23 21:00:00	1.644116117	1.675556482	3.310690175
28-May-23 22:00:00	1.658698195	1.674314411	3.368305227

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
28-May-23 23:00:00	1.691926757	1.688533834	3.380478454
29-May-23 00:00:00	1.713863088	1.642861754	3.389255997
29-May-23 01:00:00	1.701691091	1.671708332	3.316332082
29-May-23 02:00:00	1.710978495	1.703435375	3.402499826
29-May-23 03:00:00	1.726121061	1.673591045	3.411833449
29-May-23 04:00:00	1.741272271	1.672417569	3.416370524
29-May-23 05:00:00	1.712415622	1.690015488	3.371263117
29-May-23 06:00:00	1.706181553	1.689446607	3.317593944
29-May-23 07:00:00	1.70887972	1.681278721	3.389151605
29-May-23 08:00:00	1.733905925	1.675579905	3.445345529
29-May-23 09:00:00	1.681042936	1.674380211	3.366337962
29-May-23 10:00:00	1.719004022	1.675985298	3.342208001
29-May-23 11:00:00	1.703541054	1.659234502	3.42633766
29-May-23 12:00:00	1.710576117	1.726206152	3.389939617
29-May-23 13:00:00	1.699165463	1.810512702	3.500540495
29-May-23 14:00:00	1.75207288	1.798238896	3.576548093
29-May-23 15:00:00	1.662960165	1.797932847	3.506028321
29-May-23 16:00:00	1.620347374	1.743736507	3.362329651
29-May-23 17:00:00	1.616390251	1.637277674	3.277094693
29-May-23 18:00:00	1.619777143	1.685867978	3.297061745
29-May-23 19:00:00	1.642924839	1.668487822	3.30195575
29-May-23 20:00:00	1.666963451	1.674877731	3.335064495
29-May-23 21:00:00	1.70790452	1.672173059	3.379486446
29-May-23 22:00:00	1.709039617	1.685709346	3.340817376
29-May-23 23:00:00	1.706203812	1.601693206	3.316233794
30-May-23 00:00:00	1.748993635	1.588229523	3.392454695
30-May-23 01:00:00	1.72431259	1.589680703	3.312824051
30-May-23 02:00:00	1.707834012	1.591303803	3.279299683
30-May-23 03:00:00	1.712974918	1.591998466	3.383934309
30-May-23 04:00:00	1.706205979	1.59277141	3.370123529
30-May-23 05:00:00	1.710433488	1.639164025	3.379809332
30-May-23 06:00:00	1.676419357	1.68047963	3.329483295
30-May-23 07:00:00	1.666328351	1.675163062	3.340350986
30-May-23 08:00:00	1.621859507	1.671514201	3.25544297
30-May-23 09:00:00	1.620664358	1.665357995	3.284407554
30-May-23 10:00:00	1.624586312	1.627784952	3.200246811
30-May-23 11:00:00	1.675836629	1.593859577	3.303331031
30-May-23 12:00:00	1.676780608	1.590600981	3.278290749
30-May-23 13:00:00	1.7048293	1.611324167	3.325413823
30-May-23 14:00:00	1.706301854	1.668138838	3.321349012
30-May-23 15:00:00	1.712542541	1.565842197	3.306136121
30-May-23 16:00:00	1.701008617	1.594793105	3.293492723
30-May-23 17:00:00	1.65415287	1.584796691	3.236293713

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
30-May-23 18:00:00	1.638317499	1.584602356	3.254134563
30-May-23 19:00:00	1.624030272	1.588713626	3.264318837
30-May-23 20:00:00	1.617776897	1.596341749	3.256517454
30-May-23 21:00:00	1.625236485	1.599566209	3.204135921
30-May-23 22:00:00	1.649414155	1.583421904	3.281665464
30-May-23 23:00:00	1.639930089	1.583463657	3.260151142
31-May-23 00:00:00	1.61837802	1.590913389	3.223407461
31-May-23 01:00:00	1.622432997	1.587702642	3.246113094
31-May-23 02:00:00	1.623312577	1.615401386	3.250297493
31-May-23 03:00:00	1.664573742	1.585607457	3.286877844
31-May-23 04:00:00	1.653243158	1.588940244	3.237680541
31-May-23 05:00:00	1.61879213	1.587494194	3.220313168
31-May-23 06:00:00	1.619201478	1.592033116	3.280399349
31-May-23 07:00:00	1.62632666	1.659017399	3.192580123
31-May-23 08:00:00	1.647825804	1.655519517	3.207244248
31-May-23 09:00:00	1.67714517	1.602535509	3.294506166
31-May-23 10:00:00	1.638895348	1.593131138	3.209794393
31-May-23 11:00:00	1.621685751	1.602919686	3.269008644
31-May-23 12:00:00	1.622745434	1.611712452	3.296711588
31-May-23 13:00:00	1.621881293	1.681049287	3.302498351
31-May-23 14:00:00	1.659031881	1.672578875	3.368839754
31-May-23 15:00:00	1.655222698	1.669764364	3.352210225
31-May-23 16:00:00	1.622292029	1.668965985	3.296595439
31-May-23 17:00:00	1.61416626	1.549931158	3.138691358
31-May-23 18:00:00	1.620425369	1.63658202	3.18173788
31-May-23 19:00:00	1.631084217	1.64314791	3.205506325
31-May-23 20:00:00	1.597174214	1.583872221	3.162059704
31-May-23 21:00:00	1.541386584	1.593556593	3.131309072
31-May-23 22:00:00	1.53961676	1.506848134	3.120778227
31-May-23 23:00:00	1.531319241	1.540570974	3.072651611
01-Jun-23 00:00:00	1.543493633	1.50066282	3.049504903
01-Jun-23 01:00:00	6.305290434	53.44053099	59.74612596
01-Jun-23 02:00:00	6.299846596	53.43821165	59.73794789
01-Jun-23 03:00:00	6.400901755	53.39100407	59.7920937
01-Jun-23 04:00:00	6.309104893	53.48505635	59.77897008
01-Jun-23 05:00:00	6.483443975	53.49314774	59.97588539
01-Jun-23 06:00:00	6.529099756	53.38256115	59.91383235
01-Jun-23 07:00:00	6.518271605	53.58133782	60.10403124
01-Jun-23 08:00:00	6.543567657	53.62172318	60.19835465
01-Jun-23 09:00:00	6.284356091	53.57527973	59.86171489
01-Jun-23 10:00:00	6.370183971	53.44901276	59.81429672
01-Jun-23 11:00:00	6.435428646	53.59215588	60.03402964
01-Jun-23 12:00:00	6.431654692	53.42058235	59.80784247

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
01-Jun-23 13:00:00	6.422230985	53.02256648	59.43403117
01-Jun-23 14:00:00	6.38733689	52.91409273	59.29581017
01-Jun-23 15:00:00	6.286952522	52.9350037	59.20090887
01-Jun-23 16:00:00	6.220143708	53.15726732	59.38590057
01-Jun-23 17:00:00	6.219588134	53.28803719	59.51074261
01-Jun-23 18:00:00	6.209420098	53.32751422	59.54342397
01-Jun-23 19:00:00	6.321730543	53.13044315	59.43743335
01-Jun-23 20:00:00	6.265152136	53.04833465	59.31918314
01-Jun-23 21:00:00	6.302731329	52.96509308	59.27076573
01-Jun-23 22:00:00	6.313941214	53.44998105	59.76623366
01-Jun-23 23:00:00	6.303062916	53.23870701	59.54540783
02-Jun-23 00:00:00	6.337151819	53.37969971	59.71528117
02-Jun-23 01:00:00	6.239900986	53.30256547	59.52091726
02-Jun-23 02:00:00	6.225310802	53.29766734	59.52518887
02-Jun-23 03:00:00	6.220704052	53.36878077	59.57943736
02-Jun-23 04:00:00	6.218891435	52.79398685	59.02125825
02-Jun-23 05:00:00	6.21164857	53.03437191	59.23784277
02-Jun-23 06:00:00	6.331207196	53.16287486	59.50777806
02-Jun-23 07:00:00	6.122532633	53.34607972	59.46489271
02-Jun-23 08:00:00	6.225569672	53.14676454	59.40794161
02-Jun-23 09:00:00	6.22104054	52.76908747	58.98449092
02-Jun-23 10:00:00	6.233540429	53.18486659	59.41015159
02-Jun-23 11:00:00	6.229700247	54.19987763	60.42549183
02-Jun-23 12:00:00	6.112259176	54.23373954	60.31961717
02-Jun-23 13:00:00	6.180129025	54.04783376	60.21190679
02-Jun-23 14:00:00	6.225610018	53.43271743	59.65075429
02-Jun-23 15:00:00	6.224206713	52.7762288	59.00086466
02-Jun-23 16:00:00	6.247280995	51.88454586	58.12477303
02-Jun-23 17:00:00	6.119120889	51.74580341	57.87401507
02-Jun-23 18:00:00	6.114644951	51.88620165	58.01732852
02-Jun-23 19:00:00	6.222454548	52.25777584	58.52273402
02-Jun-23 20:00:00	6.234242174	52.73545678	58.95462163
02-Jun-23 21:00:00	6.217584319	52.79403369	59.01680692
02-Jun-23 22:00:00	6.216949269	52.81497277	59.03512133
02-Jun-23 23:00:00	6.076063792	52.81675678	58.88451131
03-Jun-23 00:00:00	6.217221048	52.63701312	58.84828334
03-Jun-23 01:00:00	6.232361264	53.1652529	59.41576661
03-Jun-23 02:00:00	6.207609918	53.29554802	59.50833755
03-Jun-23 03:00:00	6.247237126	53.98870002	60.24560059
03-Jun-23 04:00:00	6.055878666	53.87496101	59.93155204
03-Jun-23 05:00:00	6.145829731	53.8801633	60.00953929
03-Jun-23 06:00:00	6.236156437	53.31783528	59.56496726
03-Jun-23 07:00:00	6.217836711	52.91894997	59.14167701

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
03-Jun-23 08:00:00	6.21808317	53.24313842	59.45422702
03-Jun-23 09:00:00	6.140093909	53.26023716	59.40834448
03-Jun-23 10:00:00	6.084638622	53.41742812	59.49606281
03-Jun-23 11:00:00	6.092245261	53.07858488	59.14467133
03-Jun-23 12:00:00	6.086677975	52.76577059	58.85814391
03-Jun-23 13:00:00	6.081822978	52.66776021	58.74395498
03-Jun-23 14:00:00	6.086400341	51.23658244	57.31822141
03-Jun-23 15:00:00	6.101873967	50.72222766	56.82489974
03-Jun-23 16:00:00	6.086579561	50.61509542	56.70980821
03-Jun-23 17:00:00	6.083858702	50.80260328	56.85104307
03-Jun-23 18:00:00	6.092862871	36.19923894	42.27302283
03-Jun-23 19:00:00	6.46533921	7.086986733	13.56406551
03-Jun-23 20:00:00	6.447551462	7.118322108	13.51167568
03-Jun-23 21:00:00	6.439423905	7.1259106	13.57602422
03-Jun-23 22:00:00	6.432849328	7.126538176	13.55760425
03-Jun-23 23:00:00	6.423633893	7.070004463	13.51863384
04-Jun-23 00:00:00	7.723239819	14.75989844	22.4706068
04-Jun-23 01:00:00	7.714200691	53.3652313	61.07323763
04-Jun-23 02:00:00	7.718494548	53.22843658	60.94452625
04-Jun-23 03:00:00	7.022052323	52.67733998	59.68122758
04-Jun-23 04:00:00	6.046911558	52.83576658	58.87160005
04-Jun-23 05:00:00	6.11675326	52.89451408	58.99677446
04-Jun-23 06:00:00	6.106988465	53.20234066	59.30002497
04-Jun-23 07:00:00	6.083801614	53.31057252	59.38543023
04-Jun-23 08:00:00	6.150379313	52.78704898	58.92753474
04-Jun-23 09:00:00	6.143583139	52.87282732	59.00249947
04-Jun-23 10:00:00	6.126067585	52.79781426	58.92921935
04-Jun-23 11:00:00	6.230104976	52.85238245	59.08031019
04-Jun-23 12:00:00	6.22253508	53.31409348	59.54096709
04-Jun-23 13:00:00	6.21763338	53.61000803	59.81447326
04-Jun-23 14:00:00	6.164149284	53.85660044	60.02008947
04-Jun-23 15:00:00	6.093241294	53.79292583	59.88895618
04-Jun-23 16:00:00	6.102319161	53.78797566	59.8932191
04-Jun-23 17:00:00	6.079646905	53.30889448	59.38480547
04-Jun-23 18:00:00	6.093559901	53.24760649	59.34359339
04-Jun-23 19:00:00	6.24354993	53.34408654	59.61094093
04-Jun-23 20:00:00	6.109082354	53.40009124	59.52302339
04-Jun-23 21:00:00	6.190542407	53.48249637	59.66849581
04-Jun-23 22:00:00	6.216941198	53.03785557	59.24040074
04-Jun-23 23:00:00	6.205331882	52.93775262	59.13306978
05-Jun-23 00:00:00	6.211295896	53.36072964	59.55628734
05-Jun-23 01:00:00	6.197546456	53.48336686	59.7088657
05-Jun-23 02:00:00	6.068183952	53.31825765	59.41118813

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
05-Jun-23 03:00:00	6.001452367	53.13948992	59.13912498
05-Jun-23 04:00:00	6.011285252	52.95516777	58.97068045
05-Jun-23 05:00:00	6.012449	52.64505598	58.65930345
05-Jun-23 06:00:00	6.057090044	52.14058749	58.20437135
05-Jun-23 07:00:00	6.012880564	52.20094914	58.21602758
05-Jun-23 08:00:00	6.023862176	52.28877272	58.31074036
05-Jun-23 09:00:00	5.991653575	53.02153344	59.02084033
05-Jun-23 10:00:00	6.013465537	52.75089073	58.75874074
05-Jun-23 11:00:00	6.1049175	52.16391118	58.25519816
05-Jun-23 12:00:00	6.036204232	52.18049643	58.19986725
05-Jun-23 13:00:00	6.079835945	52.10699357	58.16644075
05-Jun-23 14:00:00	6.100759718	52.48884703	58.60052808
05-Jun-23 15:00:00	6.103692876	53.02761714	59.12969822
05-Jun-23 16:00:00	6.087608788	52.30707211	58.39381451
05-Jun-23 17:00:00	6.169521729	51.87185182	57.9900482
05-Jun-23 18:00:00	6.060757001	51.87681452	57.93888961
05-Jun-23 19:00:00	6.003750218	52.25276434	58.27129364
05-Jun-23 20:00:00	6.010386361	53.11362097	59.12474039
05-Jun-23 21:00:00	6.006580856	52.78819508	58.80090735
05-Jun-23 22:00:00	6.139703936	52.48620224	58.6220044
05-Jun-23 23:00:00	6.036515209	52.55732307	58.58940202
06-Jun-23 00:00:00	6.085310035	52.59515762	58.670219
06-Jun-23 01:00:00	6.105276426	52.92764791	59.03046099
06-Jun-23 02:00:00	6.088864512	53.01450009	59.10377969
06-Jun-23 03:00:00	6.155691544	53.91257011	60.06167009
06-Jun-23 04:00:00	6.070434782	53.85813416	59.90619412
06-Jun-23 05:00:00	6.052161906	53.76742787	59.85126771
06-Jun-23 06:00:00	6.097442283	53.2736158	59.37088055
06-Jun-23 07:00:00	6.09472696	52.90572611	59.00082567
06-Jun-23 08:00:00	6.082169771	52.73595789	58.81749958
06-Jun-23 09:00:00	6.090532276	52.59201961	58.67745845
06-Jun-23 10:00:00	6.014920632	52.64628092	58.65948041
06-Jun-23 11:00:00	6.010602554	52.7174927	58.72303391
06-Jun-23 12:00:00	6.007444286	52.66900274	58.67300245
06-Jun-23 13:00:00	5.999677738	52.57566208	58.57720142
06-Jun-23 14:00:00	6.090008497	52.17746581	58.26793045
06-Jun-23 15:00:00	6.005826142	52.16391351	58.17471759
06-Jun-23 16:00:00	6.024469455	52.05512799	58.06345558
06-Jun-23 17:00:00	5.996685743	52.71731398	58.72414907
06-Jun-23 18:00:00	5.998805364	53.18709278	59.18926504
06-Jun-23 19:00:00	6.013628774	52.47144233	58.48902914
06-Jun-23 20:00:00	6.068998973	52.26790661	58.35950322
06-Jun-23 21:00:00	6.084472762	52.41364182	58.51515834

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
06-Jun-23 22:00:00	6.091396173	52.70415391	58.79127863
06-Jun-23 23:00:00	6.08780298	53.10575655	59.20060772
07-Jun-23 00:00:00	6.076394531	52.75485187	58.83516269
07-Jun-23 01:00:00	6.113119809	52.84210597	58.95894976
07-Jun-23 02:00:00	5.991446283	52.86107402	58.86304347
07-Jun-23 03:00:00	6.014364958	52.85257297	58.86094411
07-Jun-23 04:00:00	5.991843727	52.92071724	58.92346276
07-Jun-23 05:00:00	5.99847375	53.17566893	59.16997125
07-Jun-23 06:00:00	6.087500148	53.67688709	59.75990423
07-Jun-23 07:00:00	6.009168095	53.64055766	59.64677281
07-Jun-23 08:00:00	6.010616188	53.54108598	59.54227172
07-Jun-23 09:00:00	6.004768689	53.35729366	59.36072752
07-Jun-23 10:00:00	6.001600327	53.33283001	59.33663262
07-Jun-23 11:00:00	6.005871163	53.52677578	59.51681561
07-Jun-23 12:00:00	6.112595148	53.45998753	59.56246758
07-Jun-23 13:00:00	6.078480959	53.56806978	59.65170309
07-Jun-23 14:00:00	6.082040548	53.57756858	59.66027095
07-Jun-23 15:00:00	6.095892747	53.38754039	59.47763591
07-Jun-23 16:00:00	6.101382414	53.32150057	59.43712319
07-Jun-23 17:00:00	6.160574012	53.48889754	59.65324847
07-Jun-23 18:00:00	6.034391244	53.42026901	59.44495985
07-Jun-23 19:00:00	6.075900661	53.32429038	59.42590819
07-Jun-23 20:00:00	6.08258348	53.22663562	59.31287893
07-Jun-23 21:00:00	6.093999439	53.2166055	59.31152301
07-Jun-23 22:00:00	6.155285199	53.33222569	59.52885755
07-Jun-23 23:00:00	6.088949124	53.15339597	59.24016783
08-Jun-23 00:00:00	6.038366079	53.22138437	59.23394754
08-Jun-23 01:00:00	6.098779519	53.17465761	59.29345491
08-Jun-23 02:00:00	6.090286122	53.20492066	59.29692501
08-Jun-23 03:00:00	6.098368141	52.88725344	58.98571248
08-Jun-23 04:00:00	7.238263413	52.97907427	60.21701304
08-Jun-23 05:00:00	7.585025258	52.97473462	60.56260978
08-Jun-23 06:00:00	7.724971897	52.96355014	60.68994983
08-Jun-23 07:00:00	7.710647689	53.12704892	60.83855629
08-Jun-23 08:00:00	7.716131952	52.99082163	60.69282511
08-Jun-23 09:00:00	7.062040395	53.09864638	60.17477028
08-Jun-23 10:00:00	6.161938084	52.98013857	59.15118557
08-Jun-23 11:00:00	6.226278994	53.00689401	59.22622511
08-Jun-23 12:00:00	6.218501541	52.90211953	59.11633152
08-Jun-23 13:00:00	6.219587273	53.15985235	59.38692474
08-Jun-23 14:00:00	6.605383025	53.1936779	59.80525377
08-Jun-23 15:00:00	7.921565294	53.17948454	61.10100269
08-Jun-23 16:00:00	6.419772466	53.24356786	59.66917192

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
08-Jun-23 17:00:00	6.433746179	53.23366197	59.68376329
08-Jun-23 18:00:00	6.43184336	52.99283367	59.44028282
08-Jun-23 19:00:00	6.431116978	52.81918165	59.23621602
08-Jun-23 20:00:00	6.426444583	52.77828471	59.20844279
08-Jun-23 21:00:00	8.886259079	52.75579368	61.63820012
08-Jun-23 22:00:00	9.809171173	52.72069465	62.52771441
08-Jun-23 23:00:00	9.838171888	52.98769866	62.82774162
09-Jun-23 00:00:00	9.805354436	53.20637767	63.0008155
09-Jun-23 01:00:00	10.56767225	53.640497	64.20199246
09-Jun-23 02:00:00	11.77559418	53.49509451	65.26134025
09-Jun-23 03:00:00	12.11948236	53.67804803	65.79549436
09-Jun-23 04:00:00	12.11628107	58.60730913	70.71807543
09-Jun-23 05:00:00	12.14510043	60.68673833	72.83067915
09-Jun-23 06:00:00	12.12877745	60.83515252	72.94692273
09-Jun-23 07:00:00	26.15922377	60.96791458	87.12508096
09-Jun-23 08:00:00	26.86921353	61.01635138	87.87671661
09-Jun-23 09:00:00	27.49841171	60.6179213	88.122368
09-Jun-23 10:00:00	27.48576811	59.99664455	87.48217773
09-Jun-23 11:00:00	27.53793928	60.61373096	88.15240945
09-Jun-23 12:00:00	27.80806202	61.21458944	89.0244111
09-Jun-23 13:00:00	27.83511734	61.11324819	88.93844859
09-Jun-23 14:00:00	26.76122856	61.09984652	87.86456553
09-Jun-23 15:00:00	26.68358644	60.22765186	86.99808502
09-Jun-23 16:00:00	26.71690167	60.00359811	86.71343019
09-Jun-23 17:00:00	27.15619776	59.589961	86.74860594
09-Jun-23 18:00:00	28.65871239	59.70514234	88.34460661
09-Jun-23 19:00:00	29.16858832	59.81127527	88.99225489
09-Jun-23 20:00:00	29.65266683	60.13410801	89.7843914
09-Jun-23 21:00:00	29.6933279	60.23608928	89.9400035
09-Jun-23 22:00:00	29.61546485	60.19639375	89.81166048
09-Jun-23 23:00:00	27.74587875	60.35762596	88.10668733
10-Jun-23 00:00:00	27.41845756	60.3957208	87.81883409
10-Jun-23 01:00:00	26.3750302	60.19115787	86.57724677
10-Jun-23 02:00:00	26.48598406	60.09638786	86.57529873
10-Jun-23 03:00:00	26.4407498	59.94997385	86.39087211
10-Jun-23 04:00:00	27.87465906	59.91518077	87.80512492
10-Jun-23 05:00:00	28.93799273	59.78863462	88.71519809
10-Jun-23 06:00:00	27.77314727	59.85327466	87.62453334
10-Jun-23 07:00:00	27.60079575	60.198182	87.78606457
10-Jun-23 08:00:00	27.57401936	60.21228896	87.78049427
10-Jun-23 09:00:00	27.41396756	60.41972499	87.82061895
10-Jun-23 10:00:00	27.12908512	60.49128342	87.65442657
10-Jun-23 11:00:00	27.16233932	60.56837548	87.71776199

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
10-Jun-23 12:00:00	27.5668637	60.20962567	87.78090329
10-Jun-23 13:00:00	27.53843562	60.07468647	87.6142807
10-Jun-23 14:00:00	27.53167142	59.59869194	87.1360143
10-Jun-23 15:00:00	28.67022864	59.35837788	88.00723436
10-Jun-23 16:00:00	29.58360555	59.18329938	88.78030417
10-Jun-23 17:00:00	30.37283749	56.13591777	86.51167721
10-Jun-23 18:00:00	30.34081237	29.37024869	59.72136688
10-Jun-23 19:00:00	30.26438565	28.73482259	59.02137947
10-Jun-23 20:00:00	28.69551728	28.83465852	57.50457213
10-Jun-23 21:00:00	26.38263289	28.82004907	55.20842425
10-Jun-23 22:00:00	26.32167223	28.87143372	55.18008112
10-Jun-23 23:00:00	26.11072127	28.17578841	54.30067868
11-Jun-23 00:00:00	26.07574071	27.85685603	53.93343586
11-Jun-23 01:00:00	26.18844954	27.26070351	53.45491515
11-Jun-23 02:00:00	26.8966608	27.28765335	54.16845767
11-Jun-23 03:00:00	27.01426114	27.27002234	54.27614382
11-Jun-23 04:00:00	27.23576344	27.44577832	54.68045733
11-Jun-23 05:00:00	27.20823574	27.63872359	54.85168415
11-Jun-23 06:00:00	27.21268601	27.33100096	54.54292954
11-Jun-23 07:00:00	26.97381454	27.00952657	53.95723724
11-Jun-23 08:00:00	26.72971164	26.96399434	53.66556062
11-Jun-23 09:00:00	27.4225005	27.00386913	54.43244871
11-Jun-23 10:00:00	27.35160997	27.76148436	55.11404885
11-Jun-23 11:00:00	27.37699117	27.91961193	55.29583931
11-Jun-23 12:00:00	27.40580707	28.19993326	55.60998472
11-Jun-23 13:00:00	27.30837462	28.29491398	55.59567875
11-Jun-23 14:00:00	27.41593424	28.26151254	55.68007194
11-Jun-23 15:00:00	27.17929607	28.13001567	55.29664531
11-Jun-23 16:00:00	27.23098575	27.77430942	55.01937633
11-Jun-23 17:00:00	27.30195204	27.86536429	55.15759765
11-Jun-23 18:00:00	27.06182861	27.78544786	54.83150631
11-Jun-23 19:00:00	27.11961884	27.71331933	54.84854349
11-Jun-23 20:00:00	26.43790552	27.69893056	54.13175297
11-Jun-23 21:00:00	26.51503923	27.87151718	54.39805709
11-Jun-23 22:00:00	26.49193817	28.15970908	54.67194218
11-Jun-23 23:00:00	27.14641253	28.54091259	55.68139966
12-Jun-23 00:00:00	27.50602743	28.55283621	56.07310486
12-Jun-23 01:00:00	27.3593945	28.5404067	55.91824849
12-Jun-23 02:00:00	27.29771392	27.72958713	55.03350018
12-Jun-23 03:00:00	27.35997825	27.83036412	55.1931822
12-Jun-23 04:00:00	27.33545452	28.32175318	55.67149819
12-Jun-23 05:00:00	27.37570371	28.42947961	55.76660305
12-Jun-23 06:00:00	27.97235086	28.38521758	56.3564095

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
12-Jun-23 07:00:00	28.22585954	27.93974378	56.15967235
12-Jun-23 08:00:00	28.31805113	27.65260824	55.96425939
12-Jun-23 09:00:00	28.35362392	28.17785284	56.51554553
12-Jun-23 10:00:00	27.37328826	28.49319839	55.8642949
12-Jun-23 11:00:00	27.36370839	28.42355739	55.76867125
12-Jun-23 12:00:00	26.94867282	28.39936126	55.3235213
12-Jun-23 13:00:00	26.95035754	27.5669484	54.51834297
12-Jun-23 14:00:00	26.91429435	27.7910596	54.70435397
12-Jun-23 15:00:00	27.0370867	28.31896745	55.34667672
12-Jun-23 16:00:00	27.76516204	28.33563254	56.10354148
12-Jun-23 17:00:00	27.56882964	28.42872681	55.94943767
12-Jun-23 18:00:00	27.8541583	27.79284106	55.63095404
12-Jun-23 19:00:00	27.8860747	27.70343574	55.58552371
12-Jun-23 20:00:00	27.65309535	27.97094824	55.61936915
12-Jun-23 21:00:00	27.49363083	28.00028663	55.46833526
12-Jun-23 22:00:00	27.32843198	27.95752822	55.28159231
12-Jun-23 23:00:00	27.74188317	27.78109638	55.54341698
13-Jun-23 00:00:00	27.75642851	27.726678	55.48921627
13-Jun-23 01:00:00	27.72625213	27.51919736	55.23281436
13-Jun-23 02:00:00	27.95921601	27.38476565	55.32986076
13-Jun-23 03:00:00	27.59670628	27.35178449	54.95735296
13-Jun-23 04:00:00	27.63815806	27.37351478	55.01672872
13-Jun-23 05:00:00	27.68760003	27.61923578	55.31295257
13-Jun-23 06:00:00	27.61044153	27.64696746	55.24737337
13-Jun-23 07:00:00	27.51406331	28.2474272	55.75142754
13-Jun-23 08:00:00	27.65160762	28.30461649	55.96152263
13-Jun-23 09:00:00	27.1563762	28.34358162	55.47729969
13-Jun-23 10:00:00	27.09152985	27.6462964	54.73595958
13-Jun-23 11:00:00	27.02799363	27.47475094	54.47118696
13-Jun-23 12:00:00	26.96145545	27.9108857	54.88470544
13-Jun-23 13:00:00	27.17724853	27.92758061	55.05699391
13-Jun-23 14:00:00	27.21649594	27.88245095	55.0776488
13-Jun-23 15:00:00	27.46427949	27.68113783	55.13886261
13-Jun-23 16:00:00	27.40991815	27.52055253	54.90968408
13-Jun-23 17:00:00	27.3569905	27.37114334	54.72822412
13-Jun-23 18:00:00	27.7516399	27.04992203	54.81286977
13-Jun-23 19:00:00	27.8420266	27.05377589	54.90054342
13-Jun-23 20:00:00	28.26862378	27.08363236	55.35627344
13-Jun-23 21:00:00	28.18527476	27.45046266	55.65284008
13-Jun-23 22:00:00	28.25814046	27.60346692	55.86342971
13-Jun-23 23:00:00	27.98589961	27.47678436	55.473391
14-Jun-23 00:00:00	27.39699713	27.51402504	54.88351186
14-Jun-23 01:00:00	27.57351134	27.43610446	55.00685088

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
14-Jun-23 02:00:00	27.32581033	27.51259518	54.83702109
14-Jun-23 03:00:00	27.2643794	27.55668386	54.82537778
14-Jun-23 04:00:00	27.27699248	27.40358586	54.67421299
14-Jun-23 05:00:00	27.51533498	27.25090988	54.75871446
14-Jun-23 06:00:00	27.34325769	27.27061378	54.6234578
14-Jun-23 07:00:00	27.86693308	27.42271593	55.29965634
14-Jun-23 08:00:00	27.75785711	27.49836466	55.24282434
14-Jun-23 09:00:00	27.84932666	27.89487584	55.76173931
14-Jun-23 10:00:00	27.9288701	28.49915966	56.42171372
14-Jun-23 11:00:00	27.70136452	28.537737	56.20498689
14-Jun-23 12:00:00	28.08589405	28.50615512	56.59599347
14-Jun-23 13:00:00	28.10221068	27.7175737	55.81273418
14-Jun-23 14:00:00	28.09542285	27.51886691	55.61667506
14-Jun-23 15:00:00	28.03914833	27.11929558	55.13034736
14-Jun-23 16:00:00	27.42162609	27.05543848	54.47285525
14-Jun-23 17:00:00	27.76274427	27.04305585	54.81001727
14-Jun-23 18:00:00	27.81942389	27.54792383	55.3780134
14-Jun-23 19:00:00	27.79076396	27.51517328	55.30360497
14-Jun-23 20:00:00	27.86919933	27.26113733	55.13835769
14-Jun-23 21:00:00	27.60017257	27.24933571	54.85878298
14-Jun-23 22:00:00	27.59631464	27.29981162	54.86498123
14-Jun-23 23:00:00	27.21750938	27.32133619	54.57502768
15-Jun-23 00:00:00	27.23453342	27.39067343	54.63935237
15-Jun-23 01:00:00	27.26242828	27.40941546	54.66867765
15-Jun-23 02:00:00	27.18472057	27.15074025	54.32846055
15-Jun-23 03:00:00	27.87482972	27.15381753	55.02007357
15-Jun-23 04:00:00	27.81937483	27.07988622	54.90159112
15-Jun-23 05:00:00	27.94567257	27.59929403	55.53214306
15-Jun-23 06:00:00	27.95529842	27.50687589	55.4600597
15-Jun-23 07:00:00	27.8107374	28.60638195	56.40269746
15-Jun-23 08:00:00	27.50913016	28.49731414	55.99335289
15-Jun-23 09:00:00	27.5372769	28.51286093	56.06581836
15-Jun-23 10:00:00	27.79941294	28.31433726	56.11295185
15-Jun-23 11:00:00	27.88040966	27.58850649	55.47590468
15-Jun-23 12:00:00	27.82154867	28.14978155	55.99985144
15-Jun-23 13:00:00	27.8498906	28.64933867	56.48722988
15-Jun-23 14:00:00	27.80224027	28.67438189	56.48668077
15-Jun-23 15:00:00	27.44354661	28.59017987	56.04952982
15-Jun-23 16:00:00	27.42977598	27.67737664	55.1000309
15-Jun-23 17:00:00	27.45139005	27.49567233	54.94689613
15-Jun-23 18:00:00	27.30975819	27.26473639	54.58086904
15-Jun-23 19:00:00	27.70341921	27.26119624	54.95821741
15-Jun-23 20:00:00	27.4213882	27.21434325	54.60979472

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
15-Jun-23 21:00:00	27.55180242	27.63261633	55.16758357
15-Jun-23 22:00:00	27.51638603	27.55439112	55.08596569
15-Jun-23 23:00:00	27.45189752	27.11644072	54.54680845
16-Jun-23 00:00:00	27.56116856	27.11020973	54.66387484
16-Jun-23 01:00:00	27.2242314	27.17565616	54.38432757
16-Jun-23 02:00:00	27.44408692	27.17274801	54.621039
16-Jun-23 03:00:00	27.37697411	27.34849146	54.74090272
16-Jun-23 04:00:00	27.36869007	27.61572732	54.9884118
16-Jun-23 05:00:00	27.68210263	27.58124137	55.25339868
16-Jun-23 06:00:00	27.8319806	27.58879192	55.42831612
16-Jun-23 07:00:00	27.81916693	27.47498533	55.30038198
16-Jun-23 08:00:00	27.72011895	27.51141299	55.19539028
16-Jun-23 09:00:00	27.68864897	27.29364671	54.98609204
16-Jun-23 10:00:00	27.60189395	27.87787321	55.47326907
16-Jun-23 11:00:00	27.46238486	27.82524681	55.28055573
16-Jun-23 12:00:00	27.36183283	27.87676867	55.20958116
16-Jun-23 13:00:00	27.0641116	27.72887084	54.78493373
16-Jun-23 14:00:00	27.01337528	27.21824741	54.22293854
16-Jun-23 15:00:00	27.01640903	27.0823386	54.08611202
16-Jun-23 16:00:00	27.6382601	27.07099009	54.65983832
16-Jun-23 17:00:00	27.78859064	27.05898977	54.81947567
16-Jun-23 18:00:00	28.02811782	27.0888716	55.15777609
16-Jun-23 19:00:00	28.02675194	27.31276141	55.33232533
16-Jun-23 20:00:00	27.94264264	27.38812563	55.32428084
16-Jun-23 21:00:00	27.85530217	27.57581213	55.41653972
16-Jun-23 22:00:00	27.68470807	27.5198208	55.19425329
16-Jun-23 23:00:00	28.52054999	27.51945962	56.03196886
17-Jun-23 00:00:00	28.69099617	27.59905963	56.31340839
17-Jun-23 01:00:00	28.68419006	27.24945874	55.94066577
17-Jun-23 02:00:00	28.65346728	27.27702766	55.94957627
17-Jun-23 03:00:00	27.75342655	27.3139197	55.06731415
17-Jun-23 04:00:00	27.4481873	27.34241705	54.79848353
17-Jun-23 05:00:00	26.74186929	27.54557088	54.27530543
17-Jun-23 06:00:00	26.75723055	27.24556446	54.01129712
17-Jun-23 07:00:00	26.8637743	27.16349644	54.03653653
17-Jun-23 08:00:00	27.50362947	27.27378835	54.77445317
17-Jun-23 09:00:00	27.92822531	27.25124111	55.17677392
17-Jun-23 10:00:00	27.38751613	27.30185562	54.68850136
17-Jun-23 11:00:00	27.3254296	27.36620532	54.68999481
17-Jun-23 12:00:00	27.41932954	27.20601665	54.61535083
17-Jun-23 13:00:00	27.31476953	27.33972903	54.65035333
17-Jun-23 14:00:00	27.58942689	27.28766388	54.89109371
17-Jun-23 15:00:00	27.39876005	27.36153403	54.73275545

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
17-Jun-23 16:00:00	27.494078	27.4531481	54.96076012
17-Jun-23 17:00:00	27.56776365	27.28552235	54.84944619
17-Jun-23 18:00:00	27.61163118	27.37566397	55.01575173
17-Jun-23 19:00:00	27.83197763	27.40860608	55.22483324
17-Jun-23 20:00:00	27.91221322	27.43179146	55.33734311
17-Jun-23 21:00:00	27.88062859	27.36757008	55.25938299
17-Jun-23 22:00:00	27.9232111	27.34143077	55.27720381
17-Jun-23 23:00:00	27.98990991	27.47873751	55.45765728
18-Jun-23 00:00:00	27.60073927	27.72239706	55.31479763
18-Jun-23 01:00:00	27.79988617	27.68257364	55.46250576
18-Jun-23 02:00:00	27.58919017	27.69341479	55.27176751
18-Jun-23 03:00:00	27.59305244	27.46277957	55.06022241
18-Jun-23 04:00:00	27.55757692	27.20439508	54.74983724
18-Jun-23 05:00:00	27.47068882	27.18441963	54.64828459
18-Jun-23 06:00:00	27.74734995	27.20939228	54.96218554
18-Jun-23 07:00:00	27.30715826	27.2737396	54.57173178
18-Jun-23 08:00:00	27.45716243	27.26799456	54.72900099
18-Jun-23 09:00:00	27.43387455	27.33199151	54.76657391
18-Jun-23 10:00:00	27.39851623	27.00044039	54.39866172
18-Jun-23 11:00:00	27.84699249	27.0213072	54.8334323
18-Jun-23 12:00:00	27.6994498	27.04976379	54.75065994
18-Jun-23 13:00:00	28.21498426	27.06770738	55.30687707
18-Jun-23 14:00:00	28.17117257	27.36222114	55.53309864
18-Jun-23 15:00:00	28.12013457	27.23887532	55.37540245
18-Jun-23 16:00:00	27.84806188	27.04772838	54.90141847
18-Jun-23 17:00:00	27.48885102	26.98408831	54.50180372
18-Jun-23 18:00:00	27.53600385	27.0076491	54.53794691
18-Jun-23 19:00:00	27.47693253	27.51349396	54.96271027
18-Jun-23 20:00:00	27.30491691	27.3721803	54.65170648
18-Jun-23 21:00:00	27.64862368	27.04420927	54.72370783
18-Jun-23 22:00:00	27.87972991	27.00673493	54.89551777
18-Jun-23 23:00:00	27.40869406	27.06960773	54.45297517
19-Jun-23 00:00:00	27.28124724	27.24929455	54.50979018
19-Jun-23 01:00:00	27.16051706	27.54871559	54.70371395
19-Jun-23 02:00:00	27.22111861	27.25608889	54.47417747
19-Jun-23 03:00:00	27.72478792	27.27738635	55.02566698
19-Jun-23 04:00:00	27.75540331	27.21281433	54.96100362
19-Jun-23 05:00:00	28.27839883	27.2272253	55.49412749
19-Jun-23 06:00:00	28.21082581	27.64642567	55.86740292
19-Jun-23 07:00:00	28.18413936	28.05022038	56.22785717
19-Jun-23 08:00:00	28.10087628	28.8011891	56.89548408
19-Jun-23 09:00:00	27.46770318	28.82042353	56.26483727
19-Jun-23 10:00:00	28.02592977	28.83457237	56.86092122

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
19-Jun-23 11:00:00	27.98018551	28.02407551	55.99280237
19-Jun-23 12:00:00	27.94436804	27.56296062	55.51739269
19-Jun-23 13:00:00	28.08569749	27.8254891	55.92352931
19-Jun-23 14:00:00	27.90114869	27.88311609	55.77082141
19-Jun-23 15:00:00	27.96415403	27.85974232	55.79746763
19-Jun-23 16:00:00	28.17770407	27.66706159	55.84240193
19-Jun-23 17:00:00	28.10045836	27.45759678	55.55940946
19-Jun-23 18:00:00	28.16331673	26.83879926	54.99757449
19-Jun-23 19:00:00	27.7274705	26.74120055	54.44150543
19-Jun-23 20:00:00	27.80578126	26.70997439	54.49600644
19-Jun-23 21:00:00	27.8557948	26.83449894	54.65556823
19-Jun-23 22:00:00	27.81034046	27.46307151	55.28675546
19-Jun-23 23:00:00	27.86517896	27.41312355	55.26822207
20-Jun-23 00:00:00	27.83342118	27.08492057	54.90629917
20-Jun-23 01:00:00	27.92458714	27.09077072	55.04237885
20-Jun-23 02:00:00	27.95004749	27.1097883	55.07710732
20-Jun-23 03:00:00	27.98743184	27.47345596	55.45064396
20-Jun-23 04:00:00	27.99748262	27.40495661	55.40570217
20-Jun-23 05:00:00	27.99701267	26.9300607	54.93739404
20-Jun-23 06:00:00	27.9434203	26.9578455	54.91605971
20-Jun-23 07:00:00	27.94315635	26.85665215	54.78843202
20-Jun-23 08:00:00	27.65940264	27.3419435	54.98848767
20-Jun-23 09:00:00	27.75563463	27.27994484	55.04563438
20-Jun-23 10:00:00	27.72459655	26.97716459	54.69964303
20-Jun-23 11:00:00	27.57467333	26.67847379	54.24110031
20-Jun-23 12:00:00	27.60615306	26.72019482	54.33068805
20-Jun-23 13:00:00	26.96773656	26.70652086	53.69021204
20-Jun-23 14:00:00	27.00377284	27.26958031	54.27652804
20-Jun-23 15:00:00	27.06899622	27.34716829	54.40152317
20-Jun-23 16:00:00	27.0839404	26.9330634	53.99084875
20-Jun-23 17:00:00	27.97203414	26.93765704	54.91882918
20-Jun-23 18:00:00	27.70522552	26.92966694	54.62427775
20-Jun-23 19:00:00	27.74439483	27.29130508	55.03725137
20-Jun-23 20:00:00	27.75843589	27.30599785	55.07358636
20-Jun-23 21:00:00	27.68174998	27.04752986	54.71921716
20-Jun-23 22:00:00	27.8165973	26.99086387	54.80986298
20-Jun-23 23:00:00	27.88051923	26.99637593	54.8725711
21-Jun-23 00:00:00	28.66081206	27.16092992	55.79961862
21-Jun-23 01:00:00	28.66154512	27.18953101	55.84666676
21-Jun-23 02:00:00	28.59999392	27.34588867	55.96339777
21-Jun-23 03:00:00	28.13972802	27.22457208	55.3463086
21-Jun-23 04:00:00	27.49467553	27.26501034	54.76542706
21-Jun-23 05:00:00	27.91715082	27.2475995	55.15985235

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
21-Jun-23 06:00:00	27.90862242	27.10249223	55.01909447
21-Jun-23 07:00:00	27.93595537	27.23647669	55.18478648
21-Jun-23 08:00:00	27.9181616	27.15116702	55.06252268
21-Jun-23 09:00:00	27.76873896	27.11414822	54.89639897
21-Jun-23 10:00:00	27.52333238	27.02794912	54.59804153
21-Jun-23 11:00:00	27.05911244	27.47367004	54.53348062
21-Jun-23 12:00:00	26.98048411	27.27385553	54.24893485
21-Jun-23 13:00:00	26.94962745	27.29413838	54.25379456
21-Jun-23 14:00:00	27.40424559	27.28614012	54.69976605
21-Jun-23 15:00:00	27.56493261	27.27973352	54.87776015
21-Jun-23 16:00:00	28.04865611	27.44353072	55.47367492
21-Jun-23 17:00:00	27.99207889	26.99696848	54.98511145
21-Jun-23 18:00:00	27.95311885	27.51249073	55.47578232
21-Jun-23 19:00:00	27.99780687	27.6013795	55.58289231
21-Jun-23 20:00:00	27.7270565	27.65183454	55.35763868
21-Jun-23 21:00:00	28.15507465	27.56741593	55.73101086
21-Jun-23 22:00:00	28.31646326	27.53804106	55.8561946
21-Jun-23 23:00:00	28.25552135	27.2102392	55.46859805
22-Jun-23 00:00:00	28.3048261	27.3512249	55.6486507
22-Jun-23 01:00:00	27.68993399	27.25928031	54.95467101
22-Jun-23 02:00:00	27.62579377	27.31937695	54.93706852
22-Jun-23 03:00:00	27.13694043	27.29597722	54.42634371
22-Jun-23 04:00:00	27.09562079	27.29372162	54.40615866
22-Jun-23 05:00:00	27.13372803	27.4732843	54.59587097
22-Jun-23 06:00:00	27.10902362	27.70807076	54.79293844
22-Jun-23 07:00:00	27.48988014	27.74315474	55.2060851
22-Jun-23 08:00:00	27.04037137	27.70381202	54.72595088
22-Jun-23 09:00:00	26.98690584	27.30643823	54.28735373
22-Jun-23 10:00:00	27.02212789	27.36402819	54.39815966
22-Jun-23 11:00:00	27.21007337	28.03706617	55.26284324
22-Jun-23 12:00:00	27.68424744	28.01600409	55.68591754
22-Jun-23 13:00:00	27.46503046	27.9851071	55.45033243
22-Jun-23 14:00:00	27.55221049	27.59622353	55.12124443
22-Jun-23 15:00:00	27.54074828	27.31444232	54.86014133
22-Jun-23 16:00:00	27.59926128	28.20766555	55.79384592
22-Jun-23 17:00:00	27.79939302	28.28174146	56.08690113
22-Jun-23 18:00:00	27.87932417	28.3131059	56.20160082
22-Jun-23 19:00:00	28.03225009	28.01282801	56.06758345
22-Jun-23 20:00:00	27.97695086	27.47506036	55.44714758
22-Jun-23 21:00:00	27.98294502	26.83778487	54.82265536
22-Jun-23 22:00:00	27.83409627	26.78611621	54.61985991
22-Jun-23 23:00:00	27.47855812	26.74073009	54.22616471
23-Jun-23 00:00:00	27.40402603	26.66096942	54.07713085

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
23-Jun-23 01:00:00	27.3527583	27.48607201	54.85044048
23-Jun-23 02:00:00	27.33145438	27.15249051	54.47866249
23-Jun-23 03:00:00	27.43324354	27.33965224	54.76852791
23-Jun-23 04:00:00	27.69704268	27.23820845	54.96204662
23-Jun-23 05:00:00	27.44210943	27.30919584	54.7534807
23-Jun-23 06:00:00	27.34893756	27.26191249	54.62394316
23-Jun-23 07:00:00	27.34229607	27.28850301	54.61646822
23-Jun-23 08:00:00	27.31466166	27.71506175	55.03152953
23-Jun-23 09:00:00	27.39803092	27.79847301	55.19292005
23-Jun-23 10:00:00	27.53691928	27.85653526	55.40017743
23-Jun-23 11:00:00	27.80909061	27.67909808	55.47963058
23-Jun-23 12:00:00	27.83084668	27.25555229	55.08359602
23-Jun-23 13:00:00	27.81074789	26.87390465	54.6798581
23-Jun-23 14:00:00	27.77352746	26.72261408	54.51504283
23-Jun-23 15:00:00	27.90298006	26.44767072	54.36786355
23-Jun-23 16:00:00	27.86707083	26.47173256	54.34012392
23-Jun-23 17:00:00	27.8858242	26.54438506	54.40667301
23-Jun-23 18:00:00	27.84321704	27.43275809	55.28968302
23-Jun-23 19:00:00	27.93887011	29.1627548	57.10318269
23-Jun-23 20:00:00	27.9843039	29.24532583	57.25217268
23-Jun-23 21:00:00	27.9337412	29.26040098	57.1850641
23-Jun-23 22:00:00	27.894111	29.31448476	57.18276024
23-Jun-23 23:00:00	27.87625843	29.20146794	57.06925837
24-Jun-23 00:00:00	29.28512817	29.0486216	58.34812595
24-Jun-23 01:00:00	29.36350918	27.41516198	56.78943295
24-Jun-23 02:00:00	29.30860795	27.37649554	56.68239982
24-Jun-23 03:00:00	28.69743337	27.48949782	56.18631766
24-Jun-23 04:00:00	27.77455171	27.51887847	55.28117646
24-Jun-23 05:00:00	27.53772863	27.57632849	55.089134
24-Jun-23 06:00:00	27.62895001	27.09682507	54.70983428
24-Jun-23 07:00:00	27.5880358	27.04225201	54.63911745
24-Jun-23 08:00:00	27.65473917	27.35983573	55.03392898
24-Jun-23 09:00:00	27.4201178	27.43246471	54.83842002
24-Jun-23 10:00:00	27.26317226	27.37605741	54.63870186
24-Jun-23 11:00:00	27.63727972	27.36302549	55.00870736
24-Jun-23 12:00:00	27.66882367	27.02677155	54.70747778
24-Jun-23 13:00:00	27.58243773	27.13352458	54.68429608
24-Jun-23 14:00:00	27.79348299	26.91061557	54.69226858
24-Jun-23 15:00:00	27.6220505	26.91062609	54.55694834
24-Jun-23 16:00:00	28.08733749	26.954191	55.05391831
24-Jun-23 17:00:00	28.12899886	27.03289975	55.15806262
24-Jun-23 18:00:00	28.14176189	26.91262839	55.05182711
24-Jun-23 19:00:00	27.93812762	26.08788713	54.01913751

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
24-Jun-23 20:00:00	27.54425589	26.14538882	53.67825826
24-Jun-23 21:00:00	27.5324617	26.0957924	53.66449038
24-Jun-23 22:00:00	27.04869631	26.82245647	53.87357288
24-Jun-23 23:00:00	27.10752413	27.03554832	54.13059722
25-Jun-23 00:00:00	27.1077706	26.8373883	53.94479614
25-Jun-23 01:00:00	27.49759748	26.83429919	54.31820382
25-Jun-23 02:00:00	27.26183552	26.744405	54.01169883
25-Jun-23 03:00:00	26.3976326	26.91838429	53.28024101
25-Jun-23 04:00:00	26.39936299	27.17534182	53.56575351
25-Jun-23 05:00:00	26.42998823	27.31874567	53.7223409
25-Jun-23 06:00:00	27.11033715	27.63158345	54.76788033
25-Jun-23 07:00:00	27.64157528	27.71554777	55.36063569
25-Jun-23 08:00:00	27.52616893	27.73076107	55.25521321
25-Jun-23 09:00:00	27.55571148	27.29256079	54.8363035
25-Jun-23 10:00:00	27.58269829	27.04615646	54.62169626
25-Jun-23 11:00:00	27.41114161	26.39663124	53.81906912
25-Jun-23 12:00:00	27.40335454	26.45952081	53.8436369
25-Jun-23 13:00:00	27.80908955	26.38214538	54.18924756
25-Jun-23 14:00:00	28.16003821	26.77595776	54.94252502
25-Jun-23 15:00:00	28.19066313	27.1538425	55.32995351
25-Jun-23 16:00:00	28.13020579	26.74378204	54.87089327
25-Jun-23 17:00:00	27.75718922	26.57045068	54.32504696
25-Jun-23 18:00:00	27.82364782	26.66154905	54.48644002
25-Jun-23 19:00:00	26.73717499	26.69750712	53.43213124
25-Jun-23 20:00:00	26.76949024	27.13837263	53.91725498
25-Jun-23 21:00:00	26.84433164	27.03991063	53.88269022
25-Jun-23 22:00:00	27.07194487	27.40759546	54.47441758
25-Jun-23 23:00:00	27.78379313	27.44630792	55.22020531
26-Jun-23 00:00:00	27.31020016	27.41317954	54.74058363
26-Jun-23 01:00:00	27.4245029	27.25110176	54.6627602
26-Jun-23 02:00:00	27.40510305	27.09432803	54.50271903
26-Jun-23 03:00:00	27.41686461	26.81606526	54.245596
26-Jun-23 04:00:00	27.55361387	26.79736445	54.35489718
26-Jun-23 05:00:00	27.31580872	26.77099609	54.08399391
26-Jun-23 06:00:00	27.72559611	26.93818099	54.67380375
26-Jun-23 07:00:00	27.77793524	27.17331978	54.94882485
26-Jun-23 08:00:00	27.64454863	26.79032485	54.428609
26-Jun-23 09:00:00	27.90247292	26.79126612	54.68285878
26-Jun-23 10:00:00	27.63243749	26.84204958	54.47237608
26-Jun-23 11:00:00	27.87723478	26.86293856	54.73270607
26-Jun-23 12:00:00	27.84704283	27.33412572	55.16978737
26-Jun-23 13:00:00	27.81135972	27.28585699	55.1046257
26-Jun-23 14:00:00	27.73890246	27.14520522	54.88434639

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
26-Jun-23 15:00:00	27.56379731	27.14011881	54.73035685
26-Jun-23 16:00:00	27.40296883	27.07318189	54.45453284
26-Jun-23 17:00:00	27.26337306	27.53058985	54.7892952
26-Jun-23 18:00:00	27.25963698	27.20696269	54.46196853
26-Jun-23 19:00:00	27.21840986	26.78754584	54.00744247
26-Jun-23 20:00:00	27.52229224	26.64541406	54.18985854
26-Jun-23 21:00:00	27.23883968	26.70618237	53.96053738
26-Jun-23 22:00:00	27.25369898	27.00074115	54.26068086
26-Jun-23 23:00:00	27.3413283	26.94026226	54.28542307
27-Jun-23 00:00:00	27.24327437	27.31321102	54.56052632
27-Jun-23 01:00:00	27.485553	27.26040603	54.71822845
27-Jun-23 02:00:00	27.67094866	27.26624054	54.96512455
27-Jun-23 03:00:00	27.98227787	27.22436635	55.21454204
27-Jun-23 04:00:00	28.00963529	27.05791113	55.05562189
27-Jun-23 05:00:00	27.96544107	27.07639196	55.04773543
27-Jun-23 06:00:00	27.77883646	27.5584738	55.34251538
27-Jun-23 07:00:00	27.52748076	27.47936704	55.02136697
27-Jun-23 08:00:00	27.7420614	27.50034885	55.23055458
27-Jun-23 09:00:00	27.44393211	27.40806633	54.86391207
27-Jun-23 10:00:00	27.36914794	26.97558933	54.35686154
27-Jun-23 11:00:00	27.45142852	26.38943365	53.825865
27-Jun-23 12:00:00	27.82722971	26.30548509	54.16272036
27-Jun-23 13:00:00	27.40468555	26.33329582	53.7322536
27-Jun-23 14:00:00	26.4463252	26.59522435	53.08252441
27-Jun-23 15:00:00	26.44635095	27.05722978	53.51170095
27-Jun-23 16:00:00	26.53074148	26.89769141	53.43297026
27-Jun-23 17:00:00	27.05371888	26.8350748	53.88137208
27-Jun-23 18:00:00	27.88524479	26.76114205	54.70060518
27-Jun-23 19:00:00	27.57477697	26.75587103	54.34090939
27-Jun-23 20:00:00	27.68839158	27.15629355	54.84483888
27-Jun-23 21:00:00	27.77417077	27.07481904	54.85699251
27-Jun-23 22:00:00	27.55120585	26.91566909	54.44081709
27-Jun-23 23:00:00	27.56325097	26.88037376	54.49348513
28-Jun-23 00:00:00	27.66291396	26.93148941	54.566313
28-Jun-23 01:00:00	27.69410176	27.04034703	54.72343346
28-Jun-23 02:00:00	27.74819469	27.00672966	54.7360861
28-Jun-23 03:00:00	27.71467103	27.49153116	55.21507931
28-Jun-23 04:00:00	27.81529257	27.50944498	55.33368238
28-Jun-23 05:00:00	27.63100603	27.5757781	55.18333085
28-Jun-23 06:00:00	27.56764454	27.42000241	54.99117724
28-Jun-23 07:00:00	27.57795599	27.01586586	54.58003277
28-Jun-23 08:00:00	27.51966339	27.35516357	54.87029648
28-Jun-23 09:00:00	27.50970766	27.41994116	54.94206132

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
28-Jun-23 10:00:00	27.64530065	27.37710894	55.01483727
28-Jun-23 11:00:00	27.46256818	27.44653444	54.86128977
28-Jun-23 12:00:00	27.5514058	27.25280606	54.81888284
28-Jun-23 13:00:00	27.59032853	27.03000832	54.62355762
28-Jun-23 14:00:00	27.47162925	26.98066655	54.45455572
28-Jun-23 15:00:00	27.30992709	27.06290277	54.34011714
28-Jun-23 16:00:00	27.17295763	27.05432884	54.22524156
28-Jun-23 17:00:00	27.3602776	27.06799491	54.43726434
28-Jun-23 18:00:00	27.37664307	27.05984158	54.43597349
28-Jun-23 19:00:00	27.2937959	27.30402268	54.59498755
28-Jun-23 20:00:00	27.59632206	27.34700155	54.95003372
28-Jun-23 21:00:00	27.58397823	27.33571233	54.93809827
28-Jun-23 22:00:00	28.17772759	27.35112651	55.51798481
28-Jun-23 23:00:00	28.23207728	27.12436602	55.38168716
29-Jun-23 00:00:00	28.20322768	27.09722445	55.30903308
29-Jun-23 01:00:00	28.10707654	26.99738729	55.12823497
29-Jun-23 02:00:00	27.6441537	27.0100832	54.65723462
29-Jun-23 03:00:00	27.65238126	27.01830938	54.6783816
29-Jun-23 04:00:00	27.31893847	27.16959964	54.47160678
29-Jun-23 05:00:00	27.30965212	26.98966853	54.29679786
29-Jun-23 06:00:00	27.2907646	27.26610777	54.55869447
29-Jun-23 07:00:00	27.27319654	27.3407171	54.65167457
29-Jun-23 08:00:00	27.13493866	27.38279703	54.51678015
29-Jun-23 09:00:00	26.47074721	27.19485145	53.65695339
29-Jun-23 10:00:00	26.50442325	27.14101982	53.62741492
29-Jun-23 11:00:00	26.47169516	27.43013636	53.88708517
29-Jun-23 12:00:00	27.02542347	27.65635879	54.69271398
29-Jun-23 13:00:00	27.51250426	27.62574524	55.11157036
29-Jun-23 14:00:00	27.69649802	27.61260555	55.32057847
29-Jun-23 15:00:00	27.47991647	27.30366696	54.7869855
29-Jun-23 16:00:00	27.55402544	27.14325873	54.69170295
29-Jun-23 17:00:00	27.52702162	27.00582176	54.53604168
29-Jun-23 18:00:00	27.70148002	27.00885222	54.71816932
29-Jun-23 19:00:00	27.99114524	27.0384228	55.0498174
29-Jun-23 20:00:00	27.82384788	27.24773333	55.06901367
29-Jun-23 21:00:00	27.82395003	27.13211653	54.98279254
29-Jun-23 22:00:00	27.80576611	26.84690995	54.66036415
29-Jun-23 23:00:00	27.56819132	26.73479519	54.32493475
30-Jun-23 00:00:00	27.40822241	26.70971828	54.10557641
30-Jun-23 01:00:00	27.18439282	26.81208134	54.00953696
30-Jun-23 02:00:00	27.27077749	27.21079848	54.49164602
30-Jun-23 03:00:00	27.24027623	27.12274753	54.36872652
30-Jun-23 04:00:00	27.21480486	26.71520836	53.91367128

Time Stamp	A-Train SO2 Emission Rate	B-Train SO2 Emission Rate	Total SO2 Emission Rate From A&B RTO's
30-Jun-23 05:00:00	27.54858928	26.72033967	54.27071783
30-Jun-23 06:00:00	27.30739435	26.7388649	54.04487419
30-Jun-23 07:00:00	27.57110172	27.30273454	54.82891846
30-Jun-23 08:00:00	27.57422521	27.02918106	54.61181937
30-Jun-23 09:00:00	27.33435228	27.69789039	55.04006047
30-Jun-23 10:00:00	27.22453594	27.77558445	54.97699081
30-Jun-23 11:00:00	27.27162965	27.75143554	55.02885953
30-Jun-23 12:00:00	27.42940892	27.50060993	54.92149067
30-Jun-23 13:00:00	27.41835192	27.04733223	54.47028478
30-Jun-23 14:00:00	27.40991031	27.12904951	54.53288937
30-Jun-23 15:00:00	27.39042918	27.15420248	54.56318622
30-Jun-23 16:00:00	27.19373544	27.12143408	54.30505604
30-Jun-23 17:00:00	27.37635114	27.20109649	54.56990698
30-Jun-23 18:00:00	27.35813967	27.00975906	54.37508392
30-Jun-23 19:00:00	27.30910375	27.09804217	54.40019396
30-Jun-23 20:00:00	27.35190593	27.03677675	54.38649722
30-Jun-23 21:00:00	27.45619573	27.05360487	54.51669968
30-Jun-23 22:00:00	27.17673514	27.07772832	54.24570105
30-Jun-23 23:00:00	27.00306066	26.89058468	53.89026515
01-Jul-23 00:00:00	26.99771637	26.86108043	53.87858274

Attachment R

Naphthalene Distillation Shutdown Checklist

Response to Violation Notice A-2023-00162

Koppers Inc.

Naphthalene Distillation Shutdown Checklist

Purpose:

To provide a checklist to bring the Naphthalene Unit down to either reflux, circulation, or planned utility/power outage shutdown.

Safety, Health and Environmental Considerations

PPE requirements:

Standard PPE - Safety glasses w/side shields (ANZI Z87), Metatarsal safety boots (minimum six-inch lace type), Long sleeved shirt/pant (cotton work uniform), Nitrile gloves

Physical Hazards: Burn hazard
Chemical Hazards: Fire
Environmental Considerations: Release
Other requirements: None

Accountability

The operator is responsible for this task.

Relevant Documents

WI-NAPH-0008

Procedures

Naph Shutdown to Reflux Checklist

The first checklist is to bring the unit down to reflux, follow this checklist if your initating the shutdown process. If Naph Plant is shutting down to reflux automatically please skip to checklist on page 4

Start Date: ______________ **Time:** ________________

1 Shutdown all feed flows and flows to storage by placing controllers in manual at 0%
- NSR to storage, LIC-3630B ________
- Naph to storage, FIC-3633 ________
- Solvent to storage, FIC-3621A ________
- Dehydrator oil to storage, LIC-3613 ________
- V-610 feed, LIC-3610A. Also shutoff P-654A/B ________
- V-620 feed, FIC-3618A ________
- V-620 to V-630 feed, LIC-3620B ________
- Methyl side draw, XV-3635A to closed position ________

2 Turn off NSR cooling fan, E-633 ________

3 Clear NSR to storage line
- close HV-808 in the field
- introduce steam to the line
- set LIC-3630B to 100% in manual
- blow steam through the line for 30-60 minutes
- shutoff steam to the line
- set LIC-3630B to 0% in manual ________

4 Clear naph to storage line
- close HV-1630 in the field
- introduce **low pressure** nitrogen to the line
- set FIC-3633 to 100% in manual
- blow nitrogen through the line for 30-60 minutes
- shutoff nitrogen to the line
- set FIC-3633 to 0% in manual ________

5 Clear methyl to storage line (if previously operating with a side draw)
- close HV-815 in the field
- introduce steam to the line
- set FIC-3635 to 0% in manual
- blow steam through the line for 30-60 minutes
- shutoff steam to the line
- set FIC-3635 to 0% in manual
- open HV-815 in the field ________

6 Verify levels in columns are 60% - 80%

- if levels are low open up LIC-3610A, FIC-3618A, or LIC-3620B as needed ________

7 Once levels are stable close off the feed to V-630 by closing HV-461 in the field. It is underneath the flowmeter, FI-3628A, at E-625 on the 2nd floor. ________

Napthalene plant is now down to reflux. If bringing down to circulation continue to next checklist. If the plant will be down to reflux for an extended period take the acid washer down. Reference WI-NAPH-0008 for instructions

Finish Date: ________________ **Time:** __________________

Naph Plant Automatic Shutdown to Reflux Checklist

When #2 Fume System vent valve (V4749) opens, alarm annunciator will turns red, at this time PLC will shutdown Naph plant to reflux and closes the valves to storage tank but will not interlock, please ensure shutdown process on the checklist below and blow NSR to storage, Naph to storage and Methly to storage

- #2 Fume System valve Alarm Turned Red ________
- AFO Feed Pump shuts off and XV closed (which ever was running) ________
- V613 Level Control valve, LV-3613 closed, controller in manual ________
- V610 Bottoms Temp, TIC-3613 set point changed to 160C ________
- V620 Feed valve, FIC-3618A closed, controller in manual ________
- Solvent to storage, FIC-3621A closed, controller in manual ________
- V630 Feed valve, LIC-3620B closed, controller in manual ________
- Naph to storage, FIC-3633 closed, controller in manual ________
- NSR to storage, LIC-3630B, closed, controller in manual
- Methly to storage, XV-3635A, closed, controller in manual ________
- V640 Reboiler outlet temp, set point changed to 290C________
- NSR cooler, E633 shuts off ________

Clear NSR to storage line

- close HV-808 in the field
- introduce steam to the line
- set LIC-3630B to 100% in manual
- blow steam through the line for 30-60 minutes
- shutoff steam to the line
- set LIC-3630B to 0% in manual ________

Clear naph to storage line

- close HV-1630 in the field
- introduce **low pressure** nitrogen to the line
- set FIC-3633 to 100% in manual
- blow nitrogen through the line for 30-60 minutes
- shutoff nitrogen to the line
- set FIC-3633 to 0% in manual ________

Clear methyl to storage line (if previously operating with a side draw)

- close HV-815 in the field
- introduce steam to the line
- set FIC-3635 to 0% in manual
- blow steam through the line for 30-60 minutes
- shutoff steam to the line
- set FIC-3635 to 0% in manual
- open HV-815 in the field ________

Naph Shutdown to Circulation Checklist

The second checklist is to bring the unit down to circulation after already being down to reflux, follow this checklist if your initating the shutdown process. If Naph Plant is shutting down to circulation automatically please skip to checklist on page 7

Start Date: ________________ **Time:** __________________

1 Turn off 2 burners on the reboiler, V-640
- Turn off 1 burner, wait 5 minutes, then turn off the 2nd burner
- If burners are shut off too quickly the reboiler may kickout ________

2 Set TIC-3610E to 140 C in auto ________

3 Run columns as is for 1 hour to bring temperatures down ________

4 Shutoff P-623A/B and close XV-3623C ________

5 Set TIC-3612 to 0% in manual ________

6 Shutoff P-619A/B ________

7 Empty naph column reflux tank, V-633
- set FIC-3636 to 20% in manual
- run P-636A/B until the tank empties and the pump kicks out
- monitor the level in V-633, as the column cools more material may still reflux into the surge tank. Re-start P-636A/B as necessary to empty the tank. The tank can gain level multiple times before column has cooled enough to stop refluxing. ________

8 Empty solvent column reflux tank, V-621
- set FIC-3621 to 20% in manual
- run P-621A/B until the tank empties and the pump kicks out
- monitor the level in V-621, as the column cools more material may still reflux into the surge tank. Re-start P-621A/B as necessary to empty the tank. The tank can gain level multiple times before column has cooled enough to stop refluxing.
- Shutoff the condenser, E-624 ________

9 Clear the naph reflux line
- Close HV-1630 in the field
- Introduce steam to the line
- Blow steam through the line for 15 minutes while monitoring column pressure, PI-3629. If pressure exceeds 1700mmHg shutoff the steam to allow the column to depressurize
- Shutoff steam to the line. Allow material in the line to settle for 10 minutes and the column to depressurize
- Introduce steam to the line
- Blow steam through the line for 15 minutes while monitoring column pressure, PI-3629. If pressure exceeds 1700mmHg shutoff the steam to

allow the column to depressurize
- Shutoff steam to the line. Allow material in the line to settle for 10 minutes and the column to depressurize
- Introduce steam to the line
- Blow steam through the line for 15 minutes while monitoring column pressure, PI-3629. If pressure exceeds 1700mmHg shutoff the steam to allow column to depressurize
- Shutoff steam to the line
- Set FIC-3636 to 0% in manual ________

10 Change SP of FIC-3628B to 450 in auto ________

11 Open up hot oil bypass to naph condenser, E-631, in the field, HV-1243 ________

Napthalene plant is now down to circulation. If bringing down further for a Utility Outage continue to next checklist. If circulating for an extended period monitor the BOC temperature on V-630. Temperature should be kep at 200°C – 220°C by cycling a single burner on the reboiler on and off.

Finish Date: _______________ Time: _________________

Naph Plant Automatic Shutdown to Circulation Checklist

When Naph TO shutsdown or vent valve XV-3671B opens, SSM timer (180 minutes) starts, at the end of timer, if it not shutdown already, PLC will shutdown Naph plant automatically, at this time ensure following shutdown process on the checklist below and blow NSR to storage, Naph to storage and Methly to storage.

- Vacuum Pump shuts off, P-623A or B, whichever was runing at the shudtown ________
- AFO Feed Pump shuts off and XV closed (which ever was running) ________
- V613 Level Control valve, LV-3613 closed, controller in manual ________
- V610 Bottoms Temp, TIC-3613 set point changed to 160C ________
- V620 Feed valve, FIC-3618A closed, controller in manual ________
- Solvent to storage, FIC-3621A closed, controller in manual ________
- V630 Feed valve, LIC-3620B closed, controller in manual ________
- Naph to storage, FIC-3633 closed, controller in manual ________
- NSR to storage, LIC-3630B, closed, controller in manual _____
- Methly to storage, XV-3635A, closed, controller in manual ________
- V640 Two falmes off, only one flame ON, all pilots ON
- NSR cooler, E633 shuts off ________

Clear NSR to storage line

- close HV-808 in the field
- introduce steam to the line
- set LIC-3630B to 100% in manual
- blow steam through the line for 30-60 minutes
- shutoff steam to the line
- set LIC-3630B to 0% in manual ________

Clear naph to storage line

- close HV-1630 in the field
- introduce **low pressure** nitrogen to the line
- set FIC-3633 to 100% in manual
- blow nitrogen through the line for 30-60 minutes
- shutoff nitrogen to the line
- set FIC-3633 to 0% in manual ________

Clear methyl to storage line (if previously operating with a side draw)

- close HV-815 in the field
- introduce steam to the line
- set FIC-3635 to 0% in manual
- blow steam through the line for 30-60 minutes

- shutoff steam to the line
- set FIC-3635 to 0% in manual
- open HV-815 in the field ________

Set TIC-3610E to 140 C in auto ________

Run columns as is for 1 hour to bring temperatures down ________

Set TIC-3612 to 0% in manual ________

Shutoff P-619A/B ________

Empty naph column reflux tank, V-633

- set FIC-3636 to 20% in manual
- run P-636A/B until the tank empties and the pump kicks out
- monitor the level in V-633, as the column cools more material may still reflux into the surge tank. Re-start P-636A/B as necessary to empty the tank. The tank can gain level multiple times before column has cooled enough to stop refluxing. ________

Empty solvent column reflux tank, V-621

- set FIC-3621 to 20% in manual
- run P-621A/B until the tank empties and the pump kicks out
- monitor the level in V-621, as the column cools more material may still reflux into the surge tank. Re-start P-621A/B as necessary to empty the tank. The tank can gain level multiple times before column has cooled enough to stop refluxing.
- Shutoff the condenser, E-624 ________

Clear the naph reflux line

- Close HV-1630 in the field
- Introduce steam to the line
- Blow steam through the line for 15 minutes while monitoring column pressure, PI-3629. If pressure exceeds 1700mmHg shutoff the steam to allow the column to depressurize
- Shutoff steam to the line. Allow material in the line to settle for 10 minutes and the column to depressurize
- Introduce steam to the line
- Blow steam through the line for 15 minutes while monitoring column pressure, PI-3629. If pressure exceeds 1700mmHg shutoff the steam to allow the column to depressurize

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- Shutoff steam to the line. Allow material in the line to settle for 10 minutes and the column to depressurize
- Introduce steam to the line
- Blow steam through the line for 15 minutes while monitoring column pressure, PI-3629. If pressure exceeds 1700mmHg shutoff the steam to allow column to depressurize
- Shutoff steam to the line
- Set FIC-3636 to 0% in manual ________

Change SP of FIC-3628B to 450 in auto ________

Open up hot oil bypass to naph condenser, E-631, in the field, HV-1243 ________

Naph Shutdown for a Utility Outage Checklist

The third checklist is to bring the unit down completely for a Utility Outage after already being down to circulation.

Start Date: ________________ **Time:** __________________

1 Shutdown the reboiler, V-640 ________
2 Shutoff P-618A/B ________
3 Shutoff P-628A/B ________
4 Shutoff P-634A/B ________
5 Close cooling water supply for P-634A/B in the field ________
6 Clear the reboiler loop line ________
- Close HV-821 in the field
- Introduce nitrogen to the line
- Blow nitrogen through the line for 30 minutes while monitoring column pressure, PI-3629. If pressure exceeds 1700mmHg shutoff the nitrogen
- Shutoff nitrogen to the line
- Open HV-821 ________

7 Shutoff P-626A/B ________
8 Set TIC-3617 to 0% in manual ________
9 Shutoff P-614A/B ________
10 Shutdown the thermal oxidizer ________
- Close the purge vent header
- Initiate auto stop
- If any level in T-675 run P-675 to empty it ________

11 Shutdown the SO_2 scrubber
- Shutoff B-693A/B ________
- Shutoff P-693A/B ________
- Close the P-693A/B blowdown valve at pump discharge in the field ________

12 Shutdown the hot oil system
- Shutoff P-676A/B ________
- Shutoff P-672A/B ________
- Shutoff E-676 ________
- Shutoff E-672 ________

13 Shutdown cooling water tower
- Close chain valve for water return, HV-3391, in the field ________
- Shutoff P-673A/B ________
- Shutoff M-673 ________

- Close ball valve for city make-up water in the field ________

14 Verify the SCR is shutdown. If it is not, contact a supervisor ________

Naphthalene plant is now completely shutdown for a Utility Outage.

Finish Date: ________________ Time: __________________

Revision History

Revision Number	Prepared by	Date	Summary of Changes
0	J.Lynch	7/16/19	Initial issue
1	J. Lynch	5/27/20	Updated after review
2	M. Genz	5/22/23	Update and re-write after outage review
3	N.Ravikanti	1/19/2024	Update to include Automatic Shutdown of Naph Plant to Reflux and Circulation

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Attachment S

Pump Sheets

Response to Violation Notice A-2023-00162

Koppers Inc.

Tar 1/3/23

Form T-330 Rev 3.0 Written: Chris Carlson Reviewed: Bob Michalowski Effective Date 7/20/2022 | Date

Tar Pump Sheet

Time Start to Pump	Time Stop Pump	Material being pumped	From: Tank No	From: Start Ft.	From: Start Ins.	From: Stop Ft.	From: Stop Ins.	From: % H2O	From: Temp F	Material in Discharge Tank	To: Tank No	To: Start Ft.	To: Start Ins.	To: Stop Ft.	To: Stop Ins.	To: % H2O	To: Temp F	Name of Pumper
			49						430	m.T Hollow	228287					TC		JH
0800	0030	PC TUTW	Guns Sd	Barge						PC TUTW	101	53	8	39	6			
12:00	4:00	PSB	P9	15	6	22	8			CCOT	2024							SH/TW
1800am	845p	CBO	34C							Blend	302K	23	0	4	0			SH/TW/RW
		PSB	P-8							PSB	4162					TW		SH/TW
		HCP	T46							SDK	220175					DCL	450.	MG
		HCP	T46							RTT	60711					TW	450.	MG
		CPS	301							CPS	679729			169	265	TC		RW
		CPS	301							CPS	88814			175	369	TC		RW
		BLEND	302							BLEND	79669			20	000	TC		RW

C. Carlson 1/4/23

TC=Tank Car TW= Tank Wagon aka Tank Truck

No truck transfers occured to that would utilize the Naphthelene oxidizer on 1/3/2023

TW 3/23/23

Form T-330 Rev 3.0 Written: Chris Carlson Reviewed: Bob Michalowski Effective Date 7/20/2022 | Date

Tar Pump Sheet

Time Start to Pump	Time Stop Pump	Material being pumped	From							Material in Discharge Tank	To							Name of Pumper
			Tank No	Start		Stop		% H2O	Temp F		Tank No	Start		Stop		% H2O	Temp F	
				Ft.	Ins.	Ft.	Ins.					Ft.	Ins.	Ft.	Ins.			
		Petro	47							reagent	660						TW	SH
		CCOT	673267					DC		CCOT	STK							MC/BS
		CPS	303TK							CPS	22895	149	259				DC	MC
		CPS	303TK							CPS	67061	157	257				DC	MC
		CPS	303TK							CPS	660659	145	759				DC	MC
		Solvent	660TK	16	3	23	3			Solvent	612790						DC	SH/TW
		HCP	49TK							RTA	660724						DC	MB/TS
		CPS	303TK							CPS	89183		164,	755			DC	SH/TW
		CPS	303TK							CPS	32306		153,	837			DC	SH/TW
		CPS	303TK							CPS	68570		178,	057			DC	SH/TW
7pm	8:20pm	MPSB	P9							PSB	P8	24	0	19	0			SH/TW
7:05pm	0610	Petro Dist.	31/32TK							Petro Dist	301TK	35	10	18	2			SH/TW
		HCP	49							RTA	660215					DC		

C. Carlson 3/24/23

TC=Tank Car TW= Tank Wagon aka Tank Truck

No truck transfers occured to that would utilize the Naphthelene oxidizer on 3/23/23

Attachment T

Tar Acid Washer Work Instructions

Response to Violation Notice A-2023-00162

Koppers Inc.

Tar Acid Washer Column V-601 Operation

Purpose:

- Provide instruction for the cold (empty) start-up, warm start-up, short and long-term shutdown of the Refined Chemical Oil (RCO) Caustic Wash column, V-601.

Safety, Health and Environmental Considerations

PPE requirements:

- ✓ Standard PPE - Class B (ANSI Z89.1) hard hat,
- ✓ Safety glasses w/side shields (ANSI Z87),
- ✓ Face Shield,
- ✓ Metatarsal safety boots (minimum six-inch lace type),
- ✓ Long sleeved shirt/pant (cotton work uniform),
- ✓ Rubber protective gloves

Physical Hazards:

- ✓ Slips, Trips, Falls
- ✓ Overhead obstruction
- ✓ Strains
- ✓ Burns from hot equipment

Chemical Hazards:

- ✓ Eye contact
- ✓ Dermal exposure
- ✓ Inhalation

Environmental Considerations:

- ✓ Harmful to aquatic life

Other:

Accountability

The processman, board operator, and supervisor are responsible for this procedure

All employees are responsible for knowing and following this procedure.

Relevant Documents

25% Caustic SDS

Phase 2 PCP

P&ID's:

1. LCH-4010 RCO Storage Tanks T-649 and T-650
2. LCH-4011 Caustic Storage Tank T-658
3. LCH-4012 Caustic Wash Column V-601 (Tar Acid Washer)
4. LCH-4014 AFO Storage Tank T-654

Definitions:

- None

Procedure:

- Section 1 – Pre-Start Tasks
- Section 2 – Start-up when V-601 is empty.
- Section 3 - Short Term Shutdown of V-601 (<3 days)
- Section 4 – Warm Start-Up of V-601.
- Section 5 – Continuous Bottoms Stripping of T-654 to V-601
- Section 6 – Emptying of V-601.
- Section 7-Automatic Shutdown of V-601

Steps
Section 1 – Pre-Start Tasks
1. Prepare the utility side of E-600, cooling water, for operation. (2nd Floor Tar Acid Washer Structure, south side). Verify cooling water is bypassed around E-600 a. Close HV-369 – Cooling Water Return Block Valve (Shell Side) b. Close HV-348 – Cooling Water Supply Block Valve (Shell Side) c. Open HV-372 – Shell Side Water drain (bottom of shell) d. Open HV-2578 – Drain on cooling water return line e. Open TIC-3600B – Cooling Water Control Valve set to automatic at PCP setpoint (Board Operator)
2. Ensure Caustic Storage Tank, T-658, is approximately 75°C. If tank temperature is too low, turn heat on steam bayonet on this tank to raise tank temperature to 75°C before continuing with Section 2 and the start-up of V-601 Tar Acid Washer Column.
Section 2 – Start-up when V-601 is empty.
Note: This procedure will include a bulk transfer of 75°C caustic then a steady transfer to generate Cresylate and AFO, all the while filling the vessel to the proper operating range for establishing a steady state feed forward operation.
1. Close HV-168 Sodium Cresylate Bottoms Product Valve on the bottom of V-601.
2. Open HV-162 AFO Overflow Valve on the top of V-601.

Steps
3. Set up to feed from the 20% sodium carbonate tank, T-658. Perform the following to make a transfer of caustic to the empty V-601 Tar Acid Washer column: a. Begin the transfer of 30,000 lbs of caustic to V-601 (~3,000 gallons) b. Open HV-282 Valve to caustic feed line to V-601 *(3rd Floor by top of Tar Acid Wash Column)* c. Open HV-152 Valve on caustic feed line before FV-3601 caustic control valve *(Top landing of Acid Washer Column)* d. Open HV-160 Valve on caustic feed line after FV-3601 caustic control valve *(Top landing of Acid Washer Column)* e. Use FIC-3601 to control the transfer feed rate to 1,300 lbs/hr. This is a higher feed rate than normal but it will still take roughly 24 hours to make this transfer. As the liquid is pumped, it is important to keep track of the volume transferred as there will be no level indication in V-601 during this transfer. *(V-601 Tar Acid Washer Screen)* f. Once the transfer is complete, Board Operator will stop the transfer by closing the automatic caustic feed flow valve, FV-3601. *(V-601 Tar Acid Washer Screen)*

Steps

3. Prepare Sodium Cresylate product piping line-up to T-648. (V-601 Tar Acid Washer bottoms product)

Hand valves in a. thru g. are at the base of the V-601 Tar Acid Wash Column shown to the left.

   a. Close HV-168 Bottom outlet valve from V-601
   b. Close HV-2363 Pump out valve to pumps P-601 A/B
   c. Close HV-180 N2/Steam connection
   d. Close HV-2749 Block valve on cresylate sample valve
   e. Open HV-212 Isolation valve for cresylate flow valve to T-648
   f. Close HV-213 Drain valve on cresylate line
   g. Open HV-214 Isolation valve for cresylate flow valve to T-648
   h. Open XV-3648 Operator can verify open on control screen (T-648 high level shut-off valve, *V-601 Tar Acid Washer Control Screen*)
   i. Open HV-2573 Inlet valve to top of T-648 *(Top of T-648 Cresylate Tank)*

4. Prepare AFO product piping line-up to T-654.
   a. Open HV-162 RCO Outlet valve from V-601
   b. Close HV-166 Vent valve on AFO line to T-654 tank
   c. Open HV-482 Inlet valve to T-654 AFO tank
   d. Open XV-3654A Operator can verify open on control screen (T-654 high level shut-off valve)

Steps

5. If T-649 or T-650 not already circulating, line up the feed line from RCO Feed Tank T-649 or T-650 to P-651A/B suction valves.
   a. T-649 Line up to P-651A/B suction valves:
      i. Close HV-1686 Nitrogen purge line
      ii. Close HV-236 Steam out valve
      iii. Close HV-153 Drain valve
      iv. Open HV-199 Inlet from T-649 to pump suction line
      v. Close HV-202 Inlet from T-650 to pump suction line
      vi. Close HV-182 Strainer drain valve to pump suction line
      vii. Open HV-194 Outlet valve from pump suction strainer
      viii. Close HV-183 Drain valve
   b. T-650 Line up P-651A/B suction valves:
      i. Close HV-1691 Nitrogen purge line
      ii. Close HV-159 Steam out valve
      iii. Close HV-199 Inlet from T-649 to pump suction line
      iv. Open HV-202 Inlet from T-650 to pump suction line
      v. Close HV-182 Strainer drain valve to pump suction line
      vi. Open HV-194 Outlet valve from pump suction strainer
      vii. Close HV-183 Drain valve

Steps

6. If T-649 or T-650 is not already circulating, line up from RCO feed tank specified through P-651A/B as directed:
   a. Line up through P-651A:
      i. Close HV-156 Suction Valve to P-651B
      ii. Open HV-106 Suction valve to P-651A
      iii. Close HV-142 Steam out valve to P-651A
      iv. Close HV-138 Drain valve for P-651A
      v. Open HV-111 Discharge valve from P-651A
      vi. Close HV-122 Discharge valve from P-651B
      vii. Close HV-237 Valve to RCO truck loading line
      viii. Open HV-239 Valve to E-600 and V-601
   b. Line up through P-651B:
      i. Close HV-106 Suction valve to P-651A
      ii. Open HV-156 Suction Valve to P-651B
      iii. Close HV-145 Steam out valve to P-651B
      iv. Close HV-140 Drain valve for P-651B
      v. Open HV-143 Suction valve to P-651B
      vi. Close HV-123 Discharge valve to T-649 and T-650 tank recirculation line
      vii. Open HV-122 Discharge valve from P-651B
      viii. Close HV-111 Discharge valve from P-651A
      ix. Close HV-237 Valve to RCO truck loading line
      x. Open HV-239 Valve to E-600 and V-601

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Steps
7. Continue line up from RCO pumps P-651A/B thru E-600 cooler to V-601 a. Open HV-327 RCO valve on inlet line to E-600 b. Open HV-121 RCO inlet valve to E-600 c. Close HV-135 drain valve on RCO bypass line around E-600 d. Close HV-127 RCO bypass valve around E-600 e. Open HV-124 RCO outlet valve from E-600 f. Close HV-2589 Drain Valve on line from E-600 to V-601 g. Close HV-147 Valve from Cresylate stripping line from T-654 to V-601 h. Close HV-2590 Nitrogen/Steam purge connection valve i. Open HV-139 RCO Inlet valve to V-601 Acid Washer Column j. Close XV-3601E RCO inlet Control Valve to V-601 (Board Operator)
8. If directed to feed when either T-649 or T-650 is already circulating, ensure that HV-239 is closed and line to V-601 as specified in Step #5 above.

Steps

9. Begin flow of RCO from T-649 or T-650 through E-600 RCO cooler to V-601.
   a. If neither tank is previously circulating:
      i. Open tank outlet HV-155 and HV-247 on T-649 or HV-154 and HV-248 on T-650 as directed if one of the tanks is not circulating.
      ii. Start RCO pump P-651A/B whichever is lined up
      iii. Board operator to open XV-3601E and confirm flow through pump to E-600 and V-601
   b. If either T-649 or T-650 is already circulating and:
      i. Using P-651A:
         1. Open HV-239 RCO feed line valve to E-600 and V-601
         2. Close HV-122 RCO circulation line to T-649 or T-650
      ii. Using P-651B:
         1. Close HV-111 Discharge valve from P-651A
         2. Close HV-237 Discharge valve to RCO truck loading line
         3. Open HV-122 Discharge valve from P-651B to E-600 and V-601
         4. Open HV-239 RCO feed line valve to E-600 and V-601
   c. Board Operator will set the RCO flow rate to 25% of normal rate or approximately 4,400 lb/hr to 11,000 lb/hr:
      i. The consumption of Caustic (NaOH solution) in V-601 will occur at rates indicated in the following table. It is important to maintain a steady and restricted flow of RCO

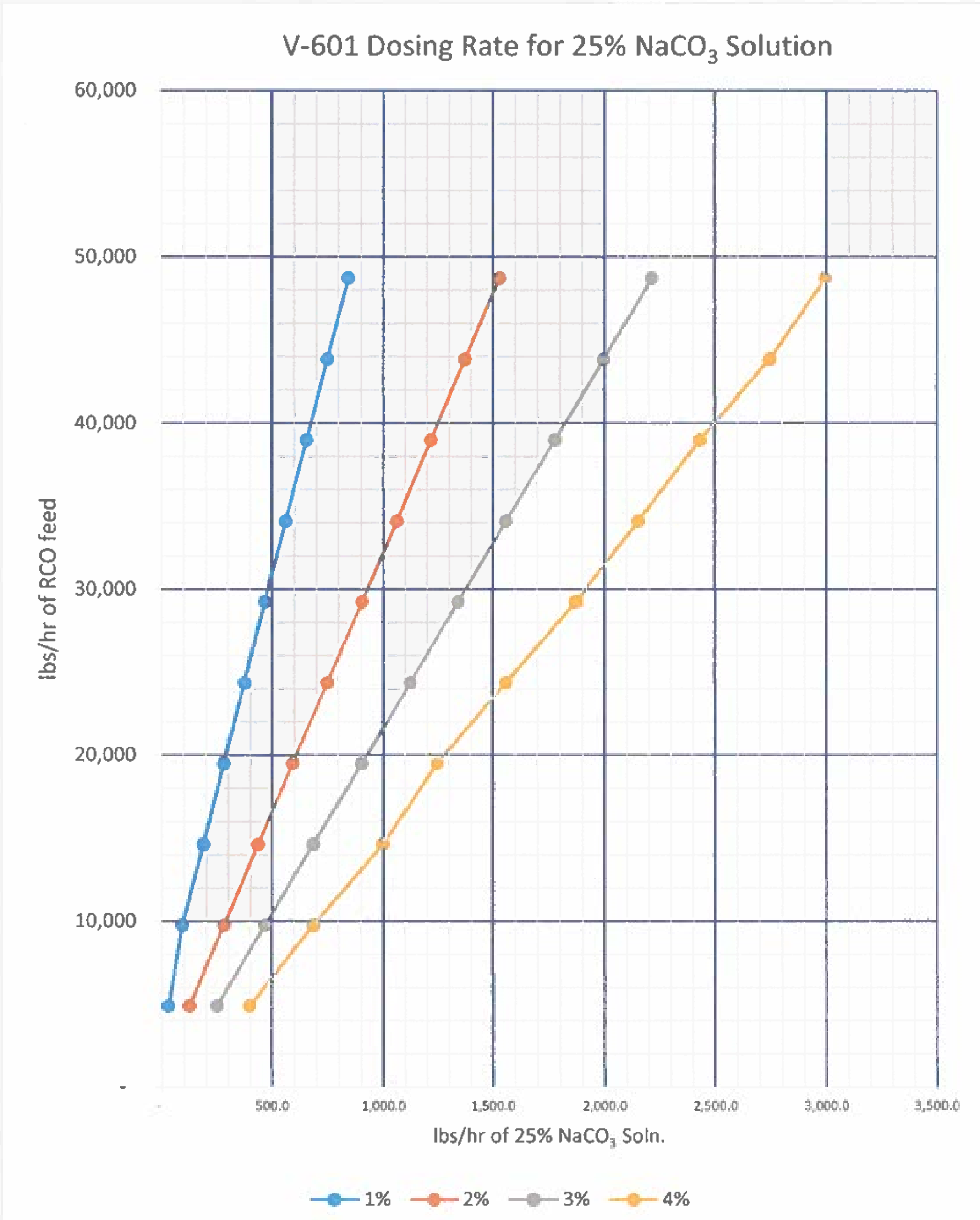
<u>RCO Feed Rates and Time Duration to V-601</u>

Table 1	
RCO Feed Rate (lbs/hour)	Hours to Consume $NaCO_3$ and fill V-601
2,204	114.6
4,408	57.3
6,612	38.2
8,816	28.6
11,020	22.9
13,224	19.1
15,428	16.4
17,632	14.3
19,836	12.7
22,040	11.5

The above Table and original bulk transfer of $NaCO_3$ is based upon using a 20% $NaCO_3$ solution and an assumed $3\%_{wt}$ of tar acids in the RCO.

Steps
10. Once the RCO feed is established through E-600 and into V-601, processman starts up the cooling water on E-600 a. Close HV-2578 Drain on cooling water return line b. Close HV-372 Shell Side Water drain (bottom of shell) c. Close HV-364 Nitrogen/Steam purge line d. Open HV-348 Cooling Water Supply Block Valve (Shell Side) e. Open HV-369 Cooling Water Return Block Valve (Shell Side)
11. Board Operator sets the RCO outlet temperature from E-600 to 75°C using FIC-3600B. Allow the exchanger and washer to stabilize at these conditions for 15 minutes.
12. Using the Feed Rate Table in step #9 above, estimate the time the operator should begin to see level indication on LIC-3601.
13. When the interface level, LIT-3601, indicates an interface reading of 50% (indicates a layer of AFO has collected above the heavy phase), processman will open the Cresylate Bottoms Valve HV-168 Note that the Absolute Level reading will show level indications prior to the interface level, LIT-3601.
14. Board Operator opens Level Control Valve, LV-3601, in manual initially to control the interface level. This level control valve opens to allow cresylate to flow out of the bottom of V-601 and into T-648 when the interface is higher than set point.
15. Board Operator to start feeding caustic to V-601 by opening automatic Caustic Feed Flow Control Valve FV-3601. Board Operator will control caustic flow rate to V-601 using FV-3601 at a dosing rate using the correct RCO / Caustic Dosing Ratio as shown in Chart 1 that follows below.
16. If the interface is still within range of LIC-3601, slowly ramp up the RCO to the target feed rate as necessary. At the same time, incrementally increase the NaOH to the appropriate rate in Chart 1 assuming a 3% tar acid percentage. That is the gray line.
17. Start cresylate stripping from AFO Feed Tank T-654 as described in Section 5 of this Work Instruction.

CHART 1 : RCO / Caustic Solution Dosing Ratio



Steps

Section 3 – Short Term Shutdown of V-601

1. Shutdown and clear/drain the cooling water side of E-600.
   a. Close HV-369 – Cooling Water Return Block Valve (Shell Side)
   b. Close HV-348 – Cooling Water Supply Block Valve (Shell Side)
   c. Open HV-372 – Shell Side Water drain (bottom of shell)
   d. Open HV-2578 – Drain on cooling water return line
2. Lower RCO federate to 4,400 lb/hr and the $NaCO_3$ feed rate to 220 lb/hr. Stabilize the interface at 50%.
3. Stop the caustic flow to V-601:
   a. Close HV-282 to V-601
   b. Close FV-3601 Caustic Control Valve to V-601
4. Close LV-3601 to stop the flow of cresylate.
5. If operating, shutdown the transfer of T-654 bottoms to the RCO feed line to V-601 by shutting off pump P-694 and close FV-3601B from Control System
6. Shut off RCO feed to V-601 by shutting down P-651A or P-651B.
7. Shut off RCO Feed Control Valve XV-3601E

Section 4 – Warm Start of V-601

1. The designated RCO feed tank for V-601 through E-600 is already lined up after the short-term shutdown. Ensure RCO and caustic is lined up for restart.
2. Ensure E-600 is drained of water and isolated from the cooling water system.
3. Set FV-3600A RCO Feed Control Valve at 4,400 lb/hr and start pump P-651A or B (whichever is lined up). Ensure RCO is feeding and troubleshoot as necessary.
4. Start Caustic flow to V-601 Tar Acid Washer Column:
   a. Open HV-282 to V-601
   b. Open FV-3601 Caustic Control Valve to V-601
   c. Use FIC-3601 to control caustic feed rate to 220 lb/hr
5. Set LIC-3601 in Auto at 40% and allow system to adjust so interface is detected if not already.

Steps
6. Start up the cooling water system to E-600: a. Close HV-372 – Shell Side Water drain (bottom of shell) b. Close HV-2578 – Drain on cooling water return line c. Open HV-369 – Cooling Water Return Block Valve (Shell Side) d. Open HV-348 – Cooling Water Supply Block Valve (Shell Side)
7. If the interface is still within range of LIC-3601, slowly ramp up the RCO to the target federate. At the same time, incrementally increase the NaOH to the appropriate rate in Chart 1 assuming a 3% tar acid percentage. That is the gray line.
8. Once V-601 back to normal operating conditions and if Continuous Bottoms Stripping from T-654 was in effect during previous short-term shutdown, open FV-3601B and start pump P-694 from Control System to begin pumping cresylate from the bottom of T-654 to the Tar Acid Washer Column V-601.
Section 5 – Continuous Bottoms Stripping of T-654 to V-601
Note: The operation of V-601 will result in a small amount of carryover of Sodium Cresylate in the AFO to T-654. Sodium Cresylate is the heavier phase thus a system has been installed to allow for the continuous bottoms stripping of the AFO tank, T-654, back into the RCO feed to V-601. **Note:** It is important to never feed Sodium Cresylate to the distillation unit which would cause serious operational problems.
1. V-601 must be in operation.
2. Prepare for the transfer of the bottoms stream: a. Check the electrical tracing is functioning properly. b. Open HV-490 Tank T-654 outlet valve c. Close HV-2709 Vent valve from T-654 outlet d. Open HV-222 Suction valve to P-694 e. Open HV-2703 Discharge valve to P-694 f. Close 2704 Purge line valve g. Open HV-144 Inlet valve to FV-3601B control valve h. Close HV-2102 Drain valve before FV-3601B control valve i. Close HV-146 Drain valve after FV-3601B j. Open HV-147 Outlet valve from FV-3601B control valve
3. Start P-694 from control system. Put FIC-3601B in automatic and set pump rate to 22 lb/hr.

Steps
Section 6 – Emptying of V-601
1. Follow the instructions of Section 3 (Steps 1 thru 8) of this procedure to stop the flow of the feed streams.
2. If T-648 is not already circulating, follow procedure WI-NAPH-0018 Circulation of T-648 Cresylate Tank to begin circulation.
3. Verify that T-648 has sufficient space available to hold the contents of V-601
4. Pump out V-601 from the bottom into Cresylate Tank T-648 using P-601 A/B a. Open HV-2363 Inlet valve to pump out line to T-648 b. Close HV-2594 Nitrogen/Steam Purge valve c. Open HV-2597 Valve on pump out line to T-648 d. Close HV-2526 Inlet valve from V-690 e. Close HV-2598 Drain valve on pump out line to T-648 f. Open HV-2599 Inlet valve to P-601A/B suction line Once these hand valves are open, the level will start dropping in V-601.
5. Close HV-2071 tank outlet valve from T-648 so the pump can quickly transfer the contents of V-601.
6. When V-601 level falls below PI-3601B and DPI-3601 drops to -0- psi, clear the caustic and RCO feed line to V-601.

Steps
7. Clear caustic line to V-601 by the following: a. Shut off operating caustic pump either P-658A or B b. Close HV-281 Discharge from P-658A c. Close HV-284 Discharge from P-658B d. Close HV-283 Circulation line to SO2 scrubber e. Open FV-3601 Control valve to V-601 Acid Washer Column f. Connect nitrogen or steam hose to HV-817 and pressurize g. Open HV-817 Purge line valve to V-601 Acid Washer Column h. Purge line for 5 minutes or until PI-3601 registers pressure increase i. Close HV-817 j. Depressurize nitrogen or steam hose and disconnect from HV-817
8. Restart caustic circulation to SO2 Scrubber: a. Close HV-282 b. Open HV-283 c. Open HV-281 d. Open HV-284 e. Turn on caustic pump P-658A/B to resume flow of caustic to SO2 Scrubber f. Board Operator verifies flow restarted from FE-3693B caustic flow meter to SO2 Scrubber

Steps
9. Clear Heavy Cresylate Strippings from P-634: a. Close HV-490 Bottom outlet from T-654 b. Close HV-2703 Discharge from P-694 c. Connect Nitrogen Purge Hose to HV-2705 d. Open FV-3601B Control Valve e. Open HV-2705 f. Open HV-2704 g. Pressurize nitrogen or steam hose to start purge of Heavy Cresylate Line to V-601 h. Once PI-3601 or PI-3601B indicate pressure increase, close HV-147 and FV-3601B i. Stop nitrogen or steam purge by closing HV-2704 j. Close nitrogen or steam source to hose and open HV-2706 to depressurize hose k. Close HV-2705 and disconnect hose

Steps
10. Clear RCO feed line to V-601 Acid Washer Column: a. If RCO feed was from T-649 RCO tank: i. Close HV-155 ii. Close HV-247 iii. Connect Nitrogen hose to HV-1686 iv. Open XV-3601E from control screen to allow purge to V-601 v. Open HV-1686 and pressurize hose to start purge vi. Purge RCO line from tank, through P-651A/B, through E-600, and into V-601 vii. Once PI-3601 or PI-3601B indicate pressure increase, stop nitrogen purge by closing HV-1686 viii. Close XV-3601E ix. Depressurize Nitrogen hose and disconnect b. If feeding was from T-650 RCO tank: i. Close HV-154 ii. Close HV-248 iii. Connect Nitrogen hose to HV-1691 iv. Open XV-3601E from control screen to allow purge to V-601 v. Open HV-1691 and pressurize hose to start purge vi. Purge RCO line from tank, through P-651A/B, through E-600, and into V-601 vii. Once PI-3601 or PI-3601B indicate pressure increase, stop nitrogen purge by closing HV-1691 viii. Close XV-3601E ix. Depressurize Nitrogen hose and disconnect
11. Monitor the pump amps of P-601A/B. Once the pump's performance indicates the suction is not flooded (The pump may have already shutdown), close HV-2599 and open HV-2071, then restart the pump to continue T-648 circulation.
12. Close valves on V-601 pump out line: a. Close HV-2363 b. Close HV-2597

Steps
Section 7 – Automatic Shutdown of Acid Washer PLC will shutdown Acid Washer (V-601) automatically, on two cases, in both case valves listed below will close, but will not interlock, please ensure this process on the checklist below and blow the lines as indicated Case 1: When #2 fume system valve opens and alarm annunciator turns red Case 2: When Naph TO shutsdown or vent valve XV-3671B open and SSM timer (180 minutes) runs out. i. #2 Fume System valve Alarm Turned Red ii. RCO Feed Pump (P-651A/B) shuts off (which ever was running) iii. RCO Feed Valve (XV-3601E) closes iv. Cresylate Valve (XV-3648) closes v. Carbone Feed Valve (FIC-3601), closes, controller in manual. vi. RCO Cooler Temp Valve (TIC-3600B), closes, controller in manual. vii. Heav Cresylate Pump (P-694) shuts off
13. Close carbonate valve HV-160 in the field, top platform of Acid Washer
14. Clear RCO line to T649/T650 i. Close HV-139 in the field, introduce steam in the line and open XV-3601E ii. Blow steam through the line for 30-60 minutes and close XV-301E
15. Clear Cresylate line to T648 i. Close HV-168 in the field, introduce steam in the line and open XV-3648 ii. Blow steam through the line for 10-15 minutes and close XV-3648

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Revision History

Revision Number	Prepared By	Date	Summary of Changes
0	C. Mueller	08/28/18	Initial Draft
1	M. Genz	07/19/22	Modified to reflect using $NaCO_3$, not NaOH
2	N. Ravikanti	1/8/2024	Modified to include section 7, Automatic Shutdown of Acid Washer

Attachment #1 – Process Description

The caustic wash column, V-601, is a continuous liquid/liquid extraction column. The light phase, RCO, passes up the column as the heavy phase, NaOH solution (caustic), passes down the column. The primary purpose is to allow the caustic to react with the phenolic compounds (tar acids) contained in the RCO and move them into the heavy phase. The RCO then becomes AFO or acid free oil.

RCO is pumped from either T-649 or T-650 using pumps P-651A or B. The RCO passes through E-600 where it is cooled to 75°C using TIC-3600B. The RCO feed rate is flow controlled using FIC-3600A before being injected into the bottom of V-601. As the light phase, RCO, ascends the column, it coalesces under and disperses above each of 10 sieve trays. This coalescing/dispersion action causes intimate contact between the phases permitting an efficient extraction of the tar acids from the oil. The AFO accumulates at the top of the column and overflows into T-654.

Caustic is pumped from T-658 using pumps P658A or B. The strength of the caustic is 22% to 25% by weight as received from the supplier. The flow to V-601 is flow controlled using FIC-3601 before being injected above the internal trays. The caustic descends and flows across the top of each tray reacting with the RCO to become sodium cresylate. The caustic/sodium cresylate mixture descends down the column through a downspout between each tray. The sodium cresylate finally exits the bottom of V-601 and is pumped using P-601A or B to V-604, to the oil stripping column.

The column is controlled by managing the level of an interface between the oil and caustic phases by pumping away the cresylate continually generated from the bottom. The light phase, AFO, overflows out of the vessel above the interface as it is continually produced.

Attachment U

EIIP Chapter 16 Emission Estimates

Response to Violation Notice A-2023-00162

Koppers Inc.

Volume II: Chapter 16

Methods for Estimating Air Emissions from Chemical Manufacturing Facilities

August 2007

Final

Prepared for

Emission Inventory Improvement Program

Prepared by

Mitchell Scientific, Inc.
Westfield, NJ

RTI International
Research Triangle Park, NC

Disclaimer

As the Environmental Protection Agency has indicated in Emission Inventory Improvement Program (EIIP) documents, the choice of methods to be used to estimate emissions depends on how the estimates will be used and the degree of accuracy required. Methods using site-specific data are preferred over other methods. These documents are non-binding guidance and not rules. EPA, the States, and others retain the discretion to employ or to require other approaches that meet the requirements of the applicable statutory or regulatory requirements in individual circumstances.

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1.0 Introduction

The purpose of this guideline document is to describe emission estimation techniques for point sources in an organized manner and to provide concise example calculations to aid in the preparation of emission inventories. While emissions estimates are not provided, the information presented in this document may be used to select an emission estimation technique best suited to a particular application. This chapter describes the procedures and recommended approaches for estimating emissions from batch chemical manufacturing operations and is intended to assist industry as well as regulatory agency personnel.

As EPA has indicated in this and other EIIP documents, the choice of methods to be used to estimate emissions depends on how the estimate will be used and the degree of accuracy required, and methods using site-specific data are preferred over other methods. Because this document provides non-binding guidance and is not a rule, EPA, the States, and others retain the discretion to employ or require other approaches that meet the specific requirements of the applicable regulations in individual circumstances.

Section 2 of this chapter identifies some of the types of emission events in chemical manufacturing operations. Section 3 provides an overview of available emission estimation methods for these types of emission events, and section 4 provides an overview of emission estimation methods for emission streams that are routed to condensers or to vacuum devices in which water mixes with the emission stream (i.e., liquid ring vacuum pumps and vacuum steam jets). It should be noted that the use of site-specific emissions data is always preferred over the use of default values developed through use of industry emission averages.

Section 5 provides an overview of considerations that should be used when assessing process vent emissions for basic process unit operations.

Section 6 describes many of the underlying physical property relationships that are used in support of the basic models that are presented in earlier sections of this document.

The techniques presented in this document represent significant advances over previous emission-estimating methods for chemical manufacturing processes. New methodologies are, however, continuously being developed and published by EPA for subsequent incorporation into national environmental policies and programs. The reader is thus encouraged to periodically check the Clearinghouse for Inventories and Emission Factors (CHIEF) website (http://www.epa.gov/ttn/chief) to learn about such new information and developments.

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2.0 Source Category Description

2.1 Process Description

This section provides a brief overview of batch chemical manufacturing operations. Chemical processes vary widely from one industry to another with respect to the types of chemicals that are used, batch and production sizes, and unit operations that are involved. However, most chemical processes include at least one or more combinations of four basic operations: preassembly, reaction, isolation, and purification. Solvent recovery operations are also important because they enable the chemical operator to reuse basic raw materials and reduce the manufacturing cost and environmental impact. Additionally, cleanout operations are important since they enable production equipment to be reused for other manufacturing operations.

- Preassembly. A preassembly (or premixing) is normally the initial step of the process and typically involves charging, mixing, or dissolving various liquids, solids, and/or gases. Essential equipment for this step might include agitated vessels or tanks with charge chutes, liquid inlet lines, and utility connections for temperature and pressure control. For certain continuous chemical processes, feed preparation might involve inline mixers with heat exchangers.
- Reaction. The purpose of the reaction step is to facilitate the actual chemical synthesis. A reaction may be carried out by applying heat or by adding specific reactants to the batch. The batch composition changes as the reaction takes place although many of the compounds such as process solvents and other materials remain unchanged. Equipment that is used to carry out reactions includes a batch, semi-continuous stirred tank or tubular reactor. The actual reactor used must meet the specific chemical, physical, and productivity needs of the process design.
- Isolation. Once chemical products have been formed from reaction, they must be recovered or isolated from basic process impurities that also formed or from unreacted materials and/or process solvents. In many cases the product is solid portion of a batch slurry. Isolation can be achieved through the use of spray driers coupled with various dust collectors. Extraction, crystallization filtration, or distillation might be applied in cases when the batch product is a homogeneous solution. Distillation is often used for collecting liquid products when the vapor pressure/temperature relationships can be exploited.
- Purification. Once isolated, chemical products must be further processed through purification equipment to obtain the desired high purity level. Products from this purification step are to be used either as the final product or as a key ingredient in the next step of a multi-step synthesis. For example, in a pharmaceutical process a low quality product might be purified by carbon treatment, additional extractions, ion exchange, chromatography, or crystallization. The overall purification process involves other preassembly, purification, and final isolation steps.

2.2 Emission Sources

The majority of emissions that occur from batch chemical manufacturing operations are from volatile organic solvents that evaporate during manufacturing. Particulate matter emissions may also occur from the handling of solid powders that are used in manufacturing.

Several air emission sources have been identified for chemical manufacturing operations; they are as follows:

- Process operations

- Storage tanks
- Equipment leaks
- Wastewater collection and treatment
- Cleaning
- Solvent recovery
- Spills

2.2.1 Process Operations

2.2.1.1 Material Charging Emissions

Volatile Organic Compounds (VOC) emissions may occur during material loading of equipment due to the displacement of organic vapors.

Particulate matter (PM) and PM equal to or less than 10 micrometers in diameter (PM10) emissions may also occur during the material loading process from handling of solids in powder form. VOC and PM emissions during material loading emissions may occur as point source or fugitive, depending on whether a PM emissions collection system is in place.

2.2.1.2 Emissions from Process Heating

Many processes involve batch heating in conjunction with a reaction or in preparing for distillation. As the batch temperature is increased to a new level, the molar capacity of the vessel headspace is reduced due to the ideal gas law ($PV=nRT$). Additionally, the vapor pressures of volatile materials in the batch also increase. Vapors from vessel headspace are emitted through the process vent until the final temperature is reached.

2.2.1.3 Emissions from Process Depressurization

Reducing the system pressure is one way that solvents can be recovered from the batch at a lower temperature than would normally be possible. In some cases it is desired to replace the primary process solvent with a different one at reduced temperature. In other cases it may be desired to concentrate the batch through solvent stripping at reduced temperature to avoid thermal decomposition of compounds in the batch. When the pressure of the batch is reduced then solvent vapors are drawn from the vessel (and connected equipment) by the vacuum system.

2.2.1.4 Emissions from Gas Evolution Processes

Some reactions produce off gases such as hydrogen chloride, sulfur dioxide, and others that evolve from the batch and exit the process through the vessel vent. These off gases will also carry solvent vapors from the batch with them.

2.2.1.5 Emissions from Gas Sweep and Purge Operations

Nitrogen is frequently applied to the process vessel as a means of establishing inert conditions for safety purposes or to prevent moisture from entering the system and avoiding undesirable chemical reactions to take place. As nitrogen enters the vessel it must exit the vessel through the process vent along with solvent vapors from the vessel.

2.2.1.6 Surface Evaporation

Surface evaporation may occur during mixing and blending operations if the vessel contents are exposed to the atmosphere.

2.2.2 Miscellaneous Operations

2.2.2.1 Solvent Reclamation

Solvent reclamation refers to the purification of contaminated or spent solvent through distillation. VOC emissions occur from the solvent charging and the normal distillation equipment operation.

2.2.2.2 Cleaning

Cleaning is an important ancillary part of the chemical manufacturing process. Process equipment may be cleaned with solvent as often as after each batch. VOC emissions will result from any of the normal process operations such as charging, heating, gas sweep, and others. Additionally, emissions will result from the wiping of equipment with solvent wet clothes. In addition to this type of cleaning, small items used in the chemical manufacturing process may be cleaned by washing with solvents in a cold cleaner or open-top vapor degreaser.

2.2.3 Wastewater Treatment

A chemical manufacturing facility may use a wastewater treatment system to treat contaminated water generated during the chemical manufacturing process (e.g., water that has been used to clean equipment, extractions, crystallizations, and other operations). Wastewater treatment systems generally consist of a series of surface impoundments that are used for equalization, neutralization, aeration, and clarification of the waste stream. Fugitive VOC emissions may occur from each type of basin. Procedures used to estimate emissions from wastewater treatment facilities are described in detail in Volume II, Chapter 5, *Preferred and Alternative Methods for Estimating Air Emissions from Wastewater Collection and Treatment*.

2.2.4 Storage Tanks

Various types and sizes of storage tanks are used to store solvents and resins used in the chemical manufacturing process. Most of these tanks have a fixed-roof design. The two significant types of emissions from fixed-roof tanks are breathing and working losses. Breathing loss is the expulsion of vapor from a tank through vapor expansion and contraction that result from changes in ambient temperature and barometric pressure. This loss occurs without any liquid level change in the tank. The combined loss from filling and emptying tanks is called working loss. Evaporation during filling operations results from an increase in the liquid level in the tank. As the liquid level increases, the pressure inside the tank exceeds the relief pressure and vapors are expelled from the tank. Evaporative emissions during emptying occur when air drawn into the tank during liquid removal becomes saturated with organic vapor and expands, expelling vapor through the vapor relief valve (EPA, 1995a). Emissions from tanks are characterized as a point source because VOCs are released through a vent.

2.2.5 Equipment Leaks

In order to transport stored materials (e.g., organic solvents and resins) from storage tanks to the chemical manufacturing operation, a network of pipes, pumps, valves, and flanges is employed. As liquid material is pumped from the storage tanks to the particular process area, the pipes and supporting hardware (process line components) may develop leaks over time. When leaks occur, volatile components in the transported material are released to the atmosphere. This generally occurs from the following process line components:

- Pump seals
- Valves
- Compressor seals
- Safety relief valves
- Flanges
- Open-ended lines
- Sampling connections.

Emissions from equipment leaks can be characterized as fugitive and are described in detail in Volume II, Chapter 4, *Preferred and Alternative Methods for Estimating Fugitive Emissions from Equipment Leaks*.

2.2.6 Spills

Solvents, resins, or product may be accidentally spilled during manufacturing or cleaning activities. Materials that are spilled onto the ground may spread over an area, vaporize, and thus result in an air emission (EPA, 1987). Such an emission would be characterized as fugitive.

2.3 Process Design and Operating Factors Influencing Emissions

VOC and PM emissions from chemical manufacturing may be reduced through the use of add-on control systems or through equipment and process modifications.

2.3.1 VOC Control Systems

A VOC control system typically consists of a capture device and a removal device. The capture device (such as a hood or enclosure) captures the VOC-laden air from the emission area and ducts the exhaust air stream to removal equipment such as a recovery device or a destructive control device. In either case, the purpose of the control device is to remove VOCs from the exhaust air stream. The overall efficiency of a control system is a function of the specific removal efficiency for each device in the system.

Example recovery devices:

- Condensers are one of the most frequently used control devices in industry. They work by reducing the temperature of the emission exhaust gas to a cold enough temperature so that VOC vapors are recovered through condensation.
- Adsorption Devices that incorporate activated carbon are capable of removing VOC vapors from exhaust emission streams to very low levels in the final gas stream. Large scale adsorption based recovery systems normally have two or more activated carbon adsorption chambers. One carbon chamber is being used to remove VOCs from emission stream while the spent carbon chamber is being regenerated. VOCs are recovered from the system during the regeneration phase. Steam is routed into the saturated carbon bed to cause the VOCs to desorb from the carbon and condense at the condenser. Once VOCs liquids have been collected then they may be recycled or further purified prior to reuse in the manufacturing operation.

- Dust collectors are used to collect particulate matter from the emission stream. Dust collectors are constructed in many different designs. A bag house consists of a large rectangular housing with many internal banks of vertically mounted filter bags. The emission stream enters the bag house through the side inlet, passes through the bag filter media, and exits the unit through the discharge port at the top. Particulate matter builds up on the filter media until it is shaken off by pulses of compressed air from within each bag. The dust that falls from the bags during the pulsing process is collected at the lower section of the bag house and finally discharged through the solids outlet to a drum or other container. When designing a bag house for an installation it is important to select the appropriate filter media and surface area for the particulate matter to be collected. The pore size of the filter cloth will determine the removal efficiency of the overall unit.
- A floating roof on a storage tank helps to reduce solvent emissions by eliminating the headspace that is present in conventional storage tanks. For the conventional storage tank air that is saturated with solvent vapors exits the vessel as the surrounding temperature increases during the day. Outside air then reenters the vessel during the evening hours as the surrounding temperature decreases and the daily cycle prepares to be repeated. Additionally, when a conventional storage tank is filled periodically then emission occur by way of displacement. A floating roof moves up and down the vessel vertical walls as the level of the storage tank changes. Since the vessel contains no headspace all breathing and filling losses are avoided.

Example destructive control devices:

- Catalytic Incinerators are used to eliminate VOCs from process exhaust gases from a broad variety of process operations. Catalytic incineration is a technology used in selective applications to greatly reduce emissions due to VOCs, hydrocarbons, odors, and opacity in process exhaust. The catalyst section operates at between 315°C to 400°C to convert VOC to $CO2$ and $H2O$. A properly designed and installed system can achieve a VOC destruction efficiency of greater than 95%.
- Thermal Incinerators control VOC levels in a gas stream by passing the stream through a combustion chamber where the VOCs are burned in air at temperatures between 700°C to 1,300°C. Fuel is burned in the unit to supply the necessary heat for decomposition of the VOC's. Heat exchangers may also be installed as part of the unit to conserve energy by warming the inlet air stream with the hot exhaust gases.
- Venturi Scrubbers are used to remove particulate material from vent exhaust streams. These units normally incorporate a spray nozzle section where liquid is discharged at a high velocity, a mixing section where liquid droplets contact the incoming emission gas stream, and a settling/separation section where scrubber fluid is recycled to the inlet spray nozzle and the exit gas is discharged to the atmosphere or to a secondary control device.
- Enclosed Oxidizing Flares convert VOCs into $CO2$ and $H2O$ by way of direct combustion. Normally an enclosed oxidizing flare is used when the waste gas is rich enough in organic content to be its own fuel source. If the process gas stream does not contain an adequate level of combustible VOCs then additional fuel must be supplied for effective operation.

The removal efficiency for each control device is a function of the specific design of the unit and how well its capability matches the intended application. Before selecting pollution equipment one should consult different manufacturers and/or engineering firms to determine the most appropriate control device solution for a given application.

2.3.2 PM/PM_{10} Control Systems

PM/PM_{10} control systems for the chemical industry consist of a capture device paired with a control device that is typically a fabric filter (bag house). These systems are typically employed to reduce PM emissions from charging pigments and other solids into mixing and grinding devices. The captured dust may be recycled or sent for off-site disposal or treatment.

Bag Houses remove particulate material from an emission gas stream by passing the emission stream through engineered fabric filter tubes, envelopes, or cartridges. Particulate material is retained on the filter media as the clean air is discharged to the atmosphere. Vibrators or timed air blast are used for removing and discharging the dust that has been collected in the unit. When identifying a bag house for an application it is important to consider the particle size in the emission stream, the particle size control requirements, the air flow rate of the emission stream, and the bag filter surface area requirements. Additionally, it is important to identify the appropriate chemical resistance requirements for the materials of construction in the unit.

Fabric filters are least efficient with particles 0.1 to 0.3 μm in diameter and with emission streams of high moisture content. When operated under optimum conditions, they can generally achieve control efficiencies of up to 99+ percent (EIIP, 2000). However, typical control efficiencies range from 95 to 99 percent.

3.0 Basic Air Emission Models

Processes for chemical manufacturing consist of different unit operations including filling, mixing, heating, depressurization, gas sweep, gas evolution, dispersing, milling, and others. A mathematical approach to estimating air emissions from these types of processes is to model them as collection of separate unit operations. This section contains several models that can be applied to many of the operations within these processes. For example, the filling model can be used to estimate the emissions from charging the primary raw materials or transferring the batch from one vessel to a second vessel. The heating and filling models can be used to model distillation operations.

3.1 Vessel Filling

When a solvent or volatile process mixture is charged into a process vessel then material losses will occur though the process vent in the form of solvent vapors. The amount of solvent that is emitted during this displacement operation is a function of the (1) volume of liquid entering the tank, (2) the equilibrium vapor pressure of each component that is contained in the inlet stream and/or present in the vessel before the filling operation begins, and (3) degree of saturation of the associated vapors. The resulting emission rate is simply a function of how quickly the filling operation takes place.

The equilibrium vapor pressure for each volatile component in the system is calculated by applying Raoult's Law to the pure vapor pressure and the mole fraction of each compound in the inlet stream and/or initial vessel contents. If non-idealities exist between molecules in the system then activity coefficient may be used to adjust the vapor pressures accordingly. The calculated equilibrium vapor pressure represents the gas space composition assuming that the degree of vapor saturation is 100%. It is highly possible that the actual saturation level of the solvent vapors may be less than the assumed 100% level. For example, if representative samples have been taken of the gas space and analyzed then this data may be substituted for the calculated vapor pressure values. However, the conservative approach is normally applied and a 100% saturation level is assumed in most cases.

Displacement emissions that are caused by charging operations may be calculated using the ideal gas law on the volume of gas that is emitted. This equation assumes that the partial pressure of component *i* in the vent gas is at saturated levels.

Ideal Gas Law:

$$E_{n\text{-}i} = \frac{p_i V}{RT} \qquad \text{Eq. 3-1}$$

Where $E_{n\text{-}i}$ are the moles of component i that are emitted due to vapor displacement
p_i is the saturated vapor pressure of component i.
V is the displacement volume that was caused by the filling operation.
R is the ideal gas constant in consistent units,
T is the temperature of the liquid being charged

3.1.1 Charging to an Empty Vessel

When a solvent mixture is being charged to an empty vessel then the vapor composition for the displacement calculation may be made based entirely upon the inlet stream composition.

$$p_i = x_i \gamma_i P_i \qquad \text{Eq. 3-2}$$

Where p_i = effective vapor pressure for component i

x_i = mole fraction of component i

γ_i = component activity coefficient (Becomes 1.0 when Raoult's Law applies)

P_i = pure component pressure i

Illustration 3-1: Charging a pure solvent to an empty vessel.

A 5,000 gallon reactor is filled at ambient conditions (25°C and 1 atm) with 3,600 gallons of hexane in one hour. The empty vessel was previously made inert with nitrogen, and the vessel is vented to atmosphere. Calculate the vapor emissions from this process.

Step 1. The displaced gas is defined by the following conditions.

T	=	25°C	=	298°K	(System temperature)
P_{System}	=	1.0 atm	=	760 mm Hg	(Total system pressure)
$V_{displacement}$	=	3600 gal	=	481.28 ft^3	(Displacement volume)
Time	=	1 hr			(Time for event)

Constants and Relationships:

Universal Gas Constant: $$R = 998.9 \frac{mmHg \cdot ft^3}{lb-mole \cdot °K}$$

Antoine Equation: $$P_i = \exp\left(a - \frac{b}{T+c}\right)$$

Gas Law: $n = \dfrac{PV}{RT}$ also $n_i = \dfrac{P_i V}{RT}$ for component *i* in the gas space.

Sum of the partial pressures in the gas space: $P_T = \sum_{i=1}^{N} p_i$

Sum of component moles in the gas space: $N_T = \sum_{i=1}^{N} n_i$

Step 2. Calculate the amount of each component in the displaced gas.

Hexane is the only component in the liquid, so the vapor pressure for hexane is only a function of the system temperature, 25°C. The partial pressure of nitrogen is determined by the difference between the total system pressure, 760 mm Hg, and the partial pressure of hexane. The vapor pressure of hexane may be calculated from the Antoine equation as follows:

$$p_{hexane} = \exp\left(15.8366 - \frac{2697.55}{298.15 - 48.78}\right) = \exp(5.019) = 151.28\ mmHg$$

therefore $$p_{N2} = P_T - p_{hexane} = 760\ mmHg - 151.28\ mmHg = 608.719\ mmHg$$

Ideal Gas Law: $$E_{n-hexane} = \frac{p_{hexane} V}{RT} = \frac{151.281\, mmHg \cdot 481.28 ft^3}{(998.9)(25°C + 273.15)} = 0.244\ lb-moles$$

$$E_{n-N2} = \frac{p_{N2}V}{RT} = \frac{608.719\ mmHg \cdot 481.28 ft^3}{(998.9)(298.15)} = 0.984\ lb-moles$$

Emission level: $$E_{Wt-hexane} = (0.244\ lb-moles)\left(86.17 \frac{lb}{lb-mole}\right) = 21.03\ lb$$

$$E_{Wt-N2} = (0.984\ lb-moles)\left(28.01 \frac{lb}{lb-mole}\right) = 27.562\ lb$$

Step 3. Calculate the emission rate based on the 1 hour addition.

Emission Rates: $$E_{R-hexane} = \frac{21.03\ lb}{1.0\ hr} = 21.03 \frac{lb}{hr}$$

$$E_{R-N_2} = \frac{27.56\ lb}{1.0\ hr} = 27.56 \frac{lb}{hr}$$

Illustration 3-2: Charging a solvent mixture to an empty vessel.

A 50-50 volume percent solvent mixture of heptane and toluene is charged to a surge tank at a rate of 50 gal/min. A total of 1,500 gal of mixed solvent is charged at 20°C.

Step 1. Define conditions of the displaced gas:

T	=	20°C	=	298.15°K	(System temperature)
P_T	=	1.0 atm	=	760 mm Hg	(Total system pressure)
V_{disp}	=	1,500 gal	=	200.53 ft3	(Displacement volume)
Time	=	5 min			(Time for event)

Constants and Relationships:

Universal Gas Constant: $$R = 998.9 \frac{mmHg \cdot ft^3}{lb-mole \cdot {}^\circ K}$$

Antoine Vapor Pressure Equation: $$P_i = \exp\left(a - \frac{b}{T+c}\right)$$

Gas Law: $n = \frac{PV}{RT}$, also $n_i = \frac{p_i V}{RT}$ for a single component *i* in the gas space.

Sum of the partial pressures in the gas space: $P_T = \sum_{i=1}^{N} p_i$

Sum of component moles in the gas space: $N_T = \sum_{i=1}^{N} n_i$

Step 2. Calculate the vapor-phase mole fractions:

VOC	Mol. Wt. lb/lbmole	Density lb/gal	Volume Charged	Weight Charged	lb-moles	Xi
Heptane	100.205	5.6977	750	4,273.3	42.65	0.42
Toluene	92.13	7.2138	750	5,410.3	58.72	0.58
Total					101.37	1.00

In this problem, heptane and toluene coexist in a miscible liquid. The vapor space partial pressure for each compound may be estimated from the pure component pressure and liquid composition using Raoult's Law. It is assumed that the vessel contains nitrogen as the remaining gas component. Pure component vapor pressures for the liquid components may be estimated using the Antoine equation.

$$P_{heptane} = \exp\left(15.8737 - \frac{2911.32}{293.15 - 56.51}\right) = \exp(3.571) = 35.55 mmHg$$

$$P_{toluene} = \exp\left(16.0137 - \frac{3096.52}{293.15 - 53.67}\right) = \exp(3.0835) = 21.84 mmHg$$

VOC	Xi	Pi (mm Hg)	pi (mm Hg)
Heptane	0.42	35.55	14.93
Toluene	0.58	21.84	12.67
Nitrogen	0.0		732.40

Ideal Gas Law:

$$E_{n-heptane} = \frac{p_{heptane}V}{RT_{sys}} = \frac{14.93 mmHg \cdot 200.53 ft^3}{(998.9)(293.15)} = 0.0102 lb-moles$$

$$n_{n-toluene} = \frac{p_{toluene}V}{RT_{sys}} = \frac{12.67 mmHg \cdot 200.53 ft^3}{(998.9)(293.15)} = 0.0087 lb-moles$$

$$n_{nitrogen} = \frac{p_{air}V}{RT_{sys}} = \frac{732.40 mmHg \cdot 200.53 ft^3}{(998.9)(293.15)} = 0.5015 lb-moles$$

Emission level:

$$E_{Wt-heptane} = (0.0102 lb-moles)\left(100.205 \frac{lbs}{lb-mole}\right) = 1.02 lbs$$

$$E_{Wt-toluene} = (0.0087 lb-moles)\left(92.13 \frac{lbs}{lb-mole}\right) = 0.80 lbs$$

$$E_{Wt-nitrogen} = (0.5015 lb-moles)\left(28.0134 \frac{lbs}{lb-mole}\right) = 14.05 lbs$$

Step 3. Calculate the emission rate in lb/hr units.

Since 1,500 of solvent mixture is charged at 50 gpm the complete charge is completed in 30 minutes.

$$E_{R-heptane} = 1.02 lbs\left(\frac{60 min/hr}{30 min}\right) = 2.04\ lbs/hr$$

$$E_{R-toluene} = 0.80 lbs\left(\frac{60 min/hr}{30 min}\right) = 1.6\ lbs/hr$$

$$E_{R-nitrogen} = 14.05 lbs\left(\frac{60 min/hr}{30 min}\right) = 28.1\ lbs/hr$$

3.1.2 Charging to a Partially Filled Vessel with Miscible Contents

When a liquid mixture is charged to a vessel that already contains process material from a prior process operation then the vessel contents composition will dynamically change as the charging operation takes place. The equilibrium vapor composition above the batch will also change in accordance to the batch composition.

At any point in the filling operation one may calculate the batch composition from the initial vessel contents and the amount of material that has been added. Let n_A represent the moles of inlet mixture that are to be added to the vessel and let N_B represent the total number of moles of mixture that are initially contained in the vessel regardless of composition. For example, if the inlet stream contained ethanol, water, and methanol then n_A would represent the total moles of ethanol, water, and methanol that have been charged at any point in the operation.

$$\varphi_A = \frac{n_A}{n_A + N_B} \qquad \text{Eq. 3-3}$$

Where φ_A is the degree of dilution of the inlet stream mixture at any point during the addition,
n_A are the moles of inlet steam mixture charged to the vessel, and
N_B are the moles of mixture that were initially contained in the vessel prior to the addition.

The average dilution $\overline{\varphi}_A$ of the inlet stream A from being mixed with the contents of the vessel may be calculated by integrating a differential expression for $d\varphi_A$ with respect to moles of inlet mixture A and then dividing the results by the total number of moles of mixture A that were charged. [Hatfield, 2003d].

$$\overline{\varphi}_A = \frac{1}{N_A}\int_0^{N_A} \frac{n_A}{(n_A + N_B)} dn_A \qquad \text{Eq. 3-4}$$

$$\overline{\varphi}_A = 1 + \frac{N_B}{N_A}\ln\left(\frac{N_B}{N_A + N_B}\right) \qquad \text{Eq. 3-5}$$

A similar calculation may be made for the average dilution factor of mixture B (the initial vessel contents) that exists during the filling process.

$$\overline{\varphi}_B = \frac{N_B}{N_A}\int_0^{N_A} \frac{1}{(n_A + N_B)} dn_A \qquad \text{Eq. 3-6}$$

$$\overline{\varphi}_B = -\frac{N_B}{N_A}\ln\left(\frac{N_B}{N_A + N_B}\right) \quad \text{Eq. 3-7}$$

Once $\overline{\varphi}_A$ and $\overline{\varphi}_B$ are determined then the average batch composition that exists during the filling operation may be calculated by multiplying the composition of each mixture by its corresponding integrated average dilution factor.

When the filling operation involves subsurface addition then the inlet stream is exposed to the vessel headspace only as it mixes with the vessel contents. In this case only the average batch composition that exists during the filling operation is used to calculate the average vessel headspace vapor composition. $\overline{\varphi}_A$ and $\overline{\varphi}_B$ are calculated

However, if the operation involves above surface addition then the inlet stream is exposed directly to the headspace in the vessel. The equilibrium vapor pressure of the inlet stream must then be considered as an independent source of vapors in addition to the average batch composition.

3.1.2.1 Subsurface Addition

Illustration 3-3: Charging a mixture to a partially filled vessel (subsurface addition).

Three hundred gallons of acetone at 20°C are to be added to the vessel featured in Illustration 2 by way of subsurface addition. For this problem, the initial contents of the vessel are 1,500 gallons of a mixture of heptane (42% mole fraction) and toluene (58% mole fraction) at 20°C. The system pressure is 760 mm Hg and the addition process is complete in 0.5 hour.

Step 1. Define conditions of the displaced gas.

T	=	20°C	=	298.15°K	(System temperature)
PT	=	1.0 atm	=	760 mm Hg	(Total system pressure)
Vdisp	=	300 gal	=	40.1 ft3	(Displacement volume)
Time	=	30 min			(Time for event)
Acetone	=	6.5632 lb/gal @ 20°C			

Constants and Relationships:

Universal Gas Constant: $R = 998.9 \frac{mmHg \cdot ft^3}{lb - mole \cdot {}^\circ K}$

Antoine Vapor Pressure Equation: $P_i = \exp\left(a - \frac{b}{T + c}\right)$

Gas Law: $n = \frac{PV}{RT}$, also $n_i = \frac{p_i V}{RT}$ for a single component i in the gas space.

Sum of the partial pressures in the gas space: $P_T = \sum_{i=1}^{N} p_i$

Sum of component moles in the gas space: $N_T = \sum_{i=1}^{N} n_i$

Step 2. Calculate the dilution factors for the inlet stream and the initial vessel contents.

Inlet Stream Analysis:

VOC	Mol. Wt. lb/lbmole	Density lb/gal	Volume Charged	Weight Charged	lb-moles	Xi
Acetone	58.08	6.5632	300	1968.96	33.90	1.00
Total					33.90	1.00

Initial Vessel Contents Analysis:

VOC	Mol. Wt. lb/lbmole	Density lb/gal	Volume Charged	Weight Charged	lb-moles	X_i
Heptane	100.205	5.6977	750	4,273.3	42.65	0.42
Toluene	92.13	7.2138	750	5,410.3	58.72	0.58
Total					101.37	1.00

Calculate the inlet stream dilution factor:

From Eq 3.5:

$$\bar{\varphi}_A = 1 + \frac{N_B}{N_A}\ln\left(\frac{N_B}{N_A + N_B}\right)$$

$$\bar{\varphi}_A = 1 + \frac{101.37}{33.90}\ln\left(\frac{101.37}{33.90 + 101.37}\right)$$

$$\bar{\varphi}_A = 1 + 2.99\ln(0.7494) = 0.14$$

Calculate the dilution factor for the initial vessel contents:

From Eq 3.7

$$\bar{\varphi}_B = -\frac{N_B}{N_A}\ln\left(\frac{N_B}{N_A + N_B}\right)$$

$$\bar{\varphi}_B = -\frac{101.37}{33.90}\ln\left(\frac{101.37}{33.90 + 101.37}\right)$$

$$\bar{\varphi}_B = -2.99\ln(0.7494) = 0.86$$

Step 3. Calculate the average batch and vapor-phase compositions.

VOC	Xi	φA, φB	$\bar{X}_i$	P_i (mm Hg)	p_i (mm Hg)
Acetone	1.00	0.14	0.14	184.80	25.87
Heptane	0.42	0.86	0.36	35.55	12.80
Toluene	0.58	0.86	0.50	21.84	10.92
Nitrogen					710.41
Total	1.00		1.00		760.00

Ideal Gas Law:

$$E_{n\text{-}acetone} = \frac{p_{acetone}V}{RT_{sys}} = \frac{25.87mmHg \cdot 40.1ft^3}{(998.9)(293.15)} = 0.00354\ lb-moles$$

$$E_{n\text{-}heptane} = \frac{p_{heptane}V}{RT_{sys}} = \frac{12.83mmHg \cdot 40.1ft^3}{(998.9)(293.15)} = 0.00176\ lb-moles$$

$$E_{n-toluene} = \frac{p_{toluene}V}{RT_{sys}} = \frac{10.92mmHg \cdot 40.1ft^3}{(998.9)(293.15)} = 0.0015\ lb-moles$$

$$E_{n-nitrogen} = \frac{p_{nitrogen}V}{RT_{sys}} = \frac{710.41mmHg \cdot 40.1ft^3}{(998.9)(293.15)} = 0.0973\ lb-moles$$

Emission level:

$$E_{wt\text{-}acetone} = (0.00354lb-moles)\left(58.08\frac{lbs}{lb-mole}\right) = 0.21\ lbs$$

$$E_{wt\text{-}heptane} = (0.00176lb-moles)\left(100.205\frac{lbs}{lb-mole}\right) = 0.18\ lbs$$

$$E_{wt-toluene} = (0.0015lb-moles)\left(92.13\frac{lbs}{lb-mole}\right) =0.14\ lbs$$

$$E_{wt-nitrogen} = (0.0973lb-moles)\left(28.0134\frac{lbs}{lb-mole}\right) = 2.73\ lbs$$

Step 4. Calculate the emission rate in lb/hr units.

$$E_{R-acetone} = \frac{0.21\ lbs}{0.5\ hr} = 0.42\ lbs/hr$$

$$E_{R-heptane} = \frac{0.18\ lbs}{0.5\ hr} = 0.36\ lbs/hr$$

$$E_{R-toluene} = \frac{0.28\ lbs}{0.5\ hr} = 0.56\ lbs/hr$$

$$E_{R-nitrogen} = \frac{2.73\ lbs}{0,5\ hr} = 5.46\ lbs/hr$$

3.1.2.2 Above Surface Addition

Illustration 3-4: Charging a mixture to a partially filled vessel (above surface addition).

Three hundred gallons of acetone at 20°C are to be added to the vessel featured in Illustration 3-2 by way of above surface addition. For this problem, the initial contents of the vessel are 1,500 gallons of a mixture of heptane (42% mole fraction) and toluene (58% mole fraction) at 20°C. The system pressure is 760 mm Hg and the addition process is complete in 0.5 hours.

For this problem, the inlet stream is in direct contact with the vessel headspace as it enters the vessel. Therefore, the equilibrium vapor composition for the inlet stream will be based on the exact composition of the inlet stream. A dilution factor $\overline{\varphi}_A$ for the inlet stream will be assumed to be 1.0.

Step 1. Define the conditions of the displaced vent gas:

T	=	20°C	=	298.15°K	(System temperature)
PT	=	1.0 atm	=	760 mm Hg	(Total system pressure)
V_{disp}	=	300 gallons	=	40.1 ft3	(Displacement volume)

Time	=	30 min	(Time for event)
Acetone	=	6.5632 lb/gal @ 20°C	

Constants and Relationships:

Universal Gas Constant: $R = 998.9 \dfrac{mmHg \cdot ft^3}{lb-mole \cdot °K}$

Antoine Vapor Pressure Equation: $P_i = \exp\left(a - \dfrac{b}{T+c}\right)$

Gas Law: $n = \dfrac{PV}{RT}$ also $n_i = \dfrac{p_i V}{RT}$ for a single component *i* in the gas space.

Sum of the partial pressures in the gas space: $P_T = \sum_{i=1}^{N} p_i$

Sum of component moles in the gas space: $N_T = \sum_{i=1}^{N} n_i$

Step 2. Calculate the dilution factor for the initial vessel contents.

Inlet Stream Analysis:

VOC	Mol. Wt. lb/lbmole	Density lb/gal	Volume Charged	Weight Charged	lb-moles	X_i
Acetone	58.08	6.5632	300	1968.96	33.90	1.00
Total					33.90	1.00

Initial Vessel Contents Analysis:

VOC	Mol. Wt. lb/lbmole	Density lb/gal	Volume Charged	Weight Charged	lb-moles	X_i
Heptane	100.205	5.6977	750	4,273.3	42.65	0.42
Toluene	92.13	7.2138	750	5,410.3	58.72	0.58
Total					101.37	1.00

Calculate the dilution factor for the initial vessel contents:

From Eq 3-7
$$\overline{\varphi}_B = -\frac{N_B}{N_A}\ln\left(\frac{N_B}{N_A + N_B}\right)$$

$$\overline{\varphi}_B = -\frac{101.37}{33.90}\ln\left(\frac{101.37}{33.90 + 101.37}\right)$$

$$\overline{\varphi}_B = -2.99\ln(0.7494) = 0.86$$

Step 3. Calculate the average batch and vapor-phase compositions.

VOC	XI	φA, φB	$\overline{X}_i$	Pi (mm Hg)	pi (mm Hg)
Acetone	1.00	1.00	1.00	184.80	184.80
Heptane	0.42	0.86	0.36	35.55	12.80
Toluene	0.58	0.86	0.50	21.84	10.92
Nitrogen					551.48
Total	1.00		1.00		760.00

Ideal Gas Law:

$$E_{n-acetone} = \frac{p_{acetone}V}{RT_{sys}} = \frac{184.80mmHg \cdot 40.1ft^3}{(998.9)(293.15)} = 0.0.0253\ lb-moles$$

$$E_{n-heptane} = \frac{p_{heptane}V}{RT_{sys}} = \frac{12.83mmHg \cdot 40.1ft^3}{(998.9)(293.15)} = 0.00176\ lb-moles$$

$$E_{n-toluene} = \frac{p_{toluene}V}{RT_{sys}} = \frac{10.92mmHg \cdot 40.1ft^3}{(998.9)(293.15)} = 0.0015\ lb-moles$$

$$E_{n-nitrogen} = \frac{p_{nitrogen}V}{RT_{sys}} = \frac{551.48mmHg \cdot 40.1ft^3}{(998.9)(293.15)} = 0.0755\ lb-moles$$

Emission level:

$$E_{wt-acetone} = (0.0253lb-moles)\left(58.08\frac{lbs}{lb-mole}\right) = 1.47\ lbs$$

$$E_{wt-heptane} = (0.00176lb-moles)\left(100.205\frac{lbs}{lb-mole}\right) = 0.18\ lbs$$

$$E_{wt-toluene} = (0.0015lb-moles)\left(92.13\frac{lbs}{lb-mole}\right) = 0.14\ lbs$$

$$E_{wt-nitrogen} = (0.0755lb-moles)\left(28.0134\frac{lbs}{lb-mole}\right) = 2.12\ lbs$$

Step 4. Calculate the emission rate in lb/hr units.

$$E_{R-acetone} = \frac{1.47\ lbs}{0.5\ hr} = 2.94\ lbs/hr$$

$$E_{R-heptane} = \frac{0.18\ lbs}{0.5\ hr} = 0.36\ lbs/hr$$

$$E_{R-toluene} = \frac{0.28\ lbs}{0.5\ hr} = 0.56\ lbs/hr$$

$$E_{R-nitrogen} = \frac{2.12\ lbs}{0,5\ hr} = 4.24\ lbs/hr$$

3.1.2.3 Addition of Immiscible Liquids

Illustration 3-5: Charging a mixture to a partially filled vessel (immiscable liquids).

Seven hundred fifty gallons of toluene at 20°C are to be added to the vessel that contains 500 gallons of water at 20°C. The system pressure is 760 mm Hg and the addition process is complete within 0.5 hours.

For this problem, the two mixtures are insoluble and form two distinct liquid phases as the addition process takes place. Therefore, dilution of one stream by the other does not occur and the equilibrium vapor composition is determined based on the initial composition of each mixture.

Step 1. Define conditions of the displaced gas:

T	=	20°C	=	298.15°K	(System temperature)
P_T	=	1.0 atm	=	760 mm Hg	(Total system pressure)
V_{disp}	=	750 gal	=	100.2 ft3	(Displacement volume)
Time	=	30 min			(Time for event)

Constants and Relationships:

Universal Gas Constant: $R = 998.9 \dfrac{mmHg \cdot ft^3}{lb - mole \cdot {}^\circ K}$

Antoine Vapor Pressure Equation: $P_i = \exp\left(a - \dfrac{b}{T+c}\right)$

Gas Law: $n = \dfrac{PV}{RT}$, also $n_i = \dfrac{p_i V}{RT}$ for a single component *i* in the gas space.

Sum of the partial pressures in the gas space: $P_T = \sum_{i=1}^{N} p_i$

Sum of component moles in the gas space: $N_T = \sum_{i=1}^{N} n_i$

Step 2. Calculate the dilution factor for the initial vessel contents.

Inlet Stream Analysis:

VOC	Mol. Wt. lb/lb-mole	Density lb/gal	Volume Charged	Weight Charged	lb-moles	X_i
Toluene	92.13	7.2138	750	5,410.4	58.72	1.00
Total					58.72	1.00

Initial Vessel Contents Analysis:

VOC	Mol. Wt. lb/lb-mole	Density lb/gal	Volume	Weight	lb-moles	X_i
Water	18.02	8.33	500	4,165	231.13	1.00
Total					231.13	1.00

Step 3. Calculate the average batch and vapor-phase compositions.

VOC	X_i	P_i (mm Hg)
Toluene	1.00	21.84
Water	1.00	17.35
Nitrogen		720.81
Total	1.00	760.00

Ideal Gas Law: $$E_{n\text{-toluene}} = \frac{p_{toluene}V}{RT_{sys}} = \frac{21.84 mmHg \cdot 100.2 ft^3}{(998.9)(293.15)} = 0.0.00747\ lb-moles$$

$$E_{n\text{-water}} = \frac{p_{water}V}{RT_{sys}} = \frac{17.35 mmHg \cdot 100.2 ft^3}{(998.9)(293.15)} = 0.00594\ lb-moles$$

$$E_{n-nitrogen} = \frac{p_{nitrogen}V}{RT_{sys}} = \frac{720.81 mmHg \cdot 100.2 ft^3}{(998.9)(293.15)} = 0.24665\ lb-moles$$

Emission level: $$E_{wt-toluene} = (0.00747 lb-moles)\left(92.13 \frac{lbs}{lb-mole}\right) = 0.69\ lbs$$

$$E_{wt-water} = (0.00594 lb-moles)\left(18.02 \frac{lbs}{lb-mole}\right) = 0.11\ lbs$$

$$E_{wt-nitrogen} = (0.24665 lb-moles)\left(28.0134 \frac{lbs}{lb-mole}\right) = 6.91\ lbs$$

Step 4. Calculate the emission rate in lb/hr units.

$$E_{R-toluene} = \frac{0.69\ lbs}{0.5\ hr} = 1.38\ lbs/hr$$

$$E_{R-water} = \frac{0.11\ lbs}{0.5\ hr} = 0.22\ lbs/hr$$

$$E_{R-nitrogen} = \frac{6.91\ lbs}{0,5\ hr} = 13.82\ lbs/hr$$

3.2 Purge/Gas Sweep Models

3.2.1 Purge or Gas Sweep – Empty Vessel Purge

When a gas purge is applied to an empty vessel that still contains residual vapors from a previous process operation then compound emissions may be determined by the following expression.

$$E_{n-i} = \frac{p_{i,1}V}{RT}\left(1 - e^{-Ft/V}\right)$$

Where $E_{n\text{-}i}$ are the moles of component i that are emitted due to vapor displacement,
$p_{i,1}$ is the saturated vapor pressure of component *i* at initial conditions,

V is the gas space volume of vessel when empty,
R is the ideal gas constant in consistent units,
T is the temperature of the liquid being charged,
F is the purge gas flowrate,
t is the elapsed time for the purge operation.

Illustration 3-6: Purging an empty vessel or reactor containing solvent vapors.

A 2,000 gallon reactor vessel was cooled to 20°C and the contents, an acetone solvent, were pumped out leaving only vapors. If this vessel is then purged with 1,000 standard cubic feet of nitrogen at 20°C, how much acetone is in the vented nitrogen?

Step 1. Determine the initial partial pressure of acetone in the vessel gas space.

$$p_{acetone,20°C} = \exp\left(16.6513 - \frac{2940.46}{293.15 - 35.93}\right) = \exp(5.2196) = 184.86\,mmHg$$

$$F \cdot t = (1000\,scf)\left(\frac{273.15 + 20}{273.15}\right) = 1073\,acf$$

$$V = \frac{2000\,gal}{7.48\,gal/ft^3} = 267\,ft^3$$

$$n = \frac{F \cdot t}{V} = \frac{1073\,acf}{267\,ft^3} = 4.02$$

Step 2. Calculate the acetone loss from the vessel by conducting a material balance around the vessel.

Where $N_{acetone}$ is the amount of acetone displaced from the vessel:

$$E_{n-i} = \frac{p_{i,1}V}{RT}\left(1 - e^{-Ft/V}\right)$$

$$E_{n-i} = \frac{(184.86)(267)}{(998.9)(293.15)}\left(1 - e^{-4.02}\right)$$

$$E_{n-acetone} = (0.1686)\left(1 - e^{-4.02}\right) = (0.1686)(0.9821) = 0.166\,lb-moles$$

$$E_{wt-acetone} = (0.166\,lb-moles)(58.08\,lb/lb-mole) = 9.58\,lb$$

Step 3. Calculate the amount of nitrogen emitted from the vessel.

Before the empty vessel purge began, the gas space was saturated with acetone vapors at a partial pressure of 184 mm Hg. At the completion of the purge operation, the acetone partial pressure has been reduced to 3.32 mm Hg. The amount of nitrogen that leaves the vessel through the vent is equal to the inlet amount minus the accumulation amount.

$$E_{n-nitrogen}(out) = N_{nitrogen}(in) - N_{nitrogen}(accum.)$$

$$E_{n-nitrogen}(out) = \frac{PV_{purge}}{RT} - \frac{(p_{i,1} - p_{i,2})V_{vessel}}{RT}$$

$$E_{n-nitrogen}(out) = \frac{(760)(1073)}{(998.9)(293.15)} - \frac{(184.86 - 3.32)(267)}{(998.9)(293.15)} = 2.62\,lb-moles$$

$$E_{wt-nitrogen} = (2.62lb - moles)(28lb/lb - mole) = 73.4lb$$

3.2.2 Purge or Gas Sweep – Partially Filled Vessel

Air or another non-condensable gas is directed into the vessel at a controlled rate. The discharge vapors from the vessel during this operation are normally assumed to be at equilibrium or saturated with the vessel's liquid contents within certain flow rate criteria. Further, it is assumed that the inlet purge rate is known. *Eq. 3-8* is used to calculate amounts of condensable components. The mixing factor S_i represents the degree of VOC saturation for the vent gas, and it is normally between 0 and 1.0. A value of 0.25 for S_i implies that the exit vent gas is at 25% saturation level with respect to the solvent vapors in the tank, while a S_i value of 1.0 implies that the exit vent gas is at equilibrium with the volatile contents of the vessel. [Hatfield, 2003a]

$$E_{R-i} = E_{R-nc} \frac{S_i p_i^{sat}}{p_{nc}^{sat}} \qquad \text{Eq. 3-8}$$

Where E_{R-} = moles of volatile component i emitted per unit time,

S_i = saturation level of the exit vent gas stream,

E_{nc} = moles of non-condensable gas emitted per unit time (= inlet purge rate),

p_i^{sat} = partial pressure of component i at saturated conditions,

p_{nc}^{sat} = partial pressure of the non-condensable gas (i.e., air, nitrogen) at saturated solvent pressure conditions.

The saturation factor for a solvent vapor is a function of the evaporation mass transfer coefficient K_i, the liquid surface area in the vessel, and the solvent partial pressure in the vessel headspace. When the exit emission rate for a vessel is set equal to the evaporation rate in the vessel then the following expression results for the saturation level S_i.

Saturation level S_i:

$$S_i = \frac{p_i}{p_i^{Sat}} = \frac{K_i A}{K_i A + F} = \frac{K_i A}{K_i A + F_{nc} + S_i F_i^{sat}} \qquad \text{Eq. 3-9}$$

Where

$$K_i = K_o \left(\frac{M_o}{M_i} \right)^{1/3}, \qquad \text{Eq. 3-10}$$

and

$$F_i^{sat} = F_{nc} \frac{p_i^{sat}}{p_{nc}^{sat}} = F_{nc} \frac{p_i^{sat}}{\left(P_{sys} - p_i^{sat}\right)}. \qquad \text{Eq. 3-11}$$

S_i = saturated vapor pressure for compound i,

K_i = mass transfer coefficient i,

K_o = mass transfer coefficient of a reference compound,

M_i = molecular weight of compound i,

M_o = molecular weight of the reference compound *o*,

A = surface area of the liquid,

F_{nc} = volumetric flow rate of the non-condensable gas (i.e. air, nitrogen),

F_i^{sat} = volumetric flow rate of component *i* (i.e. VOC) at saturated vapor pressure,

p_i^{sat} = saturated vapor pressure of component i,

p_{nc}^{sat} = partial pressure of the noncondensable gas (i.e. air, nitrogen) at saturated solvent pressure conditions,

P_{sys} = system pressure.

The saturated partial volumetric flow rate for each component is estimated from the component saturated vapor pressure, the inlet gas purge rate, and the partial pressure of the non-condensable at saturated conditions.

S_i may be solved using the standard quadratic solution. Although the standard quadratic equation contains two roots, only the one solution shown in Eq. 3-12 produces a realistic value since S_i must be a positive number between 0 and 1.0.

Quadratic solution:

$$S_i = \frac{-(K_i A + F_{nc}) + \sqrt{(K_i A + F_{nc})^2 + 4F_i^{sat} K_i A}}{2F_i^{sat}} \qquad \text{Eq. 3-12}$$

Finally, the emission rate for the volatile component i may be calculated using Eq. 3-13 which allows for the use of S_i, where $p_i = S_i p_i^{sat}$.

$$E_i = \frac{M_i S_i F_i^{sat} P_{sys}}{RT} \qquad \text{Eq. 3-13}$$

For multi-component liquid mixtures, Eq. 3-9 may be expanded to provide partial volumetric flow levels for each volatile component in the liquid.

$$S_{i+1} = \frac{K_i A}{K_i A + F_{nc} + S_i F_i^{sat} + S_j F_j^{sat} + \ldots + S_n F_n^{sat}} \qquad \text{Eq. 3-14}$$

where *i* is the compound for which the saturation level is being calculated, and terms *j* through *n* represent the other components in the liquid. Eq. 3-14 is solved in an iterative trial and error manner with the initial value of S for each component assigned to 1.0. The value of S that is calculated for each component is then used as the starting point for the next iteration. Finally, when the saturation level S of each compound remains the same for subsequent iterations then the calculation process is stopped.

Emission rates for each solvent compound are then calculated based on the partial volumetric flow rate as calculated from the saturation level and the saturated volumetric flow rate $F_i = S_i F_i^{sat}$.

Solvent emission rate

$$E_i = \frac{M_i S_i F_i^{sat} P_{sys}}{RT} \text{ (wt per unit of time)}$$

Illustration 3-7: Gas sweep with a vessel containing with a single volatile solvent.

A vertical process vessel with a 6-ft cross sectional diameter is at 1 atm pressure and contains a volume of heptane at 25°C. The vessel is being purged with 10 scfm (standard cubic feet per minute) of nitrogen gas. Calculate the emission rate of heptane during the purge operation.

The molecular weight of heptane is 100.2. The mass transfer coefficient is estimated using *Eq. 3-10* with the known mass transfer coefficient for water of 0.83 cm/s. Other variables are also calculated from established relationships.

$$K_i = K_o\left(\frac{M_o}{M_i}\right)^{1/3} = 0.83\frac{cm}{s}\left(\frac{18.02}{100.2}\right)^{1/3} = 0.4685\frac{cm}{s}\times\frac{60\cdot s\cdot ft}{30.48\cdot \min\cdot cm} = 0.92\frac{ft}{\min}$$

$$P^{sat}_{heptane} = 45.86\ mmHg. \quad P^{sat}_{nitrogen} = 760 - 45.86 = 714.14\ mmHg.$$

$$F_{nitrogen} = 10scfm\frac{298.15°K}{273.15°K} = 10.92\,ft^3/\min$$

$$F^{sat}_{heptane} = 10.92\frac{45.86mmHg}{714.14mmHg} = 0.70\,ft^3/\min$$

$$A = \frac{\pi d^2}{4} = \frac{3.14 * 36 ft^2}{4} = 28.26 ft^2$$

$$S_{heptane} = \frac{-(0.92*28.26+10.92)+\sqrt{(0.92*28.26+10.92)^2+4*0.70*0.92*28.26}}{2*0.70}$$

$$S_{heptane} = \frac{-36.92+\sqrt{1363.0+72.79}}{1.40} = \frac{0.97}{1.40} = 0.69$$

$$E_m = \frac{M_i S_i F_i^{sat} P_{sys}}{RT_L} = \frac{(100.2\ lb/lb-mole)(0.69)(0.70\,ft^3/\min)(760mmHg)}{(554.98\,ft^3 atm/lb-mol°R)(537°R)}$$

$$E_{R-m} = 0.12\ lb/\min = 7.2\ lb/hr$$

As an illustration on how the saturation factor for heptane could have been calculated using the iteration technique Eq 3-14 can be applied directly.

$$S_i = \frac{K_i A}{K_i A + F_{nc} + S_i F_i^{sat}} = \frac{0.92*28.26}{0.92*28.26+10.92+S_i 0.70} = \frac{25.99}{36.92+0.7*S_i}$$

Starting with an initial guess for S_i to equal 1.0, the convergence occurs rapidly with the final result 0.69 being equal to earlier results using the quadratic equation.

Iteration 0	$S_i = 1.00$
Iteration 1	$S_i = f(1.00) = 0.69$
Iteration 2	$S_i = f(0.69) = 0.69$

Illustration 3-8: Gas sweep with a vessel containing with a volatile solvent mixture.

Suppose the vessel featured in Illustration 7 contained a solvent mixture consisting of 20% heptane, 70% toluene, and 10% methanol. Assuming that the composition is specified in mole percents, calculate the saturation factor for each component using Eq. 3-14. Before applying Eq. 3-14 to this solution several values must be calculated for each component as shown in the following table:

Table 3-1. Calculated Values for Use in Eq. 3-14

Compound	MWt	VP@25C	Mole fraction	Vp	Fi(sat)	Ki	KiA
Heptane	100.21	45.86	0.2	9.17	0.14	0.47	13.24
Toluene	92.13	28.44	0.7	19.91	0.30	0.48	13.62
Methanol	32.04	126.88	0.1	12.69	0.19	0.69	19.36

The calculated values in Table 3-1 are then substituted into Eq. 3-14 for an iterative trial and error procedure.

$$S_{i+1} = \frac{K_i A}{K_i A + F_{nc} + S_i F_i^{sat} + S_j F_j^{sat} + \ldots + S_n F_n^{sat}} \qquad \text{Eq. 3-14}$$

Table 3-2. Iterative Trial and Error Results for Si using Eq. 3-14

Compound	KiA	FiSat	S_i (Iteration 0)	S_i (Iteration 1)	S_i (Iteration 2)	S_i (Iteration 3)
Heptane	13.24	0.14	1.00	0.53	0.54	0.54
Toluene	13.62	0.30	1.00	0.54	0.55	0.55
Methanol	19.36	0.19	1.00	0.63	0.63	0.63

Finally, the solvent emission rate for each component may be calculated from the relationship.

$$Q_i = \frac{M_i S_i F_i^{sat} P_{sys}}{RT} \qquad \text{(weight per unit of time)}$$

to produce the following emission rate results.

Table 3-3. Calculated Emission Rates

Compound	MWt	S_i	F_iSat	Q_i (lb/min)	Q_i (lb/hr)
Heptane	100.21	0.54	0.14	0.0192	1.15
Toluene	92.13	0.55	0.30	0.0389	2.33
Methanol	32.04	0.63	0.19	0.0100	0.60

3.3 Vacuum Operations

The application of vacuum is used in many distillation or drying operations as a means of reducing the boiling point temperature of a given process mixture. In the case of vacuum distillation, solvent is vaporized in the still vessel, condensed at a low temperature, and collected in a receiving vessel. In the case of a solids drying operation, wet product cake is placed in a rotary or tray dryer and vacuum is applied to the entire drying system. Heat is then applied to the dryer and solvent vapors are condensed at a low temperature and collected in the receiving vessel.

Vent emissions that occur from vacuum operations are the result of air being removed from the system by the vacuum pump or ejector. For solids drying, a nitrogen sweep may be applied at the dryer as a means of accelerating the drying process. The vacuum pump or ejector must remove this additional nitrogen along with any air that has leaked into the system due to the lower pressure.

When the initial distillation phase is underway then the vent emissions are calculated for the system as being from the distillate receiver based on the condensate volume, composition, and temperature. Additionally, the non-condensable gas flow rate (air leak rate and/or nitrogen) and operating vacuum level must be taken into account. It is assumed that the exiting vent gas from the vacuum receiver is saturated with vapors from the liquid condensate.

The moles of each volatile component in the exit vent gas are calculated using the following relationship.

$$E_{n-i} = E_{n-nc}\frac{p_i}{p_{nc}} \qquad \text{Eq. 3-15}$$

Where E_{n-i} = moles of volatile component *i* emitted from the process,

E_{n-nc} = total moles of noncondensable gas emitted from the process,

p_i = partial pressure of volatile component *i*,

p_{nc} = partial pressure of the noncondensable gas (i.e. air, nitrogen) at saturated solvent pressure conditions.

E_{n-nc} represents the total moles of non-condensable gas component that are removed from the system by the vacuum pump.

$$E_{n-nc} = E_{n-nc-leakage} + E_{n-nc-displacement} + E_{n-nc-gas\ sweep} \qquad \text{Eq. 3-16}$$

Where $E_{n-nc-leakage}$ are the moles of air due to leakage into the system,

$E_{n-nc-displacement}$ are the moles of air that are displaced by the condensate,

$E_{n-nc-gas\ sweep}$ are the moles of air or nitrogen admitted as a gas sweep.

If the distillation phase has been completed and the receiver continues to hold condensate while remaining under vacuum, then the non-condensable gas flow rate is based on the air leak rate and/or any nitrogen sweep flow that might exist.

In many cases the air leak rate might be expressed in acfm (ft^3/min at actual temperature and pressure conditions) because it relates to either a known vacuum pump capacity at the 25 mm Hg condition or may have been measured through prior vacuum leak test on the equipment. The nitrogen gas sweep is normally specified in scfm (ft^3/min at standard temperature and pressure conditions) because it relates to nitrogen gas flow meter that might be used for control purposes.

Illustration 3-9: Vacuum operation with vessel filling.

400 gallons of toluene are distilled from a process mixture under vacuum conditions in 2.5 hours. The equipment consists of a 1000 gallon still, condenser, and 1000 gallon receiver. A liquid ring vacuum is used to reduce the operating pressure of the equipment system to 100 mm Hg. The air leak rate is known to be 10 acfm at these conditions. The condenser is cooled with 5°C chilled glycol and the toluene condensate is measured to be 10°C. Calculate the vent emissions leaving the equipment system.

For this problem, toluene is being collected at 10°C in the receiver and an air leak rate has been specified.

Air leak rate:	10 acfm.
Receiver displacement volume:	400 gallons
Operating pressure:	100 mm Hg.
Vapor pressure of toluene at 10°C:	12.43 mm Hg. Antoine equation
Process time:	2.5 hours

Calculations:

Partial pressure of non-condensable: P_{nc} = 100 mm Hg – 12.43 mm Hg. = 87.57 mm Hg.

Displacement volume in ft³:

$$V = \frac{400\ gal}{7.485\ gal/ft^3} = 53.44\,ft^3$$

$$E_{n-nc-displacement} = \frac{p_{nc}V}{RT_{sys}} = \frac{87.57\ mmHg \cdot 53.44\,ft^3}{(998.9)(293.15°K)} = 0.25\ lb-moles$$

Leakage volume in ft³:

$$V_{leakage} = (10\ acfm)(2.5hr)(60\,\text{min}/hr) = 1560\,ft^3$$

$$E_{n-nc-leakage} = \frac{p_{nc}VT_m}{RT_{°K}} = \frac{100\ mmHg \cdot 1560\,ft^3}{(998.9)(293.15°K)} = 0.53\ lb-moles$$

Therefore

$$E_{n-nc} = E_{n-nc-leakage} + E_{n-nc-displacement} + E_{n-nc-gas\ sweep}$$

$$E_{n-nc} = 0.53_{n-nc-leakage} + 0.25_{n-nc-displacement} + 0_{n-nc-gas\ sweep} = 0.78\ lb-moles$$

Finally

$$E_{n-toluene} = E_{n-nc}\frac{p_i}{p_{nc}} = 0.78\frac{12.47}{87.57} = 0.11\ lb-moles$$

$$E_{wt-toluene} = E_{n-toluene}Mw_{toluene} = (0.11\ lb-moles)(92.13\ \text{lb/lb-mole}) = 10.23\ \text{lb}$$

Illustration 3-10: Vacuum operation without vessel filling.

100 gallons of toluene have been collected from a product solids drying operation. The equipment consists of a 200 ft³ tray drier, condenser, and 250 gallon receiver. A liquid ring vacuum is used to maintain an operating pressure of 25 mm Hg. The air leak rate is known to be 1 acfm under these conditions. For this final phase of the drying operation a 1 scfm nitrogen gas sweep is applied to the tray dryer to help accelerate the final drying phase. Although the distillation phase of the operation has ended, the recovered toluene remains in the receiver and is maintained at 7°C. Calculate the toluene emissions from the equipment system to the vacuum pump over a 1.0 hour period.

Since the distillation phase has ended the only the air leak rate and nitrogen gas sweep rate need to be considered.

Air leak rate:	1 acfm.

Nitrogen gas sweep rate:	1 scfm	
Operating pressure:	25 mm Hg.	
Vapor pressure of toluene at 7°C:	10.40 mm Hg.	Antoine equation

Calculations:

Leakage (air):

$$V_{leakage} = (1\ acfm)(60\min) = 60\,ft^3$$

$$E_{n-nc-leakage} = \frac{p_{nc}VT_m}{RT_{\circ K}} = \frac{25\ mmHg \cdot 60\,ft^3}{(998.9)(280.15°K)} = 0.0054\ lb - moles$$

Gas sweep (nitrogen):

$$V_{gas\ sweep} = (1\ scfm)(60\min) = 60\,ft^3(stp)$$

$$E_{n-nc-gas\ sweep} = \frac{P_{stp}V}{RT_{stp}} = \frac{760\ mmHg \cdot 60\,ft^3}{(998.9)(273.15°K)} = 0.17 lb - moles$$

Therefore

$$E_{n-nc} = E_{n-nc-leakage} + E_{n-nc-displacement} + E_{n-nc-gas\ sweep}$$

$$E_{n-nc} = 0.0054_{n-nc-leakage} + 0_{n-nc-displacement} + 0.17_{n-nc-gas\ sweep} = 0.18\ lb - moles$$

Finally

$$p_{nc} = P_{sys} - p_{toluene} = 25.0 - 10.4 = 14.6\ mmHg$$

$$E_{n-toluene} = E_{n-nc}\frac{p_i}{p_{nc}} = 0.18\frac{10.40}{14.60} = 0.13\ lb - moles$$

$$E_{wt-toluene} = E_{n-toluene}Mw_{toluene} = (0.13\ lb - moles)(92.13\ \text{lb/lb-mole}) = 11.98\ \text{lb}$$

3.4 Gas Evolution

Certain processes generate off gases as function of the reaction chemistry. Vent emissions from these types of operations may be estimated by assuming that the exit vent off gas containing the reaction off gas is fully saturated with vapors from the volatile components in the batch. The partial pressure of each component is calculated based on the pure component vapor pressure, mixture composition, and any non-idealities that might exist (activity coefficients).

The moles of each volatile component in the exit vent gas are calculated using the following relationship.

$$E_{n-i} = E_{n-rxn}\frac{p_i}{p_{rxn}} \qquad \text{Eq. 3-17}$$

where: E_{n-i} = moles of volatile component *i* emitted from the process,
E_{n-rxn} = total moles of reaction off gas emitted from the process,
p_i = partial pressure of volatile component *i*,
p_{rxn} = partial pressure of the noncondensable gas (i.e. air, nitrogen) at saturated solvent pressure conditions.

The stoichiometric amount of off gas is usually determined by the process chemistry. However, other considerations may need to be taken into account when estimating the actual amount of off gas that leaves the system. For example, if the off gas is partially soluble in the process solvent then the portion that does not dissolve in the batch will exit the vessel through the vent. If the solubility of the off gas is not known the one could conservatively assume that 100% of the reaction off gas exits the process through the vessel vent.

Illustration 3-11: Reaction involving a gas evolution of one component.

A reaction takes place in a vessel at 50°C with toluene as the primary solvent. Eight pounds of hydrogen chloride is generated based on the chemistry and vented out of the vessel over a one-hour period. Calculate the compound emissions that occur from the reaction, if the system pressure is 760 mm Hg. Also, assume that the batch consist of 95% toluene (mole/mole) and 5% compounds that are nonvolatile.

Step 1. Determine the hydrogen chloride that is discharged from the vessel.

$$E_{n-HCl} = \frac{Wt_{HCl}}{MWt_{HCl}} = \frac{8\ lbs}{36.461\ lb/lb-mole} = 0.219\ lb-mole$$

Step 2. Calculate the vapor pressure of toluene at 50°C using the Antoine equation.

$$P_{toluene,50°C} = \exp\left(16.0137 - \frac{3096.52}{323.15 - 53.67}\right) = \exp(4.52298) = 92.11\ mmHg$$

$$p_{toluene,50°C} = 0.95 \times 92.11\ mmHg = 87.50\ mmHg$$

Step 3. Calculate the toluene emission rate by the ratio of vapor pressures.

$$E_{n-toluene} = E_{HCl}\left(\frac{p_{toluene}}{p_{HCl}}\right)$$

$$E_{n-toluene} = 0.219\ lb-moles\left(\frac{87.50\ mmHg}{760 mmHg - 87.50\ mmHg}\right) = 0.0285\ lb-moles$$

$$E_{wt-toluene} = 0.0285\ lb-moles \times 92.13\ lb/lb-mole$$

$$E_{wt-toluene} = 2.63\ lbs$$

Illustration 3-12: Reaction involving gas evolution of two components.

A reaction takes place in a vessel at 50°C with toluene as the primary solvent. Eight pounds of hydrogen chloride along with an equal molar quantity of sulfur dioxide is generated and vented out of the vessel over a one-hour period. Calculate the compound emissions that occur from the reaction, if the system pressure is 760 mm Hg. Also, assume that the batch consist of 95% toluene (mole/mole) and 5% compounds that are nonvolatile.

Step 1. Determine the hydrogen chloride and sulfur dioxide that is discharged from the vessel.

The molar amount of HCl is calculated from the molecular weight and the quantity of HCL emitted. The molar amount of SO_2 is set equal to the calculated molar amount of HCl.

$$E_{n-HCl} = \frac{Wt_{HCl}}{MWt_{HCl}} = \frac{8\ lbs}{36.461\ lb/lb-mole} = 0.219\ lb-mole$$

$$E_{n-SO_2} = n_{HCl} = 0.219\ lb-moles$$

$$E_{wt-SO_2} = 0.219\ lb-moles \times 64.063\ \text{lb/lb-mole} = 14.03\ \text{lbs}$$

Step 2. Calculate the vapor pressure of toluene at 50°C using the Antoine equation.

$$P_{toluene,50°C} = \exp\left(16.0137 - \frac{3096.52}{323.15 - 53.67}\right) = \exp(4.52298) = 92.11\ mmHg$$

$$p_{toluene,50°C} = 0.95 \times 92.11\ mmHg = 87.50\ mmHg$$

Step 3. Calculate the toluene emission rate by the ratio of vapor pressures.

$$E_{n-toluene} = \left(\frac{p_{toluene}}{p_{HCl} + p_{SO_2}}\right)(n_{HCl} + n_{SO_2}) = \left(\frac{p_{toluene}}{P_{sys} - p_{toluene}}\right)(n_{HCl} + n_{SO_2})$$

$$E_{n-toluene} = \left(\frac{87.50\ mmHg}{760 mmHg - 87.50\ mmHg}\right) 0.438\ lb-mole = 0.057\ lb-moles$$

$$E_{wt-toluene} = 0.057\ lb-moles \times 92.13\ lb/lb-mole$$

$$E_{wt-toluene} = 5.26\ lbs$$

$$E_{wt-HCl} = 8.0\ lbs$$

$$E_{wt-SO_2} = 14.03\ lbs$$

Illustration 3-13: Reaction involving multicomponent gas evolution and nitrogen purge.

A reaction takes place over a 1.0 hour period in a vessel at 50°C with toluene as the primary solvent. Eight pounds of hydrogen chloride along with an equal molar quantity of sulfur dioxide is generated and vented out of the vessel over a one-hour period. Calculate the compound emissions that occur from the reaction, if the system pressure is 760 mm Hg and a nitrogen purge is being applied at 30 SCFH. Also, assume that the batch consist of 95% toluene (mole/mole) and 5% compounds that are nonvolatile.

Step 1. Determine the hydrogen chloride, sulfur dioxide, and nitrogen that are discharged from the vessel over the one hour period. The molar amount of HCl is calculated from the molecular weight and the quantity of HCL emitted. The molar amount of SO_2 is set equal to the calculated molar amount of HCl.

$$E_{n-HCl} = \frac{Wt_{HCl}}{MWt_{HCl}} = \frac{8\ lbs}{36.461\ lb/lb-mole} = 0.219\ lb-mole$$

$$E_{n-SO_2} = n_{HCl} = 0.219\ lb-moles$$

$$E_{wt-SO_2} = 0.219\ lb-moles \times 64.063\ lb/lb-moles = 14.03\ lbs$$

The molar amount of N_2 is calculated based on the 30 SCFH (standard cubic feet per hour) flow rate or nitrogen for the 1.0 hour reaction period.

$$E_{n-N_2} = \frac{30.0\ SCFH \times 1.0HR}{359.046\ \ SCF / lb - mole} = 0.084\ lb - mole$$

$$E_{wt-N_2} = 0.084\ lb - moles \times 28.013\ \text{lb/lb - moles} = 2.35\ lbs$$

The total moles of non-condensable compounds are calculated by summing the molar amounts of HCl, SO2, and N2.

$$E_{n-nc} = E_{n-NCl} + E_{n-SO_2} + E_{n-N_2} = 0.219 + 0.219 + 0.084$$

$$E_{n-nc} = 0.522\ lb - moles$$

Step 2. Calculate the vapor pressure of toluene at 50°C using the Antoine equation.

$$P_{toluene,50^{\circ}C} = \exp\left(16.0137 - \frac{3096.52}{323.15 - 53.67}\right) = \exp(4.52298) = 92.11\ mmHg$$

$$p_{toluene,50^{\circ}C} = 0.95 \times 92.11\ mmHg = 87.50\ mmHg$$

Step 3, Calculate the toluene emission rate by the ratio of vapor pressures.

$$E_{n-toluene} = \left(\frac{p_{toluene}}{\sum p_{nc}}\right) E_{n-nc} = \left(\frac{p_{toluene}}{P_{sys} - p_{toluene}}\right) E_{n-nc}$$

$$E_{n-toluene} = \left(\frac{87.50\ mmHg}{760mmHg - 87.50\ mmHg}\right) 0.522\ lb - mole = 0.13\ lb - moles$$

$$E_{wt-toluene} = 0.13\ lb - moles \times 92.13\ lb / lb - mole$$

$$E_{wt-toluene} = 11.98\ lbs$$

$$E_{wt-HCl} = 8.0\ lbs$$

$$E_{wt-SO_2} = 14.03\ lbs$$

$$E_{wt-N_2} = 2.35\ lbs$$

3.5 Depressurization

Estimating solvent emissions from the depressurization of a batch pressure filter for solids discharge or for the evacuation of a vessel that contains a volatile liquid mixture and a noncondensable gas-phase component, such as air or nitrogen, requires certain assumptions and approximations be made:

- The system pressure is decreased linearly over time.
- Air leakage into the vessel during the operation is negligible.
- The liquid and gas space temperature remains constant during the operation.
- The vapor space of the vessel remains in equilibrium with the volatile liquid contents during the depressurization process.

Since the system temperature is assumed to remain constant during the depressurization operation then the equilibrium vapor pressure of the vessel liquid contents remains constant as well. The moles of solvent vapor that exist within the vessel headspace during the depressurization remain constant for this reason. However, the volatile solvent vapor occupies a greater fraction of the vessel headspace and exit vent gas as the depressurization takes place since the system pressure is being reduced toward the solvent vapor pressure level. As the depressurization unfolds then more and more solvent must evaporate in order to maintain the equilibrium vapor pressure. Therefore, the solvent emissions that occur during depressurization are equal to the net solvent evaporation within the vessel, based on the assumptions for this model.

Eq. 3-18 is based on a material balance for the non-condensable in the vessel headspace and the assumption that the total system pressure is equal to the partial pressure of the volatile plus the partial pressure of the non-condensable. Eq. 3-18 may be integrated as shown in Eq. 3-19 to result in Eq. 3-20. . [Hatfield, 1998b]

$$dn_i(out) = -\left(\frac{V}{RT}\right)\frac{p_i}{p_{nc}}\,dp_{nc} \qquad \text{Eq. 3-18}$$

$$\int_{P_1}^{P_2} dn_i(out) = -\left(\frac{Vp_i}{RT}\right)_{T,V}\int_{P_1}^{P_2}\frac{dp_{nc}}{p_{nc}} \qquad \text{Eq. 3-19}$$

$$n_{i,out} = \frac{Vp_i}{RT}\ln\left(\frac{p_{nc,1}}{p_{nc,2}}\right) \qquad \text{Eq. 3-20}$$

Where: $n_{i,out}$ = moles of volatile component i leaving the vessel
V = vessel headspace volume
p_i = partial pressure of the volatile component
R = Universal gas constant
T = system temperature
$p_{nc,1}$ = partial pressure of the non-condensable component at initial conditions
$p_{nc,2}$ = partial pressure of the non-condensable component at final conditions

Illustration 3-14: Vessel depressurization involving one volatile component.

A 1,000 gallon nutsche filter is used to compress a slurry containing acetone and nonvolatile solids at 80°F (26.7°C). A pressure of 35 psig is imparted onto the slurry until the desired filtration is achieved (approximately 40 minutes). The nutsche filter is then depressurized prior to the discharging of its contents. Residual solids in the filter are estimated to occupy 500 gallons of the filter volume.

Calculate the acetone emissions from the depressurization operation.

Given:

T	=	26.7°C	=	299.85°K	
P1	=	35 psig	=	2570 mm Hg	(Initial pressure)
P2	=	0.0 psig	=	760 mm Hg	(Final pressure)
V	=	500 gal	=	66.843 ft3	(Gas space volume)

Step 1. Determine the saturated vapor pressure for acetone at 26.7°C and the non-condensable partial pressure at initial ($P_{nc,1}$) and final conditions ($P_{nc,2}$).

$$p_{acetone,26.7°C} = \exp\left(16.6513 - \frac{2940.46}{299.85 - 35.93}\right) = \exp(5.5098) = 247.11\,mmHg$$

Therefore:

Pnc,1 = (2570 – 247.11) = 2,322.89 mm Hg

Pnc,2 = (760 – 247.11) = 512.89 mm Hg

Step 2. Calculate the amount of acetone vapor that is emitted from the depressurization operation.

$$E_{n-acetone} = \frac{Vp_i}{RT}\ln\left(\frac{p_{nc,1}}{p_{nc,2}}\right) = \frac{(66.843)(247.11)}{(998.9)(300)}\ln\left(\frac{2322.89}{512.89}\right) = 0.0827\,lb-moles$$

$E_{wt-acetone}$ = (0.0827 lb-moles) (58.08 lb/lb-mole) = 4.8 lbs

Illustration 3-15: Vessel depressurization involving a solvent mixture.

A 1,200 gallon process vessel contains 700 gallons of solvent mixture that is being prepared for vacuum distillation. The solvent mixture is at 20°C and has a molar composition of 20% acetone, 50% toluene, and 30% methanol. Calculate the emissions from the depressurization operation if the pressure is reduced from 760 mm Hg to 100 mm Hg .

Given:

T	=	20.0°C	=	293.15°K	
P1	=	760 mm Hg			(Initial pressure)
V	=	500 gal	=	66.843 ft3	(Gas space volume)

Universal Gas Constant: $R = 998.9\,\frac{mmHg \cdot ft^3}{lb-mole \cdot °K}$

Gas Law: $n = \frac{PV}{RT}$, also $n_i = \frac{p_i V}{RT}$ for a single component, *i*, in the gas space.

Step 1. Determine the saturated vapor pressure composition for the process material at 25°C.

For this illustration the equilibrium vapor pressure composition for the process mixture may be calculated based on the pure vapor pressure and mole fraction of each component in the mixture. The total saturated vapor pressure for the mixture is calculated to be 77.08 mm Hg. as shown in the following table.

Compound	Pure Vapor Pressure (mm Hg)	Mole Fraction X_i	$P_i = X_i * P_i$ (mm Hg)
Acetone	184.86	0.2	36.97
Methanol	97.30	0.3	29.19
Toluene	21.84	0.5	10.92
Total			77.08

$$E_{n-acetone} = \frac{Vp_i}{RT}\ln\left(\frac{p_{nc,1}}{p_{nc,2}}\right) = \frac{(66.843)(36.97)}{(998.9)(293.15)}\ln\left(\frac{682.92}{22.92}\right) = 0.0286\ lb-moles$$

$$E_{n-methanol} = \frac{Vp_i}{RT}\ln\left(\frac{p_{nc,1}}{p_{nc,2}}\right) = \frac{(66.843)(29.19)}{(998.9)(293.15)}\ln\left(\frac{682.92}{22.92}\right) = 0.0226\ lb-moles$$

$$E_{n-toluene} = \frac{Vp_i}{RT}\ln\left(\frac{p_{nc,1}}{p_{nc,2}}\right) = \frac{(66.843)(10.92)}{(998.9)(293.15)}\ln\left(\frac{682.92}{22.92}\right) = 0.0085\ lb-moles$$

3.6 Heating

Heat-up losses that occur during the operation of reactors, distillation equipment, and similar types of processing equipment may be estimated by application of the Ideal Gas Law and vapor-liquid equilibrium principles. Emissions are calculated using the following assumptions:

The vessel is closed during the operation but vapors are vented through a process vent. Additional material is not added to the vessel during heat-up. The displaced gas is assumed to be saturated with VOC vapor in equilibrium with the process material.

When a vessel containing a volatile liquid and a noncondensable gas (e.g. air) is heated at constant pressure, the vapor space gas undergoes expansion and a portion of the gas phase leaves the vessel through the vent. Additionally, the saturated vapor pressures for the volatile liquid components increase. The calculation is based on the premise that the amount of the non-condensable component (air, nitrogen, etc.) that is displaced from the vessel is determined by the initial and final gas space composition. If a nitrogen purge or sweep is placed on the vessel during the heating step, then the amount of non-condensable component that is displaced from the vessel is increased by the total amount of purge gas that passes through the vessel during the heating.

In the heating model, rising vapors from the vessel liquid contents displace the non-condensable gas components from the headspace through the process vent. As the liquid mixture reaches the boiling point, all of the non-condensable component is purged from the vapor space. This model assumes that the average molar headspace volume remains constant relative to changes in the molar composition of the vessel headspace. *Eq. 3-21* is derived from performing material balances around the vessel headspace for the non-condensable component and for component *i* during the heating. [Hatfield, 1998c]

$$E_{n-i,out} = N_{avg}\ \ln\left(\frac{p_{nc,1}}{p_{nc,2}}\right) - \left(n_{i,2} - n_{i,1}\right)_{vessel}$$

Eq. 3-21

Where: $$N_{avg} = \frac{1}{2}(n_1 + n_2)$$ Eq. 3-22

$n_{i,out}$ = moles of volatile component *i* leaving the vessel process vent
N_{avg} = average gas space molar volume during the heating process
p_{nc1} = partial pressure of non-condensable in the vessel headspace at temperature T_1
p_{nc2} = partial pressure of non-condensable in the vessel headspace at temperature T_2
$n_{i,1}$ = moles of volatile component *i* in the vessel headspace at temperature T_1
$n_{i,2}$ = moles of volatile component *i* in the vessel headspace at temperature T_2
n_1 = total moles of gas in the vessel headspace at temperature T_1
n_2 = total moles of gas in the vessel headspace at temperature T_2

Illustration 3-16: Heatup losses from a vessel containing a single volatile component.

A 1250 gallon reactor containing 750 gallons of a toluene solution is heated from 20°C to 70°C. The reactor is vented to the atmosphere during the heat up. How much toluene will be emitted?

Step 1. Calculate the average molar volume of the vessel headspace.

T_i	=	20°C	=	293.15°K	(Initial temperature)
T_f	=	70°C	=	343.15°K	(Final temperature)
P_T	=	1.0 atm	=	760 mm Hg	(Total system pressure)
V_{gas}	=	500 gallons	=	66.843 ft^3	(Gas space volume)
R	=	998.9 (mmHg-ft^3)/(lb-mole-°K)			(Universal gas constant)

Gas Law: $n = \frac{PV}{RT}$, also $n_i = \frac{p_i V}{RT}$ for a single component, *i*, in the gas space.

$$N_{avg} = \frac{1}{2}(n_1 + n_2)$$

$$N_{avg} = \frac{1}{2}\left[\left(\frac{PV}{RT}\right)_1 + \left(\frac{PV}{RT}\right)_2\right] = \frac{760 \times 66.843}{2 \times 998.9}\left(\frac{1}{293.15} + \frac{1}{343.15}\right) = 0.1608 lb-moles$$

Step 2. Calculate the initial and final partial pressures of nitrogen.

Use the Antoine equation to calculate the partial pressure of toluene:

$$P_{toluene,\,20^\circ C} = \exp\left(16.0137 - \frac{3096.52}{293.15 - 53.67}\right) = \exp(3.0835) = 21.84 mmHg$$

$$P_{toluene,70^\circ C} = \exp\left(16.0137 - \frac{3096.52}{343.15 - 53.67}\right) = \exp(5.317) = 203.74 mmHg$$

The partial pressure of nitrogen is the difference between the total system pressure and the partial pressure of toluene:

$$p_{nc,1} = 760 - p_{toluene,1} = 760 - 21.84 = 738.16 mmHg$$

$$p_{nc,2} = 760 - p_{toluene,2} = 760 - 203.74 = 556.26 mmHg$$

Step 3. Calculate the initial and final number of moles of toluene in the vessel headspace.

Use the Gas Law to calculate the moles of toluene:

$$n_{toluene,1} = \left(\frac{p_{toluene,1}V}{RT_1}\right) = \frac{21.84 \times 66.843}{998.9 \times 293.15} = 0.00499 moles$$

$$n_{toluene,2} = \left(\frac{p_{toluene,2}V}{RT_2}\right) = \frac{203.74 \times 66.843}{998.9 \times 343.15} = 0.0397 moles$$

Step 4. Calculate the toluene emission using Eq. 3-21.

The moles of toluene that are displaced from the vessel are calculated by substituting values that have been calculated prior to this point into Eq. 3-21.

$$E_{n-i} = N_{avg} \ln\left(\frac{p_{nc,1}}{p_{nc,2}}\right) - \left(n_{i,2} - n_{i,1}\right)_{vessel}$$

$$E_{n-toluene} = (0.1608)\ln\left(\frac{738.16}{556.26}\right) - (0.0397 - 0.00499) = 0.0108 lb-moles$$

$$E_{wt-toluene} = (0.0108 lb-moles)(92.13 lb/lb-mole) = 0.995 lbs$$

Illustration 3-17: Heatup losses from a vessel containing a volatile mixture.

A 2000 gallon reactor contains 1,500 gallons of a solvent mixture. The solvent mixture has a molar composition of 60% toluene, 30% methyl ethyl ketone, and 10% methylene chloride.

The solvent mixture is heated from 20°C to 70°C and the reactor is vented to atmosphere (760 mm Hg) during the heat up operation. How much of each component will be emitted from the process?

Step 1. Calculate the gas space partial pressure for each compound in the liquid using Raoult's Law and residual partial pressure of nitrogen.

Table 3-4. Partial Pressure Calculates for 20°C and 70°C

Compound	Xi	P_i @ 20C (mm Hg)	X_iP_i (20C) (mm Hg)	P_i @ 70C (mm Hg)	X_iP_i (70C) (mm Hg)
Toluene	0.60	21.835	13.101	203.74	122.25
Methyl Ethyl Ketone	0.30	74.908	22.472	555.52	166.66
Methylene Chloride	0.10	355.540	35.554	2005.2	200.52
Totals	1.00		71.127		489.43

			(mm Hg)		(mm Hg)
Nitrogen (Residual)			688.873		270.57

Step 2. Calculate the average gas space molar volume.

$$N_{avg} = \frac{1}{2}(n_1 + n_2)$$

$$N_{avg} = \frac{1}{2}\left[\left(\frac{PV}{RT}\right)_1 + \left(\frac{PV}{RT}\right)_2\right] = \left(\frac{760 \times 66.843}{2 \times 998.9}\right)\left(\frac{1}{293.15} + \frac{1}{343.15}\right) = 0.1608 lb-moles$$

Step 3. Calculate the initial and final number of moles of toluene in the vessel headspace.

Use the Gas Law to calculate the moles of toluene:

$$n_{i,1} = \left(\frac{p_{i,1}V}{RT_1}\right) = \frac{71.12 \times 66.843}{998.9 \times 293.15} = 0.01623\ moles$$

$$n_{i,2} = \left(\frac{p_{i,2}V}{RT_2}\right) = \frac{489.43 \times 66.843}{998.9 \times 343.15} = 0.09544\ moles$$

$$E_{n-i} = N_{avg} \ln\left(\frac{p_{nc,1}}{p_{nc,2}}\right) - \left(n_{i,2} - n_{i,1}\right)_{vessel}$$

$$E_{n-i} = (0.1608)\ln\left(\frac{688.873}{270.57}\right) - (0.09544 - 0.01623) = 0.07106\ lb-moles$$

Table 3-5. Final Calculated Results for This Problem

Compound	avg p_i (mm Hg)	Fraction To total	n_i (lb-moles)	MWt_i	wt_i (lbs)
Toluene	67.67	0.242	0.0172	92.13	1.58
Methyl Ethyl Ketone	94.566	0.337	0.0240	72.1	1.73
Methylene Chloride	118.037	0.421	0.02992	84.94	2.54
Totals	280.273	1.000	0.0687		

Illustration 3-18: Heatup losses from a vessel with a volatile mixture and nitrogen sweep.

A 1250 gallon reactor containing 750 gallons of a solution of a raw material in toluene is heated from 20°C to 70°C over a one hour period. The vessel has a known gas sweep of 3 scfm of air. The reactor is vented to the atmosphere during the heat up. Assuming a 25% vapor saturation of the gas sweep vapors, how much toluene will be emitted?

This problem differs from the prior heating illustration because we wish to take into account air or nitrogen that is entering the head space of the vessel during the operation. The basic approach used is to first calculate the vent losses of toluene and air (as in the prior example) and then calculate the total toluene losses based on the relative net change in the exit air flow rate due to the gas sweep while at the same time taking into account the saturation level.

Step 1. Calculate the average molar volume of the vessel headspace.

T_i	=	20°C	=	293.15°K	(Initial temperature)
T_f	=	70°C	=	343.15°K	(Final temperature)
P_T	=	1.0 atm	=	760 mm Hg	(Total system pressure)
V_{gas}	=	500 gal	=	66.843 ft^3	(Gas space volume)
R	=	998.9 (mmHg-ft^3)/(lb-mole-°K)			(Universal gas constant)

Gas Law: $n = \frac{PV}{RT}$, also $n_i = \frac{p_i V}{RT}$ for a single component, *i*, in the gas space.

$$N_{avg} = \frac{1}{2}(n_1 + n_2)$$

$$N_{avg} = \frac{1}{2}\left[\left(\frac{PV}{RT}\right)_1 + \left(\frac{PV}{RT}\right)_2\right] = \frac{760 \times 66.843}{2 \times 998.9}\left(\frac{1}{293.15} + \frac{1}{343.15}\right) = 0.1608 lb-moles$$

Step 2. Calculate the initial and final partial pressures of nitrogen.

Use the Antoine equation to calculate the partial pressure of toluene:

$$P_{toluene,\,20°C} = \exp\left(16.0137 - \frac{3096.52}{293.15 - 53.67}\right) = \exp(3.0835) = 21.84 mmHg$$

$$P_{toluene,70°C} = \exp\left(16.0137 - \frac{3096.52}{343.15 - 53.67}\right) = \exp(5.317) = 203.74 mmHg$$

The partial pressure of nitrogen is the difference between the total system pressure and the partial pressure of toluene:

$$p_{nc,1} = 760 - p_{toluene,1} = 760 - 21.84 = 738.16 mmHg$$

$$p_{nc,2} = 760 - p_{toluene,2} = 760 - 203.74 = 556.26 mmHg$$

Step 3. Calculate the initial and final number of moles of toluene and air in the vessel headspace.

Use the Gas Law to calculate the moles of toluene and air:

$$n_{toluene,1} = \left(\frac{p_{toluene,1} V}{RT_1}\right) = \frac{21.84 \times 66.843}{998.9 \times 293.15} = 0.00499 moles$$

$$n_{nc,1} = \left(\frac{p_{nc,1} V}{RT_1}\right) = \frac{738.16 \times 66.843}{998.9 \times 293.15} = 0.1685 moles$$

$$n_{toluene,2} = \left(\frac{p_{toluene,2} V}{RT_2}\right) = \frac{203.74 \times 66.843}{998.9 \times 343.15} = 0.0397 moles$$

$$n_{nc,2} = \left(\frac{p_{nc,2} V}{RT_2}\right) = \frac{556.26 \times 66.843}{998.9 \times 343.15} = 0.1085 moles$$

Step 4. Calculate the toluene emission using Eq. 3-21.

The number of moles of toluene displaced from the vessel is equal to the moles of nitrogen that are displaced from the vessel during the heating operation multiplied by the average molar ratio.

$$E_{n-i} = N_{avg} \ln\left(\frac{p_{nc,1}}{p_{nc,2}}\right) - (n_{i,2} - n_{i,1})_{vessel}$$

$$E_{n-toluene} = (0.1608)\ln\left(\frac{738.16}{556.26}\right) - (0.0397 - 0.00499) = 0.0108\ lb-moles$$

$$E_{wt-toluene} = (0.0108 lb - moles)(92.13 lb/lb - mole) = 0.995\ lbs$$

Step 5. Calculate the emission of air without the gas sweep present.

$$E_{n-nc} = n_{nc,1} - n_{nc,2} = 0.1685 - 0.1085 = 0.06\ moles$$

Step 6. Calculate the moles of gas sweep.

$$E_{n-gas\ sweep} = \left[\frac{760 \times (3\ scfm \times 60 \min)}{998.9 \times 273.15}\right] = 0.501\ moles\ air$$

Step 7. Calculate the toluene emissions while taking the gas sweep into account with a 25% saturation level.

$$E_{n-toluene} = \left(\frac{0.06 + (0.25 \times 0.501)}{0.06}\right) \times .0108 = 3.08 \times 0.0108 = 0.0333\ lb\ moles$$

$$E_{wt-toluene} = (0.0333\ lb - moles)(92.13\ lb/lb - mole) = 3.068\ lbs$$

$$E_{n-nc} = 0.06 + 0.501 = 0.561\ lb - moles$$

$$E_{wt-nc} = (0.561\ lb - moles)(28.97\ lb/lb - mole) = 16.25\ lbs$$

3.7 Evaporation Models

3.7.1 Evaporation from an Open Top Vessel or a Spill

The rate of vaporization of a liquid can be modeled as a function of several characteristic factors of the compound being considered. [Crowl & Louvar, 2002]

$$E_{n-i} = \frac{M_i K_i A (P_i^{sat} - P_i)}{RT_L} \qquad \text{Eq. 3-23}$$

Where E_n is the evaporation rate (mass/time).
M_i is the molecular weight of the volatile substance,
K_i is a mass transfer coefficient (length/time),
A is the evaporation surface area,
P_i^{sat} is the saturated solvent vapor pressure,
P_i is the actual vapor pressure near the liquid surface,
R is the ideal gas constant, and
T_L is the absolute temperature of the liquid.

For many cases, Psat >> p, and *Eq. 3-23* may be simplified to

$$E_{n-1} = \frac{M_i K_i A P_i^{sat}}{RT_L} \qquad \text{Eq. 3-24}$$

Eq. 3-24 may be used to estimate the vaporization rate of a volatile liquid from an open vessel or a liquid spill.

The ratio of the mass transfer coefficients between the compound of interest K and reference compound K_o is expressed as follows:

$$\frac{K_i}{K_o} = \left(\frac{D_i}{D_o}\right)^{2/3} \qquad \text{Eq. 3-25}$$

The gas-phase diffusion coefficient D for a compound is estimated from the ratio of molecular weight of the compound of interest and a known compound (normally water) as follows:

$$\frac{D_i}{D_o} = \left(\frac{M_o}{M_i}\right)^{1/2} \qquad \text{Eq. 3-26}$$

Combining *Eq. 3-25* and *Eq. 3-26* results in a relationship that can be used to estimate the mass transfer coefficient of a given volatile compound.

$$K_i = K_o\left(\frac{M_o}{M_i}\right)^{1/3} \qquad \text{Eq. 3-27}$$

Water is commonly used as a base reference for estimating the mass transfer coefficient for many compounds of interest. The mass transfer coefficient of water at 77 F and 760 mm Hg. is 0.83 cm/s.

Illustration 3-19: Evaporation from a vessel with an open top.

A large open top vertical tank with a 6-ft diameter contains heptane. Estimate the evaporation rate from the tank at 25 C and 1 atm pressure.

The molecular weight of heptane is 100.2. The mass transfer coefficient is estimated using *Eq. 3-24* with the known mass transfer coefficient for water of 0.83 cm/s.

$$K_i = K_o\left(\frac{M_o}{M_i}\right)^{1/3} = 0.83\frac{cm}{s}\left(\frac{18.02}{100.2}\right)^{1/3} = 0.4685\frac{cm}{s}\times\frac{3600\cdot s\cdot ft}{30.48\cdot hr\cdot cm} = 55.33\frac{ft}{hr}$$

$$P^{sat}_{heptane} = 45.86\ mmHg.$$

$$A = \frac{\pi d^2}{4} = \frac{3.14 * 36 ft^2}{4} = 28.26 ft^2$$

$$E_{n-i} = \frac{M_i K_i A P_i^{sat}}{RT_L} = \frac{(100.2\ lb/lb-mole)(55.33\ ft/hr)(26.26 ft^2)(45.86mmHg)}{(998.9 ft^3 atm/lb-mol°K)(298.15°K)}$$

$$E_{wt-i} = 24.42\ lb/hr$$

Illustration 3-20: Evaporation losses from a spill.

Toluene is spilled onto the ground outside of a building. Determine the toluene evaporation rate based on the following data:

The ambient temperature (T) is 25°C or 298.15°K. (°K = °C + 273.15)

The surface area (A) of the spill is 100 ft^2.
The molecular weight of toluene is 92.13 lb/lb-mole.
The vapor pressure of toluene is 28.445 mm Hg.

$$K_i = K_o\left(\frac{M_o}{M_i}\right)^{1/3} = 0.83\frac{cm}{s} * \left(\frac{18.02}{92.13}\right)^{1/3} = 0.58\frac{cm}{s} \times \frac{3600 \cdot s \cdot ft}{30.48 \cdot hr \cdot cm} = 68.50\frac{ft}{hr}$$

$$E_{n-i} = \frac{M_i K_i A\, p^{sat}}{RT_L} = \frac{(92.13\, lb/lb-mole)(68.50 ft/hr)(100.0 ft^2)(28.44 mmHg)}{(998.9 ft^3 mmHg/lb-mol^\circ K)(298.15^\circ R)}$$

$$E_{n-i} = 60\, lb/hr$$

3.8 Emission Model for Liquid Material Storage

The preferred method for calculating emissions from storage tanks is the use of equations presented in *AP-42*. EPA has developed a software package (TANKS) for calculating these types of emissions. The reader is referred to Chapter 1 of this volume, *Introduction to Stationary Point Source Emissions Inventory Development*, for more information on using the TANKS program. Additionally, the reader should consult their state agency and/or the EPA's Clearinghouse for Inventories and Emission Factors (CHIEF) website for the most recent version of TANKS.

3.9 Emission Model for Wastewater Treatment

VOC emissions from a wastewater treatment system may be estimated using equations presented in Air Emissions Models for Waste and Wastewater (EPA, 1994a), and Chapter 5, Preferred and Alternative Methods for Estimating Air Emissions from Wastewater Collection and Treatment Facilities, of this volume. These documents, as well as models such as WATER9 are available on the EPA's CHIEF website.

3.10 Using Sampling and Test Data to Validate Emission Studies

Use of stack and/or industrial hygiene test data is likely to be the most accurate method of quantifying air emissions from chemical manufacturing operations. However, collection and analysis of air samples from manufacturing facilities can be very expensive and especially complicated for chemical manufacturing facilities where a variety of VOCs are emitted and where most of the emissions may be fugitive in nature. Test data from one specific process may not be representative of the entire manufacturing operation and may provide only one example (a snapshot) of the facility's emissions.

To be representative, test data would need to be collected over a period of time that covers production of multiple chemical formulations. It may be necessary to sample multiple production areas. In addition, these methods do not address fugitive emissions that occur outside of a building. If testing is performed, care should be taken to ensure that a representative operational cycle has been selected. If possible, full cycles should be monitored as opposed to portions of cycles.

For example, in some facilities the typical process vessel used in mixing or dispersion operations may have hinged lids or other covers that are loosely fitting. Additionally, these vessels may have top mounted agitators that can be raised or lowered depending upon mixing elevation requirements. A gas tight agitator seal may not be practical for this type of process vessel. In other cases, the mixing vessel my be completely open top. Quantifying the gas sweep rate and volatile vapor saturation level for the overall emission process would not be possible in these cases. Developing a reliable emission model using classic modeling techniques presented in this document may not be reliable in this case.

US EPA Method 204D (Fugitive VOCs from Temporary Total Enclosure) may be used as a means of quantifying air emissions from specific equipment systems for one or more processes. Results from temporary total enclosure testing is considered to be more accurate than from using standardized emission models since the data is from accurate measurement sources. The results from validated emission measurement studies can be used in developing emission standards that in turn can be used to estimate emissions from partial or complete production operations.

Illustration 3-21: Using emission measurements to represent production operations.

A large mixing tank is used as part of a solvent blending operation. The vessel has a flat lid that contains several smaller hinged covers for hand holes and charge shoots. Additionally, the vessel has an agitator but no agitator seal. The tank vent is loosely connected to a large duct system that is powered by a remote exhaust fan near the roof. The exhaust manifold is monitored for air flow rate and solvent concentration using standardized instrumental analysis. During the time of testing the atmospheric pressure is measured to be 760 mm Hg (1.0 atm). The flow rate and temperature of the exhaust gas are measured to be 10 ft^3/min (or 600 ft^3/hr) and 25°C, respectively. Analytical measurements made during the process operation show the toluene and heptane content to be 2.8 mm Hg and 3.7 mm Hg in the exhaust gas, respectively. Calculate the average toluene and heptane emission rate during this process operation.

Using the partial pressure for each compound in conjunction with the ideal gas law and exhaust gas flow rate the following expression can be used to calculate the emission rate for a given pollutant.

$$Q_i = \frac{M_i p_i F}{RT}$$

where M_i = molecular weight of the pollutant,
p_i = partial pressure of the pollutant in mm Hg,
F = exhaust gas flow rate in ft^3/hr,
T = exhaust gas temperature in °K,
R = universal gas constant for mm Hg, ft^3, and °K.

For Toluene: $$Q_{toluene} = \frac{M_{toluene} p_{toluene} F}{RT} = \frac{92.13 * 2.8 * 600}{998.9 * 298.15} = 5.2 \frac{lbs}{hr}$$

For Heptane: $$Q_{hep\tan e} = \frac{M_{hep\tan e} p_{hep\tan e} F}{RT} = \frac{100.21 * 3.7 * 600}{998.9 * 298.15} = 7.5 \frac{lbs}{hr}$$

Note that the actual concentration and temperature of the process mixture that is contained in the process vessel are not required in this calculation since the emissions from the process are being entirely characterized from the analysis of the exhaust gas from the system. Also, it is important that only the process being studied be in operation during the measurement study and that contaminates from other parts of the facility not be present.

3.10.1 Correlating Standard Emission Models to Test Results

Results from total enclosure testing can then be used to correlate with conventional batch modeling formulas. Process variables such as vessel gas sweep rate and/or saturation levels may be estimated based on the test data.

For example, Eq. 3-28 relates the evaporation rate for a volatile compound *i* within a vessel to its molecular weight, mass transfer coefficient, surface area, and other known variables. [Crowl & Louvar, 2002]

$$Q_m = \frac{MKA}{RT}\left(P_i^{Sat} - p_i\right) \qquad \text{Eq. 3-28}$$

where Q_m = evaporation rate (lb/min)
M = molecular weight of compound i
K = mass transfer coefficient (ft/min)
A = surface area (ft^2)
R = ideal gas constant
T = temperature of liquid
P^{Sat} = saturated vapor pressure of compound i
p_i = actual vapor pressure of compound i next to the liquid surface.

Eq. 3-29 is the basic equation for calculating the emission rate for compound *i* from a gas sweep or purge operation based on the exit gas flow rate, partial pressure of compound *i*, molecular weight, and other known variables.

$$Q_v = \frac{FP_T}{RT}\frac{p_i}{P_T}M = \frac{MFp_i}{RT} \qquad \text{Eq. 3-29}$$

where Q_v = emissions from vessel vent (lb/min)
F = exit gas flow rate (ft^3/min)
P_T = overall system pressure
R = ideal gas constant
T = temperature of liquid
p_i = actual vapor pressure of compound i.
M = molecular weight of compound i.

For a vessel at steady state conditions, the emission rate from the gas sweep activity is equal to the evaporation rate or compound *i* from the liquid within the vessel. [Hatfield, 2003a] These two equations can be set equal and solved for the saturation level S_i as follows:

$$Q_m = Q_v$$

Substitute basic expressions $$\frac{MKA}{RT}\left(P_i^{Sat} - p_i\right) = \frac{MFp_i}{RT}$$

Cancel out common terms $$KA\left(P_i^{Sat} - p_i\right) = Fp_i$$

Expand expression $$KAP_i^{Sat} - KAp_i = Fp_i$$

Rearrange terms $KAP_i^{Sat} = Fp_i + KAp_i = (F + KA)p_i$

Divide by (F+FA) $p_i = \dfrac{KAP_i^{Sat}}{F + KA}$

Rearrange to obtain saturation. $S_i = \dfrac{p_i}{P_i^{Sat}} = \dfrac{KA}{F + KA}$ Eq. 3-30

Eq 3-30 is consistent with respect to units. If K (ft/min), A (ft^2), and F (ft^3/min) then S_i is dimensionless and represents the level of saturation as a decimal fraction between 0 and 1.0. When the purge rate becomes zero, the saturation level inside the tank becomes 1.0. The resulting emissions through the vent becomes zero because a purge does not exist through the vessel. When the purge rate increases to the point that F = KA then the saturation level becomes 0.5 (or 50%).

Eq 3-30 relates the saturation level of a volatile component the exit gas sweep rate (F) and the evaporation rate (KA). However, Eq 3.30 represents a worst case condition because it assumes that the gas space in the vessel is perfectly mixed. When F is equal to KA then the partial pressure of the volatile component is only 50% of the saturated vapor pressure. When F is greater than KA then the saturation level is greater than 50% and when F is smaller than KA then the saturation level is less than 50%.

Suppose a vessel with a diameter of 5 ft is partially filled with toluene at 25°C. The vapor pressure and molecular weight of toluene are 28.2 mm Hg and 92.13 lb/lb-mole, respectively. The cross sectional area of the tank or liquid surface area is calculated to be 19.6 ft^2. Assuming that the gas space in the vessel is mixed then the following calculations can be made.

$$K_i = K_o\left(\frac{M_o}{M_i}\right)^{1/3} = 0.83\,\frac{cm}{s}\left(\frac{18.02}{92.13}\right)^{1/3} = 0.482\,\frac{cm}{s} \times \frac{60 \cdot s \cdot ft}{30.48 \cdot \min \cdot cm} = 0.949\,\frac{ft}{\min}$$

$$S_i = \frac{K_i A}{F + K_i A} = \frac{(0.949)(19.6)}{F + (0.949)(19.6)} = \frac{18.59}{F + 18.59}$$

Saturation S_i is plotted for this vessel as a function of F in Figure 3-1 and shows the relationship between exit gas sweep rate and saturation level of the exit vent gas with respect to toluene vapor pressure.

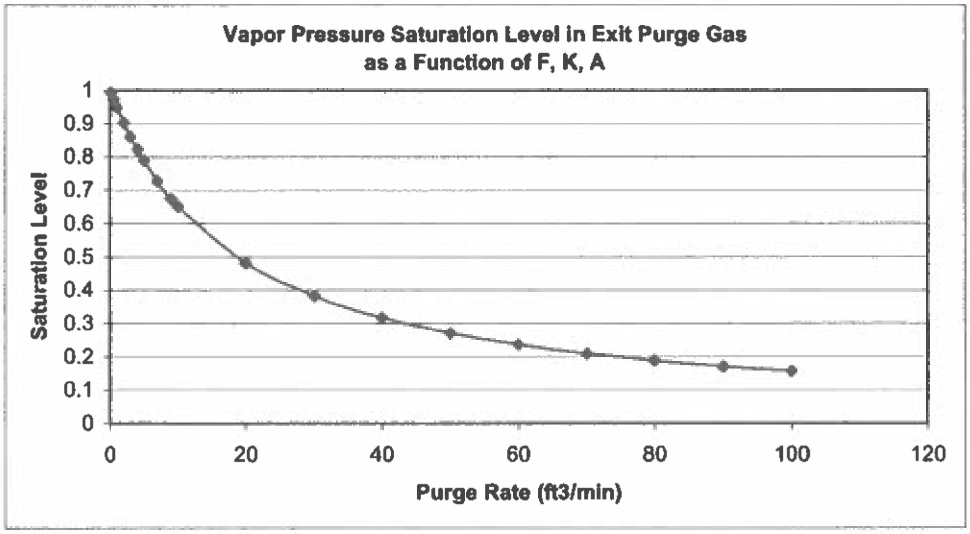


Figure 3-1. Saturation Level (S) Plotted as a Function of Exit Vent Gas Flow Rate.

Once the saturation factor S is know for any exit vent gas flow rate then the estimated emission rate for compound *i* can be plotted as a function of F as by substituting $p_i = S_i p_i^{Sat}$.

$$Q_v = \frac{MFp_i}{RT} = \frac{MFS_i p_i^{Sat}}{RT} \qquad \text{Eq. 3-31}$$

The emission rate for this specific toluene example is plotted in Figure 3-2 in lb/hr as a function of exit gas sweep rate in SCFM.

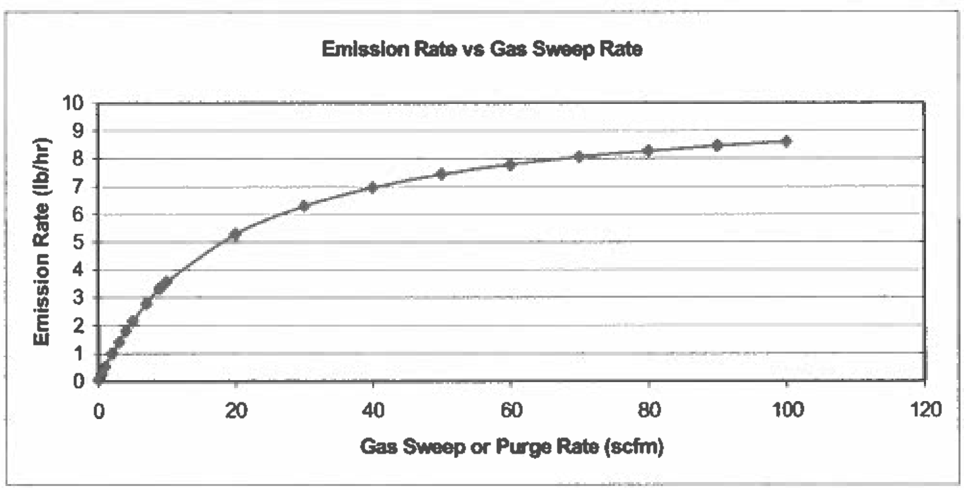


Figure 3-2. Toluene Emission Rate Plotted as a Function of Exit Gas Sweep Rate and Saturation Level.

The vessel had a loose fitting hinged cover and an over sized hole in the top where the agitator entered the vessel. The exit vent gas rate for the vessel could not be determined due to this equipment configuration. A Temporary Total Enclosure test was conducted on this vessel as it was holding toluene at 25°C while mixing was underway. A steady state toluene emission rate was measured to be 5.14 lb/hr. From Figure 3-2, a 5.14 lb/hr toluene emission rate corresponds to an exit vent gas rate of 20 scfm. From Figure 3-1, a 20 scfm exit gas rate corresponds to a saturate level of 0.48 (or 48%).

If the process material is changed with respect to solvent composition then the established gas sweep and saturation level can be used in support of a re-evaluation of the revised operation. In this case the vapor pressure and other physical properties of the new process material would be incorporated into the basic purge model for emission estimates.

3.11 Emission Calculations Using Material Balance

If the equipment or process operation is such that standard modeling techniques can not be applied then a material balance approach may be used to estimate air emissions. Processes that fall into this category might include parts cleaning or degreasing systems where the equipment is open to the atmosphere and/or does not fit typical process vessel designs.

In such cases, the quantity of initial cleaning solvent would be weighed prior to being charged to the equipment system. Once the process operation has been completed then all remaining spent solvent would be collected and weighed. If non-volatile compounds such as oil or other materials are contained in the residual spent solvent then the material would need to be assayed for volatile solvent content.

If the test results are to be used for developing emission standards for a specific process operation then additional tests should be implemented to arrive at a statistically relevant emission estimation.

Illustration 3-22: Using material balance to estimate emissions from operations.

Fresh toluene solvent is charged to an equipment parts degreaser/cleaning unit. The initial amount of toluene charged is 350 lb. At the conclusion of the operation 347.5 lb. of spent toluene (contaminated with waste oil) is collected. A sample of the spent toluene is assayed using loss on drying (LOD) analysis to be 98.8% toluene by weight. Calculate the toluene evaporation losses from the operation.

Stream	Weight (lbs.)	Purity	Weight (lbs.)
Initial Toluene Charge	350.00	100.0%	350.00
Residual Toluene	347.50	98.8%	343.33
Toluene Emitted			6.67

3.12 Emission Calculations Using Emission Factors

Emission factors are commonly used to calculate emissions from chemical manufacturing facilities. EPA maintains a compilation of approved emission factors in *AP-42* for criteria pollutants and hazardous air pollutants (HAPs). Emission factors for equipment leaks may be found in *Protocol for Equipment Leak Emission Estimates* (EPA, 1995g). Chapter 4 of this volume discusses emission estimates from equipment leaks.

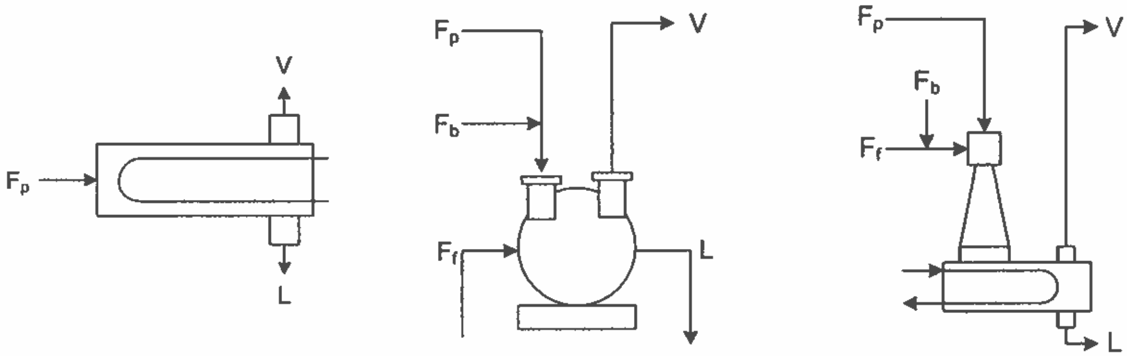
The most comprehensive source for toxic air pollutant emission factors is the Factor Information and Retrieval (FIRE) data system, which also contains criteria pollutant emission factors (EPA, 1995h).

4.0 Single Stage Vent Devices: Condensers, Vacuum Pumps, and Vacuum Steam Jets

There are many different equipment devices that can be installed and operated in the vent path depending upon what is needed by the process. A condenser would be specified if it was required to collect process vapors from the vent stream in the form of liquid condensate while a vacuum pump or steam jet would be used if vacuum was needed at the process vessel. In some cases the process vent path can contain one or more condensers followed by a vacuum pump followed by another condenser.

All of these devices including condensers, vacuum pumps, and vacuum steam jets have several things in common. As process vapors pass through the device the temperature and/or pressure changes. In most cases liquid condensate forms in the device and is discharged along with the remaining vapor. In the case of a vacuum steam jet or a liquid ring vacuum pump, working fluid (steam, water, or other fluid) enters the device and is allowed to mix with the process stream as it passes through the unit. A liquid phase is discharged with any remaining vapors similarly to the condenser. Simple diagrams of each type of device are presented in Figure 4-1.

For calculation purposes, one tends to consider that the liquid and vapor streams are in equilibrium with each other as they exit the device. Additionally, it is assumed that the material balance around the device is satisfied. The rate that material that enters the device is equal to the rate that material exits the device. These two assumptions are what enable one to solve the single stage device problem and to determine the exit stream flow rates and compositions.



Condenser Liquid Ring Vacuum Pump Vacuum Steam Jet

Figure 4-1. Diagrams of single stage vent devices.

4.1 General Calculation Considerations

4.1.1 Material Balance Considerations for the Vent Device

$$F = F_p + F_b + F_f \quad \text{Eq. 4-1}$$

Where F_p is the inlet process rate, F_b is any air or nitrogen bleed, and F_f is any working fluid such as steam, water, or other external fluid. V is the exit vapor stream and L is the exit liquid stream.

$$F = L + V \quad \text{Eq. 4-2}$$

$$z_i F = x_i L + y_i V \qquad \text{Eq. 4-3}$$

Where F is the combined inlet molar flow rate, L is the molar flow rate of the exit liquid stream and V is the molar flow rate of the vapor stream. z, x, and y are the mole fractions of component i for the respective stream.

If air, nitrogen, or another noncondensable gas with a low solubility is present then one can assume that all of the non condensable gas exits the device by way of the exit gas stream V and that none is present in the exit liquid stream L.

$$z_{nc} F = y_{nc} V \text{ where } x_{nc} = 0 \qquad \text{Eq. 4-4}$$

For most vent devices, Eq. 4-4 is a very important relationship because it provides a straightforward way to calculate the amount of the non condensable component contained in the exit vapor stream V. Additionally, Eq. 4-4 provides a way to calculate the moles of component i in the exit vapor stream V from the moles of the non condensable component *nc* and the partial pressure ratio of component *i* and the non condensable component.

$$n_i = n_{nc} \frac{p_i}{p_{nc}} \qquad \text{Eq. 4-5}$$

4.1.2 Equilibrium Relationships Between the Exit Liquid and Vapor Streams

Equilibrium relationships that exist between the exit liquid stream L and the exit vapor stream V are needed in order to relate the relative amount of component i that exists between L and V. If equilibrium is achieved between L and V then Eq. 4-6 and Eq. 4-7 must be satisfied.

$$x_i \gamma_i P_i = p_i \qquad \text{Eq. 4-6}$$

$$y_i = \frac{p_i}{P_{sys}} = \frac{x_i \gamma_i P_i}{P_{sys}} \qquad \text{Eq. 4-7}$$

Where x and y are mole fractions of component i in streams L and V. P_i and p_i are the pure vapor pressure and partial pressure of component i. P_{sys} is the system pressure and γ_i is the activity coefficient of component i.

4.1.3 Checking to See If Condensation Takes Place in the Vent Device

If the process stream contains a noncondensable component (air, nitrogen, or other gases) then it's important to check to see if condensation will likely occur before proceeding to solve the condenser problem. This is not normally an issue with calculations involving liquid ring vacuum pumps and vacuum steam jets because of the significant presence of the working fluid (water, steam, or another fluid). However, if the process stream from the process contains a large amount of noncondensable component then it is possible that condensation may not take place in a standard condenser if the dew point temperature of the process stream is lower than the condenser operating temperature.

It is relatively easy to test for condensation by first assuming that condensate does form containing all of the condensable components from the process stream. Then calculating the mole fraction that each component would need to have at the condenser temperature in order for the partial pressure to be the same as the partial pressure at the inlet conditions. The sum of the resulting liquid mole fractions is calculated. If the sum of the x_i's is equal to or greater than 1.0 then one can assume that condensation takes place in the condenser. However, if the sum of the x_i's is less than 1.0 then one can assume that condensation does not take place and that all of the process exits the condenser as a vapor stream.

$$x_i \gamma_i P_i = p_i \qquad \text{Eq. 4-6}$$

$$x_i = \frac{p_i}{\gamma_i P_i} \qquad \text{Eq. 4-8}$$

Where P_i is the pure vapor pressure at condenser temperature,

p_i is the partial pressure at the condenser inlet.

$\sum x_i \geq 1.0$ — Condensation takes place at $T_{condenser}$.

$\sum x_i < 1.0$ — Condensation does not take place at $T_{condenser}$

4.1.4 General Calculation Approach for Solving Single Stage Vent Device Problems

If the inlet process stream to the single stage device contains only one condensable component and one noncondensable component then the composition of the exit vent stream V is fairly straight forward calculation. The concentration of condensable component in the liquid stream L is 100%, therefore, p_i is equal to P_i for the device temperature. Eq. 4-5 can then be used to directly calculate the moles of the condensable component in the exit vapor stream V.

However, if the process contains two or more condensable components then the calculation becomes much more involved because there are not enough independent equations to solve the problem algebraically. Instead, equations are constructed to express the component material balance while other equations are written for the equilibrium relationships that exist between exit streams L and V. The general solution to the problem is found by iterating back and forth between the material balance equations and the equilibrium equations. The estimated quantity of each component that is contained in the liquid and vapor streams is improved with each iteration. Iterations continue until all equations are satisfied within an acceptable tolerance. When an iterative approach is needed then the Newton-Raphson or a material balance correction approach can be applied as a means to achieving convergence. Both convergence procedures will be presented in the illustrations that are presented.

4.1.5 Partial Condensers

Partial condensers are frequently used to separate compounds from a process that have a much lower boiling point than remaining compounds in the process. For example, suppose a process that is carried out in a toluene solvent (T_b = 110°C) chemically produces methyl chloride (T_b = -30°C) along with several other compounds having normal boiling points that are greater than 50°C. Now suppose that it is desired to remove methyl chloride from the batch. If the process stream is in the vapor state then a partial condenser could be used at a temperature that is above the boiling point of the methyl chloride and below the boiling point of the toluene and other compounds in the process so that the methyl chloride would remain as a gas and the remaining compounds would tend to condense. A majority of the methyl chloride would exit the partial condenser as a vapor and the rest of the process stream would exit as a liquid condensate. Only minor amounts of methyl chloride would be left with the batch and only a small quantity of toluene and other batch compounds would be left in the vapor discharge with the methyl chloride.

The general approach to solving the partial condenser problem is to use the Rachford-Rice equation which combines the material balance constraints with the equilibrium constraints. The Newton-Raphson procedure is used until convergence is achieved. This procedure will be explained further in a worked illustration later in this section.

4.1.6 Total Condensers

Generally, when one refers to condensers used in industry he or she might be thinking about condensers where everything in the process condenses to a liquid. For example, in a batch distillation a solvent is placed in a still vessel and heated to its boiling point. Solvent vapors leave the still and enter an overhead condenser where all of the solvent condenses back into a liquid. Condensate formed in the condenser is then collected in a receiving vessel. Heat continues to be applied to the still until all of the solvent has been distilled. In this example, 100% of the solvent vapor that entered the condenser was condensed and collected in the receiving vessel and none of the solvent left as a vapor. A condenser operated in this manner would be referred to as a total condenser since the entire inlet process vapor was converted into a liquid condensate. Emissions would not occur from the condenser directly since the process vapor does not contain a non condensable gas component. However, emissions would occur from the distillate receiver where the condensate is being collected and non condensable gases which are saturated with solvent vapors are exiting the receiver vent.

4.1.7 Vent Condensers

Many process operations (heating, charging, purging, etc) generate solvent emissions even though the batch is well below the boiling point. This is the result of non condensable gases (air, nitrogen, etc) that are leaving the process vessel which carry solvent vapors in the process. When vapors from these operations flow through a condenser that is colder than the vapor stream then the dew point is reached and condensation takes place. Non condensable gases exit the condenser with a reduced level of solvent vapors due to effect that the colder temperature has had on the vapor pressure of the condensable components.

Vent condensers represent a large percentage of how most condensers are operated in the field. When a total condenser is not being used to condense solvent vapors from a distillation operation then they typically operate like a vent condenser at other times during the process. Three procedures are presented for solving the vent condenser problem including the Modified Rachford-Rich equations, the vapor pressure correction method, and the material balance correction method.

4.1.8 Liquid Ring Vacuum Pumps

Liquid ring vacuum pumps are used to supply vacuum for certain process activities such as vacuum distillations, solids drying, and other operations. Liquid enters the pump and operates in conjunction with the rotating asymmetric internals to produce a low pressure side and a high pressure side by way of several vanes and chambers. In most cases, a large percentage of the liquid that passes through the pump is recycled to the inlet while the remainder is discharged to waste treatment or for subsequent processing. Fresh liquid makeup is added as required by the vacuum pump. In many cases, the operating liquid for the vacuum pump is water although other process fluids including vacuum pump oil are also used.

Liquid ring vacuum pump problems can be solved using the same approach that is used to solve vent condenser problems. All inlet streams to the liquid ring pump (process vapor stream, external air bleed, and working fluid throughput) are combined as a single process stream. The final discharge temperature and pressure are used for the equilibrium calculations. A worked illustration is presented which applies the vapor pressure correction method to solve the emission calculation.

4.1.9 Vacuum Steam Jets

Vacuum steam jets are also used to supply vacuum to certain process activities such as vacuum distillations, solids drying, and other operations. Steam jets will normally enable lower pressures to be achieved than liquid ring pumps (assuming that water is being used as the working fluid). High pressure steam enters the jet through a special nozzle where it is released and allowed to flow through a chamber with an increasing cross sectional area. As the chamber cross sectional area increases, the steam must undergo a reduction in velocity which causes vacuum to be created at the process inlet. Process vapors enter the steam jet through the inlet vacuum port and mix with the working steam. The combined steam and the process vapor stream leave the vacuum chamber and pass through an internal condenser where the steam and other vapors are condensed and the remaining vapor discharged to the atmosphere.

Vacuum steam jets problems can be solved using the same approach that is used to solve vent condenser problems. All inlet streams to the vacuum steam jet (process vapor stream, external air bleed, and steam) are combined as a single process stream. The final discharge temperature and pressure are used for the equilibrium calculations. A worked illustration is presented which applies the material balance correction method to solve the emission calculation.

4.2 Illustrations

Several worked illustrations are presented as a general guide for performing condenser calculations in a variety of configurations. As mentioned earlier, a major difference between the calculation of partial condensers and vent condensers is in how the material balance is applied to the inlet and outlet streams. For the partial condenser, the material balance is applied to inlet and outlet streams as shown in Eq. 4-2. For the vent condenser, the material balance is normally applied directly to the noncondensable gas as shown in Eq. 4-4. The composition of the exit vapor stream and the exit liquid stream is then established through vapor pressure calculations. If the process involves only a single condensable component then the calculation of the exit vapor stream is straight forward. However, if two or more condensable components are contained in the process then the calculation of the exit vapor stream normally requires iterations between the vapor pressure equilibrium calculations and the material balance calculations until both relationships are satisfied.

4.2.1 Condensers with One Condensable Component

Three examples are presented for condensers with inlet gas streams that consist of a noncondensable and one condensable component. In illustration 4-1 the entire system is at atmospheric conditions. In illustration 4-2 the process vessel and condenser are under vacuum. In illustration 4-3, the process vessel is under vacuum, but the condenser is located on the outlet side of the vacuum pump. Each of these examples uses Eq. 4-5 to calculate the amount of the condensable component leaving in the condenser outlet vapor stream. The fraction of the inlet condensable that leaves in the condenser exit vapor is also calculated in each example, although note that two approaches are used.

Illustration 4-1: Condenser with solvent vapor heptane and nitrogen

Nitrogen gas at 25°C and partially saturated with heptane vapor at a 69% level is vented from a process vessel (see Illustration 3-7 in section 3.2.2 of this document) into a condenser. The nitrogen gas constituent has a flow rate of 600.0 SCFH. The gas stream flows through a condenser and is discharged at 5°C and 760 mm Hg.

Calculate the heptane emissions from the condenser over a one hour period. Calculate the material balance for the condenser and the percent removal of heptane.

Step 1. The condenser has the following operating conditions.

Heptane	molecular weight	100.205
Nitrogen	molecular weight	28.013
$P_{heptane}$	45.69 mmHg @ 25°C	
$P_{heptane}$	15.43 mmHg @ 5°C	
T_{inlet}	25°C, 298.15°K	Condenser gas inlet
T_{exit}	5°C, 278.15°K	Condenser gas exit
P_{sys}	760 mm Hg	System pressure
Time	1 hr	Time for event

Universal Gas Constant: $R = 998.9 \dfrac{mmHg \cdot ft^3}{lb - mole \cdot {}^\circ K}$

Step 2. Calculate the amount of nitrogen that passes through the condenser.

We can assume that 100% of the nitrogen gas exits the condenser in the gas phase since little if any would condense with the heptane at 5°C. The amount of nitrogen flowing through the system over a 1.0 hour period is 600.0 ft^3 (at 273.15°C & 760 mm Hg).

$$n_{N_2} = \frac{P_{N_2} V}{RT} = \frac{760\, mmHg \cdot 600\, ft^3}{(998.9)(273.15^\circ K)} = 1.671\ lb - moles$$

$$E_{N_2} = 1.671 * 28.013 \text{ MWt} = 46.817\ lb$$

Step 3. Calculate the amount of heptane that enters the condenser in one hour.

The vent stream enters the condenser at 25°C with a heptane saturation level of 69%. In order to calculate the heptane content in the inlet gas stream we must first know the pure component vapor pressure for heptane at the 25°C stream temperature. Then the partial pressure of the heptane can be calculated for the 69% saturation level. The moles of heptane in the inlet gas stream can be calculated from the ratio of the partial pressure of heptane to the partial pressure of nitrogen and the molar rate of nitrogen.

$$0.69 \times 45.69\ \ mmHg = 31.53\ mmHg$$

The heptane is 69% saturated and so the vapor pressure of heptane is 31.53 mm Hg. The partial pressure of nitrogen is determined by the difference between the total system pressure, 760 mm Hg, and the partial pressure of heptane.

$$p_{N_2} = P_{sys} - p_H = 760\ mmHg - 31.53\ mmHg = 728.47\ mmHg$$

The moles of heptane entering the condenser over a one hour period may now be calculated from the moles of nitrogen in the inlet stream and the ratio of the partial pressure of heptane and the partial pressure of nitrogen.

$$\frac{n_H}{n_{N_2}} = \frac{p_H}{p_{N_2}} \text{ therefore } n_H = \frac{p_H}{p_{N_2}} n_{N_2}$$

$$n_H = \frac{31.53\ mmHg}{728.47\ mmHg} 1.671\ lb\ moles = 0.07233\ lb\ moles$$

$$F_{H,in} = 0.07233\ lb\ moles \times 100.205\ MWt = 7.247\ lb$$

Step 4. Calculate the partial pressure of the heptane at condenser exit temperature.

The exit gas condenser temperature is given to be 5°C. The vapor pressure of heptane in the liquid state can be calculated using the Antoine equation at 5°C (or 278.15°K). The heptane vapor pressure at 5°C is 15.43 mm Hg and less than the 31.53 mm Hg vapor pressure at the condenser inlet. Therefore, condensation must have taken place. The partial pressure of the nitrogen component at the condenser exit can be calculated by subtracting the heptane vapor pressure from the total system pressure.

$$p_{N_2,5°C} = P_{sys} - p_H = 760\ mmHg - 15.43\ mmHg = 744.57\ mmHg$$

Step 5. Calculate the heptane emissions from the condenser over the one hour period.

The final heptane emission level $E_{H,exit}$ may be calculated by multiplying the moles of nitrogen leaving the condenser by the ratio of the heptane and nitrogen partial pressures at the condenser exit conditions. Once $E_{H,exit}$ is known then $L_{H,exit}$ may be calculated by subtracting $E_{H,exit}$ from $F_{H,inlet}$.

$$\frac{n_H}{n_{N_2}} = \frac{p_H}{p_{N_2}} \text{ therefore } n_H = \frac{p_H}{p_{N_2}} n_{N_2}$$

$$n_{H,5°C} = \frac{15.43\ mmHg}{744.57\ mmHg} 1.671\ lb\ moles = 0.03463\ lb\ moles$$

$$E_{H,exit} = (0.03463\ lb\ moles)(100.205\ \text{MWt}) = 3.47\ lb$$

$$L_{H,exit} = 7.25\ lb - 3.47\ lb = 3.78\ lb$$

$$E\%_{heptane} = 100\% * \frac{3.47\ lb}{7.25\ lb} = 47.86\%$$

$$Contdensed\%_{heptane} = 100\% - 47.86\% = 52.14\%$$

Summary Results

	Condenser Inlet	Condenser Condensate	Condenser Exit Vapor
heptane	7.25 lb	3.78 lb, 52.14%	3.47 lb, 47.86%
nitrogen	46.82 lb	0.0 lb, 0.0%	46.82 lb, 100.0%

Illustration 4-2: Condenser with toluene solvent vapor and nitrogen at vacuum conditions

A vacuum receiver in a distillation operation is vented through a condenser to a vacuum pump operating at 175 mm Hg. The process vapor entering the condenser consists of nitrogen (85 mm Hg) and toluene (90 mm Hg).

1. At what temperature must the condenser operate before condensation will take place?
2. If the condenser operates at 10°C, what percent of the toluene vapor to the condenser would exit as vapor?
3. If the nitrogen component of the vapor stream is 10 lb/hr, what would the toluene emission rate be from the condenser?

Universal Gas Constant: $R = 998.9 \dfrac{mmHg \cdot ft^3}{lb - mole \cdot °K}$

Gas Law: $n = \dfrac{PV}{RT}$ also $n_i = \dfrac{P_i V}{RT}$ for component i in the gas space.

Step 1. In order for condensation to take place, the pure vapor pressure of toluene would need to be below 90 mm Hg.

The Antoine equation may be solved for the temperature that would result in a 90 mm Hg vapor pressure for toluene.

Antoine Equation: $P = \exp\left(a - \dfrac{b}{T + c}\right)$

$$\ln(P) = a - \frac{b}{T + c}$$

$$T = \frac{b}{a - \ln(P)} - c = \frac{3096.52}{16.0127 - \ln(90.0)} - (-48.78)$$

$$T = 322.61°K = 49.46°C$$

Step 2. If the condenser operates at 10°C, what percent of the toluene inlet condenser process stream would exit as vapor?

The molar ratio between the toluene and nitrogen in the inlet stream can be calculated from the respective partial pressures. The same calculation can be made at the condenser exit. The percent toluene emitted from the condenser may then be calculated by dividing the molar ratio of toluene to nitrogen at the exit by the molar ratio at the inlet.

$$\frac{p_T}{p_{N2}} = \frac{90.0\ mmHg}{(175.0 - 90.0)\ mmHg} = 1.059\ \frac{mole\ toluene}{mole\ nitrogen}$$

$$\frac{p_T}{p_{N2}} = \frac{12.43\ mmHg}{(175.0 - 12.43)\ mmHg} = 0.076\ \frac{mole\ toluene}{mole\ nitrogen}$$

$$E_T\% = \frac{0.076}{1.059} * 100\% = 7.18\%$$

Step 3. If the nitrogen component of the vapor stream is 10 lb/hr, what would the toluene emission rate be from the condenser?

We can assume that 100% of the nitrogen exits the condenser in the gas phase since little if any would condense with the toluene. The rate that nitrogen flows through the system over 10.0 lb/hr.

$$n_{N2} = \frac{10.0\ lb/hr}{28.013\ MWt} = 0.357\ \text{lb - moles/hr}$$

$$n_T = n_{N2} * \frac{p_T}{p_{N2}} = 0.357 * \frac{12.43 mmHg}{(175 - 12.43) mmHg} = 0.027\ \text{lb - moles}/hr$$

$$E_T = 0.027 \frac{lb - moles}{hr} * 92.13 \frac{lb}{lb - moles} = 2.49\ \frac{\text{lb}}{\text{hr}}$$

Illustration 4-3: Condenser with toluene vapor and nitrogen at atmospheric pressure

If the condenser described in Illustration 4-2 were located at the atmospheric discharge of the vacuum pump instead of on the vacuum inlet side what would the condenser performance been? The vacuum pump is a dry pump and the discharge vapor temperature is sufficiently warm due to adiabatic compression that none of the toluene condenses at the 760.0 mm Hg discharge pressure. The partial pressure for the toluene component is 391 mm Hg and the nitrogen flow rate is 10 lb/hr.

1. At what temperature must the condenser operate before condensation will take place?
2. If the condenser operates at 10°C, what percent of the toluene vapor to the condenser would exit as vapor?
3. If the nitrogen component of the vapor stream is 10 lb/hr, what would the toluene emission rate be from the condenser?

Universal Gas Constant: $R = 998.9 \frac{mmHg \cdot ft^3}{lb - mole \cdot °K}$

Gas Law: $n = \frac{PV}{RT}$ also $n_i = \frac{P_i V}{RT}$ for component i in the gas space.

Step 1. In order for condensation to take place, the pure vapor pressure of toluene would need to be below 391 mm Hg.

The Antoine equation may be solved for the temperature that would result in a 391 mm Hg vapor pressure for toluene.

Antoine Equation:

$$P_i = \exp\left(a - \frac{b}{T + c}\right)$$

$$\ln(P_i) = a - \frac{b}{T + c}$$

$$T = \frac{b}{a - \ln(p_i)} - c = \frac{3096.52}{16.0127 - \ln(391)} - (-48.78)$$

T = 361.9°K = 88.8°C

Step 2. If the condenser operates at 10°C, what percent of the toluene vapor to the condenser would exit as vapor?

The molar ratio between the toluene and nitrogen in the inlet stream can be calculated from the respective partial pressures. The same calculation can be made at the condenser exit. The percent toluene emitted from the condenser may then be calculated by dividing the molar ratio of toluene to nitrogen at the exit by the molar ratio at the inlet.

$$\frac{p_T}{p_{N2}} = \frac{391.0\ mmHg}{(760.0 - 391.0)\ mmHg} = 1.060\frac{mole\ toluene}{mole\ nitrogen}$$

$$\frac{p_T}{p_{N2}} = \frac{12.43\ mmHg}{(760.0 - 12.43)\ mmHg} = 0.017\frac{mole\ toluene}{mole\ nitrogen}$$

$$E_T\% = \frac{0.017}{1.060} * 100\% = 1.60\%$$

Step 3. If the nitrogen component of the vapor stream is 10 lb/hr, what would the toluene emission rate be from the condenser?

We can assume that 100% of the nitrogen exits the condenser in the gas phase since little if any would condense with the toluene. The rate that nitrogen flows through the system is 10.0 lb/hr.

$$n_{N2} = \frac{10.0\ lb/hr}{28.013\ MWt} = 0.357\ \text{lb - moles/hr}$$

$$n_T = n_{N2} * \frac{p_T}{p_{N2}} = 0.357 * \frac{12.43 mmHg}{(760 - 12.43) mmHg} = 0.00594\ \text{lb - moles}/hr$$

$$E_T = 0.00594\frac{lb - moles}{hr} * 92.13\frac{lb}{lb - moles} = 0.55\frac{\text{lb}}{\text{hr}}$$

4.2.2 Partial Condensers

The traditional approach to solving the partial condenser problem is known as the Rachford-Rice Equation [Wankat], shown in equation Eq. 4-9. Many references exist for this procedure and the reader is encouraged to review the literature for additional insights and understanding. [Rachford & Rice][Henley & Seader]

$$f\left(V/_F\right) = \sum_{i=1}^{C} \frac{(K_i - 1)\, z_i}{1 + (K_i - 1)V/F} = 0 \qquad \text{Eq. 4-9}$$

Where

$$K_i \equiv \frac{y_i}{x_i} = \frac{\gamma_i \, P_i}{P_{sys}}$$

If the system is ideal then the activity coefficient γ_i can be set equal to 1.0 and the value for K_i becomes a constant for all compositions at the fixed system temperature and pressure.

$$K_i = \frac{P_i}{P_{sys}}, \text{ were } \gamma_i = 1.0 \qquad \text{Eq. 4-10}$$

Assuming that the partial condenser is being operated at a temperature that is between the dew point and the liquid boiling point of the inlet process stream then *V/F* must have a value that is between 0.0 and 1.0. For example, if *V/F* = 0.4 then this would mean that 40% of the exit process stream will be vapor and 60% will be liquid. By solving the Rachford-Rice function we are simply looking for the value of *V/F* (0.0 < *V/F* < 1.0) that enables *f(V/F)* to become zero. When *V/F* is too low then *f(V/F)* will be less than zero and when *V/F* is too high then *f(V/F)* will be greater than zero. Figure 4-2 presents a typical example of a plot of f(V/F) versus V/F. In this case, the solution to Eq. 4-9 would occur when V/F is approximately 0.43.

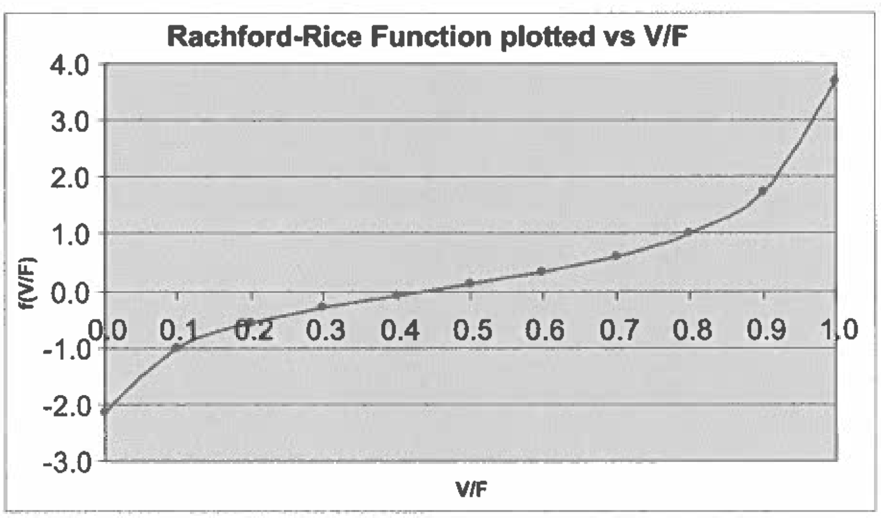


Figure 4-2. Generalized Rachford-Rice equation.

Solving the Rachford-Rice condenser model requires that a numerical search routine be applied since there are not enough independent equations to solve for *V/F* algebraically. Numerical search routines such as False Position and Newton's method can be applied until *V/F* converges to the desired degree of accuracy or tolerance. If the slope of *f(V/F)* is sufficiently large near the solution then the False Position and Newton's method will tend to converge rapidly [Henley & Seader][Rachford & Rice]. Standard spreadsheet software programs generally offer built in goal seeking routines that can be used to solve the Rachford-Rice condenser model.

Once V/F has been determined where f(V/F) = 0 then the composition of the exit liquid L and vapor V streams can be directly calculated using Eq. 4-11 through Eq. 4-14.

$$V = F\left(V/F\right) \qquad \text{Eq. 4-11}$$

$$L = F - V \qquad \text{Eq. 4-12}$$

$$x_i = \frac{z_i}{1+\left(V/F\right)\left(K_i - 1\right)} \qquad \text{Eq. 4-13}$$

$$y_i = x_i K_i \qquad \text{Eq. 4-14}$$

Newton's Method

Using Newton's method, a predicted value of *V/F* for iteration k+1 is computed from the recursive relation shown in Eq. 4-15 where *f(V/F)* is expressed in Eq. 4-9 and *f'(V/F)* is expressed in Eq. 4-16.

$$\left(V/F\right)_{k+1} = \left(V/F\right)_k - \frac{f\left(V/F\right)_k}{f'\left(V/F\right)_k} \qquad \text{Eq. 4-15}$$

$$f'\left(V/F\right)_k = \sum_{i=1}^{C} \frac{\left(K_i - 1\right)^2 z_i}{\left[1+\left(K_i - 1\right)\left(V/F\right)_k\right]^2} \qquad \text{Eq. 4-16}$$

Eq. 4-15 should be iterated until the desired accuracy of *V/F* is achieved. Stop iterating when two successive values of V/F satisfy the conditions in Eq. 4-17.

$$\frac{\left|\left(V/F\right)_{k+1} - \left(V/F\right)_k\right|}{\left(V/F\right)_k} < tolerance\ \ level \qquad \text{Eq. 4-17}$$

The acceptable tolerance level may vary depending on the application, but generally it should be small. For example, 0.0001 might be a reasonable value.

Illustration 4-4: Rachford-Rice Method

A partial condenser is used to separate excess methyl chloride from a process stream for incineration. The process vapor stream enters the condenser containing methyl chloride (1,250 lb/hr), n-hexane (2,585 lb/hr), and toluene (4,125 lb/hr). The partial condenser operates at atmospheric pressure (760 mm Hg) and at 45°C. The process stream may be calculated as an ideal mixture so that Raoult's Law may be applied.

Calculate the flow rate and composition of the discharge vapor and condensate liquid streams from the partial condenser assuming that the exit vapor and liquid stream are at equilibrium.

Step 1. Establish characteristics of the inlet feed stream.

Feed composition F_i (lb-moles/hr) and mole fraction z_i are calculated for each component in the inlet stream from the mass flow rates and molecular weights that are given. The pure vapor pressure (Pure VP) for each component in the feed stream at 45°C has been calculated based on the Antoine Equation and is supplied for this problem. K_i has been calculated using Eq. 4-10 because the problem stated that the process mixture could be treated as ideal. The results are presented in Table 4-1.

Table 4-1. Inlet Feed Stream Analysis

Compound	F_i lb/hr	MWt	F_i lb-moles/hr	z_i mole frac.	Pure VP_i (mm Hg) 45°C	$K_i=P_i/P_{sys}$
methyl chloride	1250.0	50.49	24.757	0.249	7369	9.696
n-hexane	2585.0	86.17	29.999	0.301	338	0.445
toluene	4125.0	92.13	44.774	0.450	74	0.097
Totals			99.6	1.00		

Step 2. Add known values to the Rachford-Rice equation.

The Rachford-Rice equation (Eq. 4-9) is populated using K_i and z_i from Table 4-1. Note that a separate term is required for each compound in the inlet gas stream.

$$f\left(V/F\right) = \sum_{i=1}^{C} \frac{(K_i - 1)z_i}{1 + (K_i - 1)V/F} = 0$$

$$0 = \frac{(K_{mc} - 1)\, z_{mc}}{1 + (K_{mc} - 1)\, V/F} + \frac{(K_h - 1)\, z_h}{1 + (K_h - 1)\, V/F} + \frac{(K_t - 1)\, z_t}{1 + (K_t - 1)\, V/F}$$

$$0 = \frac{(9.696 - 1)\, 0.249}{1 + (9.696 - 1)\, V/F} + \frac{(0.445 - 1)\, 0.301}{1 + (0.445 - 1)\, V/F} + \frac{(0.097 - 1)\, 0.45}{1 + (0.097 - 1)\, V/F} \qquad \text{Eq. 4-18}$$

Step 3. Add known values to the derivative of the Rachford-Rice equation.

The derivative of the Rachford-Rice equation (Eq. 4-16) is populated using the same data from Table 4-1.

$$f'(V/F)_k = \sum_{i=1}^{C} \frac{(K_i - 1)^2\, z_i}{[1 + (K_i - 1)(V/F)_k]^2}$$

$$f'(V/F)_k = \frac{(9.696 - 1)^2\, 0.249}{(1 + (9.696 - 1)\, V/F)^2} + \frac{(0.445 - 1)^2\, 0.301}{(1 + (0.445 - 1)\, V/F)^2} + \frac{(0.097 - 1)^2\, 0.45}{(1 + (0.097 - 1)\, V/F)^2} \qquad \text{Eq. 4-19}$$

Step 4. Solve for V/F using Newton's method.

Once Eq. 4-18 and Eq. 4-19 have been configured then guess an initial value for V/F and use Newton's method as shown in Eq. 4-15 until the accuracy as per Eq. 4-17 is less than 0.0001. The results of this iterative process are shown in Table 4-2. The initial guess for V/F was assumed to be 0.5. Inserting this value in Eq. 4-18 and Eq. 4-19 resulted in initial estimates for f(V/F) and f'(V/F) of 0.567262 and 2.053191, respectively. The next estimate of V/F was calculated using these values in Eq. 4-15, and then the initial and second estimates were compared using Eq. 4-17. This process was repeated for four iterations. At that point the value of V/F had converged within the specified tolerance level.

Table 4-2. Iteration Results for Illustration 4-4

Iteration	$\left(V/F\right)_k$	$f\left(V/F\right)$	$f'\left(V/F\right)$	$\left(V/F\right)_{k+1}$	$\left\lvert\frac{(V/F)_{k+1}-(V/F)_k}{(V/F)_k}\right\rvert$
1	0.5	0.567261	2.053191	0.223717	0.552565
2	0.223717	-3.45E-02	2.86477	0.235756	5.38E-02
3	0.235756	-7.89E-04	2.736357	0.236044	1.22E-03
4	0.236044	-4.16E-07	2.733474	0.236045	6.45E-07

The Rachford-Rice equation for this problem has been plotted in Figure 4-3. The solution to the problem where f(V/F) crosses the axis at V/F = 0.236 and f(V/F) = 0 has been marked with the vertical line.

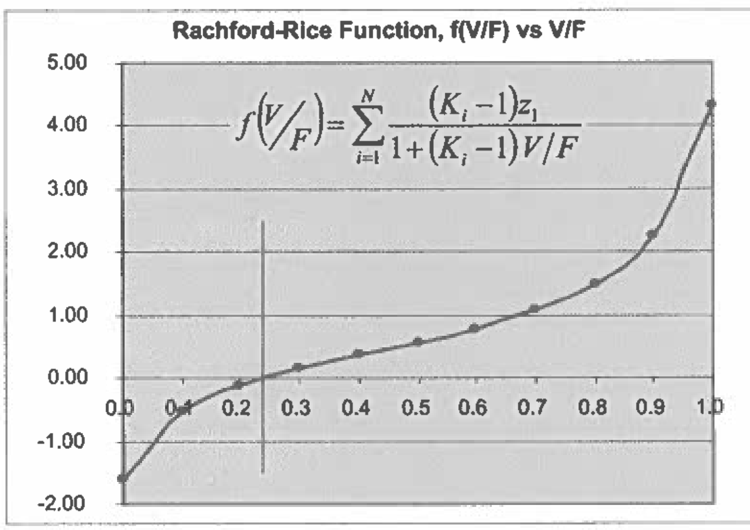


Figure 4-3. Rachford-Rice Plot showing solution at V/F = 0.236044.

Step 5. Determine the outlet vapor and liquid stream flows and compositions.

After V/F has been determined by trial and error, as shown in Table 4-2, then the molar flow rates of the exit liquid and vapor streams are calculated using Eq. 4-11 and Eq. 4-12. For example, the total moles of vapor is calculated as F x V/F (99.6 x 0.236045 = 23.494 lbmoles/hr). The mole fractions of components in each exit stream are calculated using Eq. 4-13 and Eq. 4-14. Finally, the molar flow rates of each component are calculated by multiplying the total moles by the applicable mole fractions. The results of these calculations are shown in Table 4-3.

Table 4-3. Product Outlet Stream Analysis

Compound	x_i	Li (lb-moles/hr)	y_i	Vi (lb-moles/hr)
methyl chloride	0.081	6.196	0.79008	18.562
n-hexane	0.347	26.375	0.15427	3.624
toluene	0.572	43.466	0.05566	1.308
Totals	1.000	76.037	1.000	23.494

4.2.3 Vent Condensers with Single-Phase Condensate

When the process stream contains two or more condensable components and also a noncondensable gas component (air, nitrogen, etc.) then the Rachford-Rice equation that was discussed in section 4.2.2 must be modified in order to solve the condenser problem. As in illustration 4-4, the value of V/F that solves the equation must be determined iteratively. Alternatively, two other iterative approaches may be used. Both of these alternatives involve making an initial guess of the condensate composition. This information is used to solve material balances or equilibrium relationships. If the relationships are not met within a specified level of tolerance, then the condensate composition is adjusted and the process is repeated until the specified accuracy is achieved. These two alternatives to the modified Rachford-Rice equation are not needed to solve the single liquid phase problems in this section. However, they are introduced here to show that they achieve the same results. They will also be used to solve problems with multiple liquid phases in section 4.2.4, which are not readily solved using the modified Rachford-Rice method.

All three options are illustrated in this section for a condenser with the same inlet stream. These illustrations use an inlet stream with three condensable components, but the procedures could be applied to any stream with two or more condensable components. A fourth illustration for a system with liquid that is not ideal is also presented in this section.

4.2.3.1 Option 1 – Modified Rachford-Rice Method

Including noncondensable in the inlet gas stream to a condenser complicates the determination of emissions from the condenser. Typically, the solubility of a noncondensable gas in the condensate that would form in the condenser is either very small or not known. One can simplify the problem by assuming that all of the noncondensable gas exits the vent device through the exit vapor stream and that none is contained in the exit condensate stream. If the solubility of the noncondensable gas in the condensate is set to 0.0, then $x_i = 0$, and K_i becomes infinity. When K_i equals infinity then the standard Rachford-Rice model becomes indeterminate since K_i appears in the numerator and the denominator. This problem may be solved by dividing both numerator and denominator by (K_i-1) as shown.

$$f\left(\frac{V}{F}\right)=\sum_{i=1}^{C}\frac{(K_i-1)z_i}{1+(K_i-1)V/F} \qquad \text{Eq. 4-9}$$

$$f\left(\frac{V}{F}\right)=\sum_{i=1}^{C}\left[\frac{(K_i-1)z_i}{1+(K_i-1)V/F}\times\frac{1/(K_i-1)}{1/(K_i-1)}\right] \qquad \text{Eq. 4-20}$$

$$f\left(\frac{V}{F}\right)=\sum_{i=1}^{C}\frac{z_i}{1/(K_i-1)+V/F} \qquad \text{Eq. 4-21}$$

For the case when component i is a noncondensable gas (nitrogen, air, etc) where $x_i = 0$ then:

$$K_i = \frac{y_i}{x_i} \qquad \text{Eq. 4-10}$$

$$\lim_{x_i \to 0}[K_i] = \lim_{x_i \to 0}\left[\frac{y_i}{x_i}\right] = \infty \qquad \text{Eq. 4-22}$$

The modified Rachford-Rice expression for the noncondensable component may now be evaluated as shown.

$$\lim_{K_i \to \infty}\left[\frac{z_i}{1/(K_i - 1) + V/F}\right]_{nc} = \left(\frac{z_i}{1/\infty + V/F}\right)_{nc} = \left(\frac{z_i}{V/F}\right)_{nc} \qquad \text{Eq. 4-23}$$

Combining Eq. 4-21 (for the condensable components) with Eq. 4-23 (for the noncondensable components) leads to a modified Rachford-Rice equation that can be used to solve condenser problems when non-condensable components such as air or nitrogen are present in the process stream.

$$f\left(\frac{V}{F}\right) = \sum_{i=1}^{C_c} \frac{z_i}{1/(K_i - 1) + V/F} + \sum_{j=1}^{C_{nc}} \frac{z_j}{V/F} \qquad \text{Eq. 4-24}$$

The derivative of the modified Rachford-Rice equation, with respect to V/F, is shown in Eq. 4-25 and can be applied within the framework of Newton's method using Eq. 4-15.

$$f'\left(V/F\right) = \frac{f(V/F)}{d(V/F)} = \sum_{i=1}^{C_c} \frac{-z_i}{[1/(K_i - 1) + V/F]^2} + \sum_{j=1}^{C_{nc}} \frac{-z_j}{[V/F]^2} \qquad \text{Eq. 4-25}$$

$$(V/F)_{k+1} = (V/F)_k - \frac{f(V/F)}{f'(V/F)} \qquad \text{Eq. 4-15}$$

After V/F is determined, the composition of each exit stream may be calculated using Eq. 4-11 through Eq. 4-14.

$$V = F\,(V/F) \qquad \text{Eq. 4-11}$$

$$L = F - V \qquad \text{Eq. 4-12}$$

$$x_i = \frac{z_i}{1 + (V/F)(K_i - 1)} \qquad \text{Eq. 4-13}$$

$$y_i = x_i K_i \qquad \text{Eq. 4-14}$$

Illustration 4-5: Modified Rachford-Rice Method for Vent Condenser

500 gallons of condensate from Illustration 4-4 was cooled to 30°C and is being held in a 1,000 gallon receiver. Methyl chloride, n-hexane, and toluene are assumed to be an ideal mixture. The vessel is under a nitrogen gas sweep of 1.0 scfm which is vented to a total condenser (standard conditions based on temperature of 0°C). The nitrogen off gas exits the condenser at 2°C and is assumed to be saturated for the purposes of this illustration (the actual saturation level could be determined using the procedure in illustration 3-8 in section 3.2.2). What would the emissions and the material balance for the condenser be over a one hour period under these conditions?

Step 1. Establish characteristics of the inlet gas stream.

An analysis of the process gas stream entering the condenser from the receiver is shown in Table 4-4.

Table 4-4. Analysis of the Condenser Inlet Feed Stream

Compound	F_i lb/hr	MWt	F_i lb-moles/hr	z_i Mole frac.	Partial pressure p_i mm Hg
Noncondensable					
nitrogen	4.68	28.01	0.1671	0.354	269
Condensable					
methyl chloride	12.67	50.49	0.2509	0.532	405
n-hexane	3.47	86.17	0.040252	0.0854	65
toluene	1.20	92.13	0.013006	0.0276	21
Totals			0.47126	1.0	760

Step 2. Check to confirm whether condensation will occur

Before proceeding to calculate the material balance for the vent condenser it's a good idea to perform a quick test to see if condensation is likely to occur in the condenser. In some cases the quantity of noncondensable gas component (air, nitrogen, etc) could be too high for condensation to occur.

For this test we can calculate x_i for each condensable component in hypothetical condensate at the condenser temperature (2°C in this example). If the sum of the calculated x_i values for all of the condensable components is greater than 1.0 then we can conclude that condensation will take place. However, if the sum of the calculated x_i values is less than 1.0 then condensation is not possible at the current condenser operating conditions.

$$x_i = \frac{p_i^{30°C}}{\gamma_i P_i^{2°C}} = \frac{p_i^{30°C}}{P_i^{2°C}} \quad \text{Eq. 4-26}$$

where P_i is the pure component vapor pressure at 2°C,

p_i is the component partial pressure at the condenser inlet conditions (30°C), and

γ_i is 1.0 for the ideal mixture.

The partial pressure p_i for each component in the inlet stream to the condenser was established in step 1. The pure component vapor pressure (P_i) for each component in the feed stream at 2°C has been calculated based on the Antoine Equation, and the resulting values are shown in Table 4-5. The hypothetical condensate mole fraction for each component x_i has been calculated using Eq. 4-26 because the problem stated that the process mixture could be treated as ideal. All of the component mole fractions and the sum are shown in Table 4-5. The sum is greater than 1.0. Therefore, condensation will occur in this condenser.

Table 4-5. Check to See If Condensation Will Take Place at 2°C

	Inlet Partial Pres. (mm Hg)	P_i @ 2°C	x_i Estimated
Condensable			
methyl chloride	405	2,089	0.19
n-hexane	65	50	1.3
toluene	21	8	2.63
		$\sum x_i = 4.1$	

Step 3. Calculate Values to use in the Modified Rachford-Rice Equation

Values for z_i are needed for all four components; these values were established in step 1. Values for K_i are needed for methyl chloride, n-hexane, and toluene; a K value for nitrogen is ignored since it is now assumed that the solubility of nitrogen is 0. The K_i values are calculated using Eq. 4-10 with the pure component vapor pressures at 2°C, which were calculated in step 2. Table 4-6 shows all of the input data and the calculated K_i values.

Table 4-6. Preparation for Applying the Modified Rachford-Rice Method

Compound	F_i lb-moles/hr	z_i Mole frac.	P_i (mm Hg) 2°C	$K_i=P_i/P_{sys}$
nitrogen	0.1671	0.354	---	---
methyl chloride	0.2509	0.532	2,089	2.749
n-hexane	0.040252	0.0854	50	0.066
toluene	0.013006	0.0276	8	0.011
Totals		1		

Step 4. Add known values to the modified Rachford-Rice equation.

The modified Rachford-Rice equation (Eq. 4-24) is populated using K_i and z_i from Table 4-6. Note that a separate term is needed for each component in the inlet stream.

$$f\left(\frac{V}{F}\right)=\sum_{i=1}^{C_c}\frac{z_i}{1/(K_i-1)+V/F}+\sum_{j=1}^{C_{nc}}\frac{z_j}{V/F}$$

$$0=\frac{z_{mc}}{1/(K_{mc}-1)+V/F}+\frac{z_h}{1/(K_h-1)V/F}+\frac{z_t}{1/(K_t-1)+V/F}+\frac{z_{n2}}{V/F}$$

$$0=\frac{0.532}{1/(2.749-1)+V/F}+\frac{0.0854}{1/(0.066-1)+V/F}+\frac{0.0276}{1/(0.011-1)+V/F}+\frac{0.354}{V/F}$$

Step 5. Add known values to the derivative of the modified Rachford-Rice equation.

The derivative of the modified Rachford-Rice equation (Eq. 4-25) is populated using the same data from Table 4-6.

$$f'\left(V/F\right)=\frac{f(V/F)}{d(V/F)}=\sum_{i=1}^{C_c}\frac{-z_i}{\left[1/(K_i-1)+V/F\right]^2}+\sum_{j=1}^{C_{nc}}\frac{-z_j}{\left[V/F\right]^2}$$

$$f'\left(V/F\right)=\frac{-0.249}{\left(1/(2.749-1)+V/F\right)^2}+\frac{-0.301}{\left(1/(0.066-1)+V/F\right)^2}+\frac{-0.45}{\left(1/(0.011-1)+V/F\right)^2}+\frac{-0.354}{\left(V/F\right)^2}$$

Step 6. Solve for V/F using Newton's method.

An initial guess of V/F is needed to start the iterative process of solving the modified Rachford-Rice equation. Rather than picking a value arbitrarily, sometimes it's helpful to graphically plot f(V/F) as a function of V/F as shown in Figure 4-4 for this problem. The objective is to identify the value of V/F where f(V/F) is crossing the horizontal line where the y axis = 0. Using an initial value of V/F that is close to this point will help ensure that the method will converge on a valid solution. Newton's method relies on the slope of f(V/F) to help locate the solution. At points where the slope of the function is sufficiently low the method has been known to extrapolate into areas that are out of bounds for the solution of V/F (i.e., less than 0 or greater than 1). This problem can be avoided by making an initial guess of V/F close to the value where the function crosses the x-axis. By inspection of Figure 4-4 one would know that the value of V/F that solves the Rachford-Rice equation for this condenser problem is close to 0.9.

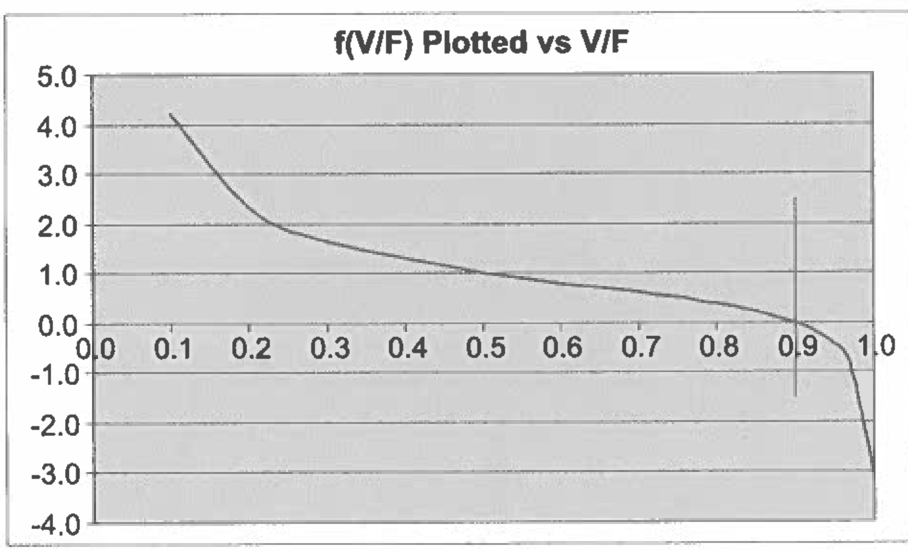


Figure 4-4. Rachford-Rice Plot showing solution at V/F = 0.90076.

Based on Figure 4-4, an initial guess for V/F was assumed to be 0.85. Newton's method as shown in Eq. 4-15 is applied until the V/F remains the same value within a 0.0001 tolerance, as determined using Eq. 4-17. The results of this iterative process are shown in Table 4-7. Inserting the initial guess for V/F in Eq. 4-24 and Eq. 4-25 resulted in initial estimates for f(V/F) and f'(V/F) of 0.23186 and -3.32408, respectively.

The next estimate of V/F was calculated using these values in Eq. 4-15, and the initial and second estimates were compared using Eq. 4-17. This process was repeated for four iterations. At that point the value of V/F had converged within the specified tolerance level.

Table 4-7. Iteration results for Illustration 4-5

Iteration	$\left(V/F\right)_k$	$f\left(V/F\right)$	$f'\left(V/F\right)$	$\left(V/F\right)_{k+1}$	$\left\lvert\frac{(V/F)_{k+1}-(V/F)_k}{(V/F)_k}\right\rvert$
1	0.85	0.23186	-3.32408	0.91975	0.08206
2	0.91975	-0.12876	-7.54609	0.90269	0.01855
3	0.90269	-0.01159	-5.85834	0.90071	0.00219
4	0.90071	0.00030	-5.70487	0.90076	0.00006

After V/F has been determined by trial and error, as shown in Table 4-7, then the molar flow rates of the exit liquid and vapor streams are calculated using Eq. 4-11 and Eq. 4-12.

$$V = F\,(V/F)$$

$$= (0.47126)(0.90076)$$

$$= 0.42454\, lb\, moles / hr$$

$$L = F - V$$

$$= 0.47126 - 0.42454$$

$$= 0.0467\, lb\, moles / hr$$

The mole fractions of components in each exit stream are calculated using Eq. 4-13 and Eq. 4-14. For example, the mole fractions for methyl chloride are calculated as follows:

$$x_{mc} = \frac{z_{mc}}{1 + (V/F)(K_{mc} - 1)}$$

$$= \frac{.532}{1 + (0.90076)(2.749 - 1)}$$

$$= 0.20676$$

$$y_i = x_i K_i$$

$$= (.20676)(2.749)$$

$$= 0.56831$$

The molar flow rates of each component are calculated by multiplying the total moles by the applicable mole fractions. For example, the molar flow rates of methyl chloride are calculated as follows:

$$n_{mc,L} = (.20676)(.0467) = 0.00967\, lb\, moles/hr$$

$$n_{mc,V} = (.56831)(.42454) = 0.24127\, lb\, moles/hr$$

Finally, the mass flow rates for each component are calculated by multiplying the molar flow rates by the molecular weight of the component. The results of all of the calculations in step 7 are shown in Tables 4-8 and 4-9.

Table 4-8. Product Outlet Stream Analysis (mole fractions and rates in lb-moles)

	F_i lb-moles/hr	Z_i	K_i	L_i lb-moles/hr	X_i	V_i lb-moles/hr	Y_i
nitrogen	0.1671	0.354	---	0.00000	0	0.16708	0.39356
methyl chloride	0.2509	0.532	2.749	0.00967	0.20676	0.24127	0.56831
hexane	0.04025	0.0854	0.066	0.02521	0.53903	0.01506	0.03546
toluene	0.01301	0.0276	0.0276	0.01189	0.25417	0.00114	0.00268
Totals	0.47126			0.0467	0.99996	0.42454	1.00000

Table 4-9. Product Streams Analysis

Component	MW_i	F_i Inlet Stream lb/hr	L_i Condensate lb/hr	V_i Vapor Emissions lb/hr
nitrogen	28.01	4.6800	0.0000	4.6800
methyl chloride	50.49	12.6700	0.4883	12.1817
hexane	86.17	3.4700	2.1727	1.2973
toluene	92.13	1.2000	1.0954	0.1046
Totals		22.0200	3.7563	18.2637

Additional Considerations Regarding Numerical Convergence Techniques

It was mentioned earlier that Newton's method had the potential to extrapolate the search into places that are out of bounds with respect to a realistic solution. In some cases a damping factor may be used to improve the tendency for Newton's method to continually move toward the desired solution. Additionally, other numerical methods exist including the False Position, Bisection, and Fibonacci Methods that can be applied to either the standard Rachford-Rice or the modified Rachford-Rice solution model. If it is desired to use standard spreadsheet software then the Goal Seek function can be applied to solve the condenser problem.

4.2.3.2 Option 2 – Partial Pressure Correction Method

A second approach to solving the vent condenser problem when two or more condensable components are present in the system involves making an initial guesstimate of the condensate composition and then placing the balance of the process in the vapor phase. Component vapor pressures are then calculated for the condensate and compared to the component partial pressures of the vapor phase. Since equilibrium between the condensate liquid phase and the vapor phase is assumed, both partial pressures that have been calculated by different means should be the same for each component. The amount of each component in the condensate is adjusted up or down until the partial pressures are the same for each component (within an acceptable tolerance). Material balance accounting is assured since 100% of each component in the feed is allocated to be split between the condensate phase and the vapor phase.

Condensable component material balance:

$$n_{i,F} = n_{i,L} + n_{i,V} \qquad \text{Eq. 4-27}$$

The partial pressure of each condensable component in the exit liquid stream may be calculated using Raoult's Law which may be extended with activity coefficients.

$$p_{i,L} = x_i \gamma_i P_i = \frac{n_{i,L} \gamma_i P_i}{L} \qquad \text{Eq. 4-28}$$

The partial pressure of each condensable component in the exit gas phase may be calculated using Dalton's Law.

$$p_{i,V} = \frac{n_{i,V}}{V} P_{sys} = y_i P_{sys} \qquad \text{Eq. 4-29}$$

At equilibrium both partial pressures should be the same for each condensable component.

$$p_{i,L} = p_{i,V} \qquad \text{Eq. 4-30}$$

However, since we are making only an initial guesstimate, the two partial pressures will likely not be the same. An error of estimate can be calculated by subtracting one from the other.

$$f(n_i) = p_{i,L} - p_{i,V} \qquad \text{Eq. 4-31}$$

Newton's method is applied to all condensable components simultaneously until the two partial pressures (from the condensate and the gas phase) agree within acceptable tolerance for each component.

$$n_{i,L,k+1} = n_{i,L,k} - \frac{f(n_{i,k})}{f'(n_{i,k})} \qquad \text{Eq. 4-15}$$

$f'(n_i)$ may be approximated using the calculus of finite differences where only condensable component i is varied and the other components are held constant. [Constantinides]

$$f'(n_{i,L,k}) \cong \left[\frac{f(n_{i,L,k} + \delta) - f(n_{i,L,k} - \delta)}{2\delta}\right]_{T,P,j} = \left(\frac{\Delta p_i}{\Delta n_i}\right)_{T,P,j} \qquad \text{Eq. 4-32}$$

If the process contains only two condensable components then Eq. 4-15 would be required for both components. If the process contains 5 condensable compounds then five separate equations would be required and so on. For each equation $f(n_{i,L,k})$ and $f'(n_{i,L,k})$ are calculated with only n_i being varied while all other compound quantities held constant. Once $f(n_{i,L,k})$ and $f'(n_{i,L,k})$ have been calculated $n_{i,L,k+1}$ is calculated for each condensable compound in the system as shown.

Component 1 $$n_{1,L,k+1} = n_{1,L,k} - \frac{f(n_{1,L,k})}{f'(n_{1,L,k})_{T,P,j\neq 1}}$$

Component 2 $$n_{2,L,k+1} = n_{2,L,k} - \frac{f(n_{2,L,k})}{f'(n_{2,L,k})_{T,P,j\neq 2}}$$

.
.
.

Component n $$n_{n,L,k+1} = n_{n,L,k} - \frac{f(n_{n,L,k})}{f'(n_{n,L,k})_{T,P,j\neq n}}$$

Illustration 4-6: Partial Pressure Correction Method for Vent Condenser

500 gallons of the condensate from Illustration 4-4 was cooled to 30°C and is being held in a 1,000 gallon receiver. A 1.0 scfm nitrogen gas sweep enters that vessel headspace and exits fully saturated with vapors from the condensate. The condenser is operated so process gas stream exits at 2°C. What would the emissions and the material balance for the condenser be over a one hour period under these conditions?

Step 1. Establish characteristics of the inlet gas stream.

An analysis of the process gas stream entering the condenser from the receiver is shown in Table 4-10. This information is the same as for illustration 4-5.

Table 4-10. Analysis of the Condenser Inlet Feed Stream

Compound	F_i lb/hr	MWt	F_i lb-moles/hr	z_i Mole frac.	Partial Pressure mm Hg
Noncondensable					
nitrogen	4.68	28.01	0.1671	0.354	269
Condensable					
methyl chloride	12.67	50.49	0.2509	0.532	405
n-hexane	3.47	86.17	0.04025	0.0854	65
toluene	1.20	92.13	0.01301	0.0276	21
Totals			0.47126	1.0	760

Step 2. Check to confirm whether condensation will occur.

This procedure is presented in illustration 4-5 and is not repeated here.

Step 3. Make initial estimate of composition of condensate.

In setting up to solve this problem using Newton's method, it improves the efficiency of convergence if one first approximates of the molar composition of the condensate to as near to the final solution as possible before beginning the iteration process. Since the pure vapor pressure of toluene (8 mm Hg @ 2°C) is lower than the partial pressure of toluene in the feed stream (21 mm Hg) then all of the toluene moles can be placed in the condensate. Similarly, since the pure vapor pressure of n-hexane (50 mm Hg @ 2°C) is lower than the partial pressure of n-hexane in the feed (65 mm Hg) then all of the n-hexane moles in the condensate. However, the pure vapor pressure of methyl chloride (2089 mm Hg) at 2°C is greater than the inlet partial pressure of methyl chloride (405 mm Hg) and so only a fraction of the inlet moles should be allocated for the condensate.

If one assumes that the condensate will be an ideal mixture where the activity coefficient equals 1.0 for each component in the condensate, then an initial guess for the concentration of methyl chloride can be estimated using Eq. 4-8, where x_i is the mole fraction of methyl chloride that would be needed in the liquid to result in the partial pressure of 405 mmHg.

$$x_i = \frac{p_i^{feed}}{\gamma_i P_i^{2^\circ C}} = \frac{405}{1 * 2089} = 0.19 \qquad \text{Eq. 4-8}$$

Once x_i is known, then the moles of methyl chloride that should be allocated to the liquid condensate can be calculated by the ratio of the methyl chloride mole fraction and the non methyl chloride portion of the condensate as shown in Eq. 4-33, where j represents n-hexane and toluene.

$$n_{i,L} \approx \frac{x_i}{1 - x_i} * n_{j,L} \qquad \text{Eq. 4-33}$$

$$= \frac{0.19}{1 - 0.19} * 0.0533$$

$$= 0.01249\, lb\, moles / hr$$

The resulting initial estimate of the condensate is presented in Table 4-11.

Table 4-11. Initial Estimate of Condensate

Compound	F_i lb-moles/hr	p_i at Feed mm Hg	P_i at 2°C mm Hg	L_i, estimated lb-moles/hr
Noncondensable				
nitrogen	0.1671	269		
Condensable				
methyl chloride	0.2509	405	2,089	0.01249
n-hexane	0.04025	65	50	0.04025
toluene	0.01301	21	8	0.01301
totals				0.06575

Step 4. Solve for the partial pressures using Newton-Raphson method to iterate on the number of moles of each component in the condensate.

Once an initial guess of the condensate has been made, then the iterative processing can begin as shown below. For the first iteration, the mole fraction of each compound in the liquid is calculated based on the initial composition from Table 4-11. For example, the mole fraction for toluene is estimated as 0.01301/0.06575 = 0.2. The partial pressure based on this liquid composition and the pure component vapor pressure at 2°C is calculated using Eq. 4-28. For example, the calculation is as follows for toluene:

$$\begin{aligned} P_{i,L} &= x_i \gamma_i P_i \\ &= (0.2)(1)(8) \\ &= 1.6\, mm\, Hg \end{aligned}$$

For the first iteration, the vapor out of the condenser is assumed to consist of only nitrogen and methyl chloride. The amount of methyl chloride in the outlet vapor is estimated as the difference between the methyl chloride in the feed and the methyl chloride in the condensate. The mole fractions are estimated based on the total number of moles of nitrogen and methyl chloride in the outlet vapor stream. The partial pressures are then estimated using Eq. 4-29. For example, the calculation is as follows for methyl chloride in the first iteration:

$$\begin{aligned} p_{i,V} &= y_i P_{sys} \\ &= (0.59)(760) \\ &= 447\, mmHg \end{aligned}$$

The difference in the partial pressures (i.e., the function) is calculated using Eq. 4-31. For methyl chloride:

$$\begin{aligned} f(n_i) &= p_{i,L} - p_{i,V} \\ &= 397 - 447 \\ &= -50\, mmHg \end{aligned}$$

The derivative of the function is estimated using finite differences as described in Eq. 4-32. This means the calculations of the partial pressures described above need to be repeated using slightly different estimates of the number of moles in the condensate. In this illustration the δ used in Eq. 4-32 was equal to 0.05 percent of the original estimate of the number of moles in the condensate. For example, for methyl chloride in the first iteration the calculations were repeated using 0.012484 lbmoles and 0.012496 lbmoles (i.e., δ = 0.0005 x 0.01249 = 0.000006245). Using these values for n_i results in $f(n_i)$ equal to -50.188 and -49.857, respectively. The difference between these values (0.331) is the numerator in Eq. 4-32, and 0.00001249 is the denominator. Dividing 0.331 by 0.00001249 results in 26,507 for the derivative of the function. This process is repeated for all of the other components in the condensate. The numerical values are not tabulated in this document due to space considerations.

The number of moles of each component in the condensate for the second iteration is estimated using Eq. 4-15. For example, the next second estimate for methyl chloride is estimated as follows:

$$n_{i,L,k+1} = n_{i,L,k} - \frac{f(n_{i,k})}{f'(n_{i,k})}$$
$$= 0.01249 - \frac{-50}{26{,}507}$$
$$= 0.0144\, lb\ moles / hr$$

This process is continued until the difference in the partial pressures estimated based on the liquid and vapor moles fractions for all components agree within an acceptable level of tolerance. For this illustration the analysis stopped after 7 iterations, when the differences in vapor pressures for all compounds appeared to be in good agreement for all compounds. One can calculate the percent agreement for each component by dividing Δpi by the average of both partial pressures. For Iteration 7 the % agreement is shown in Table 4-12.

Iteration 1

Compound	$n_{i,L,k}$	x_i	$p_{i,L}$	V_i	y_i	$p_{i,V}$	Δp_i	$\Delta p_i/\Delta n_i$	$n_{i,L,k+1}$
nitrogen	0			0.167	0.41	313	N/A	N/A	N/A
methyl chloride	0.01249	0.19	396.91	0.238	0.59	446.82	-50.2	26507	0.0144
n-hexane	0.04025	0.61	30.6	0	0	0	30.6	2169.6	0.0261
toluene	0.01301	0.2	1.6	0	0	0	1.6	1972.3	0.0122

Iteration 2

Compound	$n_{i,L,k}$	x_i	$p_{i,L}$	V_i	y_i	$p_{i,V}$	Δp_i	$\Delta p_i/\Delta n_i$	$n_{i,L,k+1}$
nitrogen	0			0.167	0.41	313	N/A	N/A	N/A
methyl chloride	0.0144	0.27	570	0.237	0.57	430	140	29609	0.0096
n-hexane	0.0261	0.5	24.8	0.014	0.03	25.6	-0.8	2233.1	0.0265
toluene	0.0122	0.23	1.9	8E-04	0	1.5	0.4	1929.4	0.012

Iteration 3

Compound	$n_{i,L,k}$	x_i	$p_{i,L}$	V_i	y_i	$p_{i,V}$	Δp_i	$\Delta p_i/\Delta n_i$	$n_{i,L,k+1}$
nitrogen	0			0.1671	0.395	300.2	N/A	N/A	N/A
methyl chloride	0.00964	0.2	418.3	0.2413	0.57	433.4	-15	35464.5	0.01007
n-hexane	0.02651	0.551	27.5	0.0137	0.032	24.7	2.9	2205	0.02522
toluene	0.012	0.249	2	0.001	0.002	1.8	0.2	1917.1	0.0119

Iteration 4

Compound	$n_{i,L,k}$	x_i	$p_{i,L}$	V_i	y_i	$p_{i,V}$	Δp_i	$\Delta p_i/\Delta n_i$	$n_{i,L,k+1}$
nitrogen	0			0.1671	0.394	299.5	N/A	N/A	N/A
methyl chloride	0.01007	0.213	445.6	0.2408	0.568	299.5	14	35598.2	0.00967
n-hexane	0.02522	0.534	26.7	0.015	0.035	26.9	-0.22	2222.3	0.02532
toluene	0.0119	0.252	2	0.0011	0.003	2	0.04	1914.7	0.01188

Iteration 5

Compound	$n_{i,L,k}$	x_i	$p_{i,L}$	V_i	y_i	$p_{i,V}$	Δp_i	$\Delta p_i/\Delta n_i$	$n_{i,L,k+1}$
nitrogen	0			0.1671	0.394	299.2	N/A	N/A	N/A
methyl chloride	0.00967	0.206	431.1	0.2412	0.568	432	-0.9	36143.2	0.0097
n-hexane	0.02532	0.54	27	0.0149	0.035	26.7	0.26	2218.7	0.0252
toluene	0.01188	0.253	2	0.0011	0.003	2	0.01	1913.9	0.01187

Iteration 6

Compound	$n_{i,L,k}$	x_i	$p_{i,L}$	V_i	y_i	$p_{i,V}$	Δp_i	$\Delta p_i/\Delta n_i$	$n_{i,L,k+1}$
nitrogen	0			0.1671	0.394	299.2	N/A	N/A	N/A
methyl chloride	0.0097	0.207	433.1	0.2412	0.568	431.8	1.29	36176.4	0.00966
n-hexane	0.0252	0.539	26.9	0.0151	0.035	27	-0.01	2220.4	0.0252
toluene	0.01187	0.254	2	0.0011	0.003	2	0	1913.7	0.01187

Iteration 7

Compound	$n_{i,L,k}$	x_i	$p_{i,L}$	V_i	y_i	$p_{i,V}$	Δp_i	$\Delta p_i/\Delta n_i$	$n_{i,L,k+1}$
nitrogen	0			0.1671	0.394	299.2	N/A	N/A	N/A
methyl chloride	0.00966	0.207	431.9	0.2412	0.568	431.9	-0.03	36228.9	0.00966
n-hexane	0.0252	0.539	26.96	0.0151	0.035	26.94	0.024	2220.1	0.02519
toluene	0.01187	0.254	2.03	0.0011	0.003	2.03	0.001	1913.6	0.01187

Table 4-12. Convergence Determination

Component	p_i avg. mm Hg	Δp_i mm Hg	$\Delta p_i/p_i$ %
nitrogen		N/A	N/A
methyl chloride	431.86	-0.03	-0.007%
n-hexane	26.95	0.02	0.089%
toluene	2.031	0.001	0.049%

Step 5. Perform material balance check.

The final results after Iteration 7 are presented in Table 4-13 with the material balance displayed in pound moles and in pounds for the exit vapor and liquid streams. The composition of the exit vapor streams is also listed by the average partial pressure for each component being emitted.

Table 4-13. Material Balance for Condenser

Compound	MWt	F_i lb/hr	F_i lb-moles/hr	L_i lb-moles/hr	L_i lb/hr	V_i lb-moles/hr	V_i lb/hr	P_i mm Hg
nitrogen	28.01	4.68	0.167	0		0.167	4.68	299.2
methyl chloride	50.49	12.67	0.251	0.0097	0.49	0.241	12.18	431.86
n-hexane	86.17	3.47	0.040	0.0252	2.17	0.015	1.30	26.95
toluene	92.13	1.20	0.013	0.0118	1.09	0.001	0.11	2.031
Totals		22.02	0.471	0.0467	3.75	0.424	18.27	760.04

The results from the Pressure Balance Method for this problem are virtually identical to the results that were obtained using the Modified Rachford-Rice Method shown in Illustration 4-5.

4.2.3.3 Option 3 – Material Balance Correction Method

A third approach to solving the vent condenser problem when two or more condensable components are present involves making an initial guesstimate of the liquid condensate composition. Component vapor pressures are then calculated for the condensate and used in conjunction with the noncondensable component to estimate the amount of each component that exists in the vapor space. For each condensable component, the moles in the liquid phase are added to the moles that have been calculated to exist in the vapor phase and the ratio between these two quantities is calculated. The moles of each component in the liquid phase are then corrected by the ratio value for the next iteration. For example, if the moles of component i in the outgoing vapor and liquid streams is calculated to be 20% greater than the moles of component i in the incoming feed stream then the amount of i in the condensate is divided by 1.2 for the next iteration. This iterative process for correcting the moles of i in the liquid phase continues until the material balance for all components is in agreement within acceptable tolerances. For any condenser, the inlet stream must equal the sum of the exit vapor and the liquid condensate at steady state operation.

Material Balance Considerations

Overall material balance: $$F = L + V$$ Eq. 4-34

A material balance can be written for each condensable component in the process as shown in Eq. 4-35.

Balance of condensable components: $$z_i F = x_i L + y_i V$$ Eq. 4-35

$$n_{i,F} = n_{i,L} + n_{i,V}$$ Eq. 4-36

Assuming that all of the noncondensable gases (air, nitrogen, etc) exit the condenser in the vapor stream then Eq. 4-35 and Eq. 4-36 can be easily simplified. The moles of noncondensable n_{nc} in the exit gas stream are equal to the moles that are contained in the inlet stream.

Noncondensable component: $$n_{nc,V} = z_{nc} F = y_{nc} V$$ Eq. 4-37

Equilibrium Considerations

The vapor pressure of each condensable component in the exit liquid stream can be calculated using Raoult's Law and extended with activity coefficients.

$$p_i = x_i \gamma_i P_i \qquad \text{Eq. 4-38}$$

At steady state conditions, the moles of each condensable component *i* in the exit gas stream can be calculated from the vapor pressure of component *i* in the liquid, the partial pressure of the noncondensable in the exit gas, and the moles of the noncondensable component as shown.

$$\frac{n_{i,V}}{n_{nc,V}} = \frac{p_i}{p_{nc}} \qquad \text{Eq. 4-39}$$

$$n_{i,V} = n_{nc}\frac{p_i}{p_{nc}} = n_{nc}\frac{x_i \gamma_i P_i}{p_{nc}} = n_{nc}\frac{n_{i,L}\gamma_i P_i}{Lp_{nc}} \qquad \text{Eq. 4-40}$$

If the process contains only a single condensable component then Eq. 4-40 can be applied directly to calculate the exit gas emissions from the condenser. This was shown in Illustrations 4-1, 4-2, and 4-3.

Combining Material Balance and Equilibrium Considerations

If the process contains two or more condensable components then a trial and error approach will be needed to determine the moles of each condensable component in the liquid and vapor phases. The equilibrium relationship (Eq. 4-40) can be combined with the material balance (Eq. 4-36) to result in a single expression that must hold true at single stage steady state conditions where equilibrium exist between each component in the liquid and vapor phase.

$$n_{i,F} = n_{i,L} + n_{i,V} = n_{i,L} + n_{nc}\frac{p_i}{p_{nc}} \qquad \text{Eq. 4-41}$$

Eq. 4-41 ties the material balance and the equilibrium relationships together for each condensable component in the system and is independent of the number of condensable components present.

Description of the Basic Material Balance Correction Procedure

In the trial and error approach that follows, an educated guess of the condensate liquid is made. Eq. 4-41 is used to calculate the molar inventory of component i from the condensate and calculated vapor phase. Eq. 4-42 is then used to calculate the ratio Φ_i between the moles of component i in the feed and the moles calculated to be in the exit vapor and liquid phases. At steady state and equilibrium conditions Φ_i must equal 1.0.

$$\frac{n_{i,L} + n_{i,V}}{n_{i,F}} = \phi_i \qquad \text{Eq. 4-42}$$

$$\frac{1}{\phi_i}\left(n_{i,L} + n_{i,L}\frac{n_{nc}\gamma_i P_i}{p_{nc}L}\right) \approx n_{i,F} \qquad \text{Eq. 4-43}$$

$$\frac{n_{i,L}}{\phi_i}\left(1+\frac{n_{nc}\gamma_i P_i}{p_{nc}L}\right)\approx n_{i,F} \qquad \text{Eq. 4-44}$$

$n_{i,L,k+1}$ is estimated by dividing $n_{i,L,k}$ by Φ_i as shown in Eq. 4-45 and applied to the next iteration until Φ_i becomes close to 1.0 within an acceptable tolerance. It should be noted that L are the total moles of condensate in the system which includes component i. For this reason Eq. 4-44 and Eq. 4-45 are approximations which narrow as the iterative process converges.

$$n_{i,L,k+1}=\frac{n_{i,L,k}}{\phi_{i,k}} \qquad \text{Eq. 4-45}$$

For each condensable component in the inlet stream, the following steps are followed until the error of estimate for each component has fallen within an acceptable tolerance.

Basic Procedures

An initial guesstimate of the condensate liquid must be made before the iteration process is started. One approach involves partitioning the moles of component i in the liquid using a measure of the relative volatility. Components having the greatest volatility will tend to concentrate in the vapor phase while compounds with the lowest volatility will tend to concentrate in the liquid phase.

$$v_i=\frac{P_i}{\sum_{j=1}^{N}P_j} \qquad \text{Eq. 4-46}$$

The moles of component $n_{i,L}$ in the condensate liquid are calculated by multiplying the moles of $n_{i,F}$ in the feed by $(1-v_i)$ since $(1-v_i)$ would be a fraction of a compound to remain in the liquid phase.

$$\left(n_{i,L}\right)_k=\left(1-v_i\right)*n_{i,F} \qquad \text{Eq. 4-47}$$

Also, $p_{nc,k}$ is set equal to the partial pressure of the noncondensable as contained in the feed stream $p_{nc,F}$. This is because we know that any condensation to occur will lead to value of p_{nc} that is greater than what we started with. So the noncondensable component partial pressure at the inlet feed is considered to be lowest starting value possible and can only become larger as the convergence takes place.

****

Step 1. Calculate L, x_i, and p_i for each component in the liquid phase.

$$L=\sum n_{i,L}\ ,\ x_i=\frac{n_{i,L}}{L}\ ,\ p_i=x_i\ \gamma_i\ P_i$$

Step 2. Calculate $n_{i,L,k+1}$ for each condensable component in the vapor phase and calculate V_{k+1} from the sum of the moles of condensable components in the vapor phase plus the noncondensable moles (which remain constant).

$$n_{i,V,k+1}=n_{nc,k}\frac{p_{i,k}}{p_{nc,k}} \quad V_{k+1}=\sum_{j=1}^{C}n_{j,V,k+1}+n_{nc}$$

Step 3. Calculate $p_{nc,k}$.

$$p_{nc,k+1} = \frac{n_{nc}}{V_{k+1}} P_{sys}$$

Step 4. Calculate Φ_i for each condensable component using Eq. 4-39 substituted in Eq. 4-42.

$$\frac{\left(n_{i,L} + n_{nc} \frac{p_i}{p_{nc,k+1}} \right)}{n_{i,F}} = \phi_{i,k+1}$$

Step 5. Calculate the next iteration value for $(n_{i,L})_{k+1}$.

$$(n_{i,L})_{k+1} = \frac{(n_{i,L})_k}{\phi_{k+1}}$$

Step 6. Repeat Steps 1 through 5 until Φ is between 0.999 and 1.001 for all condensable components in the system.

Illustration 4-7: Material Balance Correction Method for Vent Condenser

500 gallons of the condensate from Illustration 4-4 was cooled to 30°C and is being held in a 1,000 gallon receiver. A 1.0 scfm nitrogen gas sweep enters that vessel headspace and exits fully saturated with vapors from the condensate. The condenser is operated so process gas stream exits at 2°C. What would the emissions and the material balance from condenser be over a one hour period under these conditions?

Table 4-14. Analysis of the Condenser Inlet Feed Stream

Compound	F_i lb/hr	MWt	F_i lb-moles/hr	z_i Mole frac.	Partial Pressure mm Hg
Noncondensables					
nitrogen	4.68	28.01	0.1671	0.354	269
Condensables					
methyl chloride	12.67	50.49	0.2509	0.532	405
n-hexane	3.47	86.17	0.040252	0.0854	65
toluene	1.20	92.13	0.013006	0.0276	21
Totals					

Solution

The efficiency of convergence is always improved if one first approximates of the molar composition of the condensate that might be close to the final composition as an initial guess.

Table 4-15. Initial Estimate of Condensate

Compound	Pi, mm Hg	v_i	$1 - v_i$	$n_{i,F}$	$n_{i,L}$	x_i
methyl chloride	2089	0.9730	0.0270	0.2509	0.0068	0.115
n-hexane	50	0.0233	0.9767	0.040252	0.0393	0.666
toluene	8	0.0037	0.9963	0.013006	0.0130	0.219
Totals	2147	1.0000			0.0591	

Iteration 1

Components	Fi lb-m	$n_{i,L}$ lb-m	Xi fraction	Pi mm Hg	Vi lb-m	Yi fraction	Li+Vi lb-m	Φ (Li+Vi)/Fi lb-m	ni, k+1
nitrogen	0.1670			269.00	0.1670	0.4942	0.1670	1.0000	
methyl chloride	0.2509	0.0068	0.1151	240.36	0.1492	0.4415	0.1560	0.6218	0.0109
n-hexane	0.0403	0.0393	0.6650	33.25	0.0206	0.0611	0.0599	1.4892	0.0264
toluene	0.0130	0.0130	0.2200	1.76	0.0011	0.0032	0.0141	1.0835	0.0120
Totals		0.0591	1.0000	544.37	0.3380	1.0000		$P_{nc,k+1}$ =	375.56

Iteration 2

Components	Fi lb-m	$n_{i,L}$ lb-m	Xi fraction	Pi mm Hg	Vi lb-m	Yi fraction	Li+Vi lb-m	Φ (Li+Vi)/Fi lb-m	ni, k+1
nitrogen	0.1670			375.56	0.1670	0.4330	0.1670		
methyl chloride	0.2509	0.0109	0.2217	463.14	0.2059	0.5339	0.2169	0.8644	0.0127
n-hexane	0.0403	0.0264	0.5351	26.75	0.0119	0.0308	0.0383	0.9512	0.0277
toluene	0.0130	0.0120	0.2432	1.95	0.0009	0.0022	0.0129	0.9890	0.0121
		0.0493	1.0000	867.39	0.3857	1.0000		$P_{nc,k+1}$ =	329.06

Iteration 3

Components	Fi lb-m	$n_{i,L}$ lb-m	Xi fraction	Pi mm Hg	Vi lb-m	Yi fraction	Li+Vi lb-m	Φ (Li+Vi)/Fi lb-m	ni, k+1
nitrogen	0.1670			329.06	0.1670	0.3824	0.1670		
methyl chloride	0.2509	0.0127	0.2408	503.11	0.2553	0.5847	0.2680	1.0681	0.0118
n-hexane	0.0403	0.0277	0.5282	26.41	0.0134	0.0307	0.0411	1.0223	0.0271
toluene	0.0130	0.0121	0.2309	1.85	0.0009	0.0021	0.0131	1.0048	0.0121
		0.0525	1.0000	860.43	0.4367	1.0000		$P_{nc,k+1}$ =	290.65

Iteration 20

Components	Fi lb-m	$n_{i,L}$ lb-m	Xi fraction	Pi mm Hg	Vi lb-m	Yi fraction	Li+Vi lb-m	Φ (Li+Vi)/Fi lb-m	ni, k+1
nitrogen	0.1670			298.81	0.1670	0.3931			
methyl chloride	0.2509	0.0097	0.2070	432.33	0.2416	0.5688	0.2513	1.0016	0.0097
n-hexane	0.0403	0.0252	0.5391	26.96	0.0151	0.0355	0.0403	1.0006	0.0252
toluene	0.0130	0.0119	0.2539	2.03	0.0011	0.0027	0.0130	1.0001	0.0119
		0.0468	1.0000	760.13	0.4248	1.0000		$P_{nc,k+1}$ =	298.76

Iteration 21

Components	Fi lb-m	$n_{i,L}$ lb-m	Xi fraction	Pi mm Hg	Vi lb-m	Yi fraction	Li+Vi lb-m	Φ (Li+Vi)/Fi lb-m	ni, k+1
nitrogen	0.1670			298.76	0.1670	0.3933			
methyl chloride	0.2509	0.0097	0.2068	431.94	0.2414	0.5686	0.2511	1.0008	0.0097
n-hexane	0.0403	0.0252	0.5392	26.96	0.0151	0.0355	0.0403	1.0003	0.0252
toluene	0.0130	0.0119	0.2540	2.03	0.0011	0.0027	0.0130	1.0001	0.0119
		0.0467	1.0000	759.69	0.4247	1.0000		$P_{nc,k+1}$ =	298.88

After Iteration 21, all component values for *Φ* are between 0.999 and 1.001 and imply that the maximum molar change that each condensable component undergoes between iterations is smaller than 0.1%, as shown in Table 4-16.

Table 4-16. Convergence Determination

Component	Φ (Li+Vi)/Fi	(Φ-1)%
nitrogen		
methyl chloride	1.0008	0.08%
n-hexane	1.0003	0.03%
toluene	1.0001	0.01%

The final results after Iteration 21 are presented in Table 4-17 with the material balance displayed in pound moles (lb-m) and in pounds (lb) for the exit vapor and liquid streams. The composition of the exit vapor streams is also listed by the average partial pressure for each component being emitted.

Table 4-17. Material Balance for Condenser

Compound	MWt	$n_{i,F}$ lb-m/hr	F_i lb/hr	$n_{i,L}$ lb-m/hr	Li lb/hr	$n_{i,V}$ lb-m/hr	V_i lb/hr	p_i mm Hg
nitrogen	28.01	0.167	4.68	0		0.1670	4.68	298.76
methyl chloride	50.49	0.251	12.67	0.0097	0.49	0.2414	12.18	431.94
n-hexane	86.17	0.040	3.47	0.0252	2.17	0.0151	1.30	26.96
toluene	92.13	0.013	1.20	0.0119	1.09	0.0011	0.11	2.03

Totals		0.471	22.02	0.0468	3.75	0.4247	18.27	759.69

The results from the Material Balance Correction Method for this problem are very near the results that were obtained for the same problem using the Modified Rachford-Rice Method (Illustration 4-5) and the Partial Pressure Correction Method (Illustration 4-6).

4.2.3.4 Non-ideal Liquid

If a process mixture is known to exhibit non-ideal behavior then this specific information can be used within the condenser modeling framework.

Illustration 4-8: Vent condenser with azeotrope, material balance correction method.

A vent condenser, operating at 18.7°C, is used in an atmospheric distillation involving ethyl acetate and ethanol. The process vent stream to the vent condenser is at 30°C and contains ethyl acetate (1.10 lb/hr), ethanol (1.30 lb/hr), and nitrogen (1.56 lb/hr).

[Hougen, Watson, & Ragatz].

Ethyl acetate and ethanol are known to exhibit a minimum boiling point azeotrope with a composition of 73.4 % ethyl acetate and 26.6% ethanol (concentrations in mole percent) at the 18.7°C temperature.

Estimate the discharge vent emissions from the condenser.

Data Provided

Pure component vapor pressure and other conditions:

$P_{ethyl\ acetate}$	66.19 mm Hg	18.7°C
$P_{ethanol}$	36.36 mm Hg	18.7°C
P_{system}	760 mm Hg	discharge pressure
Time	1 hr	time for event

Inlet process stream to the condenser:

Compound	Rate (lb/hr)	Molecular Weight
Nitrogen	1.56 lb/hr	28.013
Ethyl Acetate	1.10 lb/hr	88.10
Ethanol	1.30 lb/hr	46.07

Azeotrope Data

Temperature	18.7°C	
Ethyl Acetate	0.734	mole fraction
Ethanol	0.266	mole fraction
Total Vapor Pressure	77.4 mm Hg	ethyl acetate + ethanol

Combined Inlet Material Flow to Condenser

The combined inlet streams to the condenser are analyzed using standard gas property relationships:

$$n_{i,F} = \frac{F_i}{MWt_i} \quad y_i = \frac{n_{i,F}}{\sum n_F} \quad p_i = y_i P_i$$

Table 4-18. Condenser Inlet Stream Analysis for 1.0 hour of Operation

Compound	F_i lb/hr	Molecular Weight	$n_{i,F}$ lb-mole	y_i mole fraction	p_i mm Hg
Nitrogen	1.56	28.013	0.056	0.578	439.070
Ethyl Acetate	1.10	88.100	0.012	0.130	98.445
Ethanol	1.30	46.070	0.028	0.293	222.485
Totals			0.096	1.000	760.00

Equilibrium Considerations and Estimating Activity Coefficients

If azeotrope data is available for a two component liquid mixture then either the van Laar or Margules equations may be applied and used to calculate activity coefficients for ethyl acetate and ethanol during the iterative processing of the condenser calculation. Other thermodynamic models may alternatively be used depending upon the availability of data.

$$\ln\gamma_1 = \frac{\alpha}{\left[1+\frac{\alpha\, x_1}{\beta\, x_2}\right]^2} \quad \ln\gamma_2 = \frac{\beta}{\left[1+\frac{\beta\, x_2}{\alpha\, x_1}\right]^2} \qquad \text{Eq. 4-48}$$

Where α and β are calculated from known experimental data.

$$\alpha = \left[1+\frac{x_2\ln\gamma_2}{x_1\ln\gamma_1}\right]^2 \ln\gamma_1 \quad \beta = \left[1+\frac{x_1\ln\gamma_1}{x_2\ln\gamma_2}\right]^2 \ln\gamma_2 \qquad \text{Eq. 4-49}$$

And γ_i can be calculated since $x_i = y_i$ for each component at the azeotrope.

$$\gamma_i = \frac{y_i P_{sat\ vp}}{x_i P_i} = \frac{P_{sat\ vp}}{P_i} \qquad \text{Eq. 4-50}$$

From the azeotrope data that has been supplied, the following calculations can be made:

$$\gamma_1 = \frac{77.4\ mmHg}{66.19\ mmHg} = 1.16 \qquad \gamma_2 = \frac{77.4\ mmHg}{36.36\ mmHg} = 2.13$$

ethyl acetate ethanol

$$\alpha = \left[1+\frac{0.266\ln(2.13)}{0.734\ln(1.16)}\right]^2 \ln(1.16) = 1.202$$

$$\beta = \left[1 + \frac{0.734\ln(1.16)}{0.266\ln(2.13)}\right]^2 \ln(2.13) = 1.797$$

$$\ln\gamma_1 = \frac{1.202}{\left[1+\dfrac{1.202\ x_1}{1.797\ x_2}\right]^2} \quad \ln\gamma_2 = \frac{1.797}{\left[1+\dfrac{1.797\ x_2}{1.202\ x_1}\right]^2} \qquad \text{Eq. 4-51}$$

Where

$$\gamma_1 = \exp(\ln\gamma_1) \qquad \gamma_2 = \exp(\ln\gamma_2) \qquad \text{Eq. 4-12}$$

Activity coefficients and vapor pressures for ethyl acetate and ethanol are calculated and plotted in Figure 4-5 and Figure 4-6.

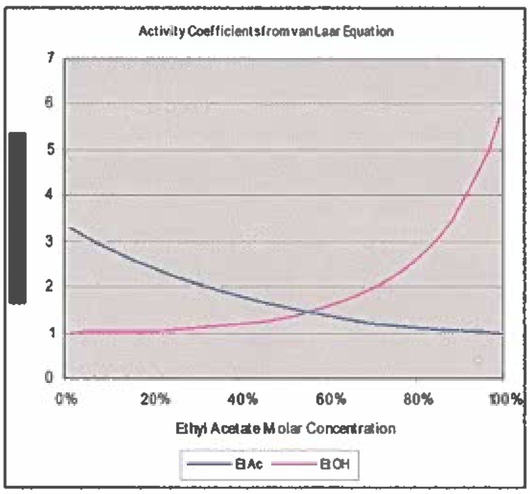


Figure 4-5. Activity coefficients calculated for ethyl acetate and ethanol from the van Laar equation for the complete composition range.

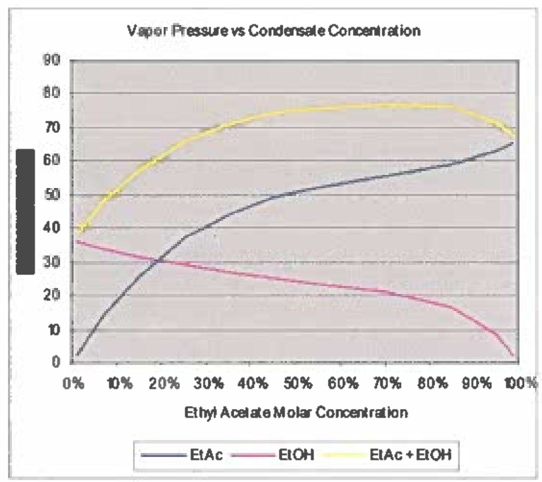


Figure 4-6. Component vapor pressures calculated for ethyl acetate and ethanol based on liquid composition, activity coefficients, and pure component vapor pressures.

Testing for condensation

For this problem, the inlet process stream at the vent condenser has been analyzed and is shown in Table 4-18. A van Laar equation has been developed based on the known azeotrope properties of the ethyl acetate and ethanol mixture (Figure 4-5) and can now be used to estimate component vapor pressures at different condensate compositions (Figure 4-6).

One problem that exists for completing a mathematical test for condensation is that the values of the activity coefficients corresponding vapor pressures for ethyl acetate and ethanol are not known since the composition of the liquid condensate is not initially known. However, if condensation is to occur then the first drop of condensate formed would be at equilibrium with the process vapor phase at the vent condenser conditions. Therefore, the composition of the first drop of condensate would have the same vapor pressure composition as the vapor stream from the process. Since a van Laar model has been established for the ethyl acetate – ethanol system then it is possible to back calculate the equilibrium condensate composition assuming that the dew point for the process vapor stream is reached at the 18.7°C. The vapor composition for the ethyl acetate-ethanol system was calculated based on the thermodynamic model Eq. 4-51 and is plotted as a function of the liquid composition in Figure 4-7. This plot represents the equilibrium relationship between the vapor and the corresponding liquid and provides a convenient way to gauge the composition of the condensate at dew point conditions for the inlet condenser stream.

The partial pressures of ethyl acetate and ethanol at the condenser inlet conditions are used to calculate the relative mole fractions of ethyl acetate and ethanol that would exist at dew point conditions. These calculations are shown in Table 4-19 where the relative ethyl acetate concentration is 0.307 or 30.7%.

Table 4-19. Calculated Mole Fractions for Only the Condensable Portion of the Inlet Process Vapor Stream

Compound	p_i mm Hg	y_i Condensables
Ethyl Acetate	98.445	0.307
Ethanol	222.485	0.693
Totals	320.930	1.000

We are interested in locating the point on the plot in Figure 4-7 where y = 30.67% ethyl acetate that corresponds to the condensable composition of the inlet process vapor phase from Table 4-19. The x coordinate at the intercept corresponds to the initial condensate composition at the vapor dew point. By inspection, this value is between 7% and 8% ethyl acetate. Alternatively, it is possible to use a goal seek routine in a spread sheet to back calculate the condensate concentration at dew point as 7.66% (mole/mole) ethyl acetate.

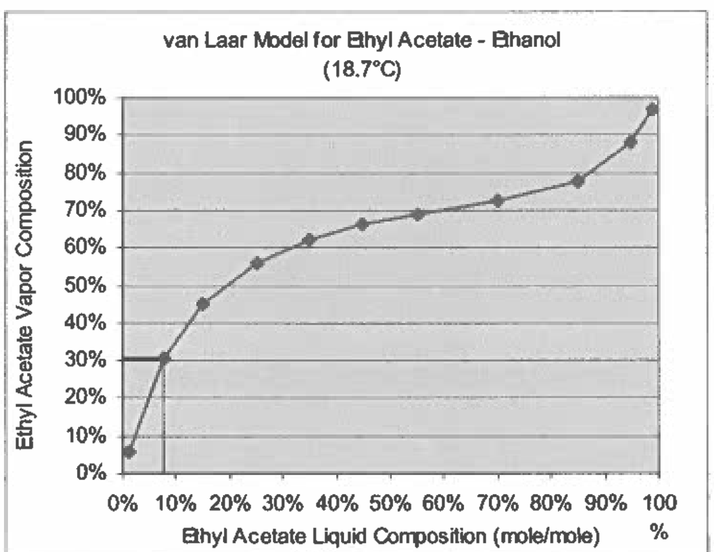


Figure 4-7. Ethyl acetate vapor composition plotted as a function of ethyl acetate composition in the liquid.

The condensation test can now be completed using the following relationships.

$$\left[\sum_{i=1}^{n} x_i = \sum_{i=1}^{n} \frac{p_i}{\gamma_i P_i} < 1.0\right]_{liq\ phase} \qquad \left[\sum_{i=1}^{n} x_i = \sum_{i=1}^{n} \frac{p_i}{\gamma_i P_i} \geq 1.0\right]_{liq\ phase}$$

No Condensation Present Condensation Present

Results from this analysis are shown in Table 4-20.

Table 4-20. Condensate Feasibility Analysis

	Inlet Partial Pressure (mm Hg)	Activity Coefficient	Pure Component Vapor Pressure mm Hg@ 18.7°C	Mole Fraction $x_i = \frac{p_i}{\gamma_i P_i}$
Ethyl Acetate	98.445	2.945374	66.19	0.50
Ethanol	222.485	1.004975	36.36	6.09
				$\sum_{i=1}^{n} x_i = 6.59$

The sum of the theoretical liquid phase mole fractions for the condensate is 6.59 and therefore, one can assume that condensation will take place in the vent condenser.

Solving for a single phase condensate using the Material Balance Correction Method

In the material balance correction method, the total amount of each component leaving the single stage device in liquid and vapor form is divided by the amount of that same component that is entering the device. The moles of each component in the condensate are corrected by the resulting ratio to obtain the corrected value to use for the next iteration, k+1.

$$\frac{n_{i,L} + n_{i,V}}{n_{i,F}} = \phi_i \qquad \text{Eq. 4-53}$$

$$n_{i,L,k+1} = \frac{n_{i,L,k}}{\phi_{i,k}} \qquad \text{Eq. 4-54}$$

Eq. 4-53 and Eq. 4-54 are repeated until the error of estimate for each component has fallen within an acceptable tolerance.

The iteration results for the vent condenser problem are presented in Table 4-21. The initial guess for the condensate was set equal to the composition of the inlet gas stream.

Table 4-21. Iterative Solution to Determine Condensate Composition

Iteration 1	n_i	x_i	γ_i	p_i	$n_{i,V}$	$n_{i,L+V}$	$n_{i,F}$	Φ^{-1}	$n_{i,k+1}$
Nitrogen				690.8	0.05569	0.05569	0.0557	1.0000	0.05569
EtAC	0.01249	0.3067	2.047	41.6	0.00335	0.01584	0.0125	0.7884	0.00984
EtOH	0.02822	0.6933	1.098	27.7	0.00223	0.03045	0.0282	0.9267	0.02615

Iteration 2	n_i	x_i	γ_i	p_i	$n_{i,V}$	$n_{i,L+V}$	$n_{i,F}$	Φ^{-1}	$n_{i,k+1}$
Nitrogen				692.6	0.05569	0.05569	0.0557	1.0000	0.05569
EtAC	0.00984	0.2735	2.155	39.0	0.00314	0.01298	0.0125	0.9619	0.00947
EtOH	0.02615	0.7265	1.075	28.4	0.00228	0.02843	0.0282	0.9924	0.02595

Iteration 3	n_i	x_i	γ_i	p_i	$n_{i,V}$	$n_{i,L+V}$	$n_{i,F}$	Φ^{-1}	$n_{i,k+1}$
Nitrogen				693.0	0.05569	0.05569	0.0557	1.0000	0.05569
EtAC	0.00947	0.2673	2.175	38.5	0.00309	0.01256	0.0125	0.9939	0.00941
EtOH	0.02595	0.7327	1.072	28.5	0.00229	0.02825	0.0282	0.9990	0.02593

Iteration 4	n_i	x_i	γ_i	p_i	$n_{i,V}$	$n_{i,L+V}$	$n_{i,F}$	Φ^{-1}	$n_{i,k+1}$
Nitrogen				693.0	0.05569	0.05569	0.0557	1.0000	0.05569
EtAC	0.00941	0.2663	2.179	38.4	0.00309	0.01250	0.0125	0.9991	0.00940
EtOH	0.02593	0.7337	1.071	28.6	0.00230	0.02822	0.0282	0.9999	0.02592

Iteration 5	n_i	x_i	γ_i	p_i	$n_{i,V}$	$n_{i,L+V}$	$n_{i,F}$	Φ^{-1}	$n_{i,k+1}$
Nitrogen				693.0	0.05569	0.05569	0.0557	1.0000	0.05569
EtAC	0.00940	0.2662	2.179	38.4	0.00309	0.01249	0.0125	0.9999	0.00940
EtOH	0.02592	0.7338	1.071	28.6	0.00230	0.02822	0.0282	1.0000	0.02592

Iteration 6	n_i	x_i	γ_i	p_i	$n_{i,V}$	$n_{i,L+V}$	$n_{i,F}$	Φ^{-1}	$n_{i,k+1}$
Nitrogen				693.0	0.05569	0.05569	0.0557	1.0000	0.05569
EtAC	0.00940	0.2661	2.180	38.4	0.00309	0.01249	0.0125	1.0000	0.00940
EtOH	0.02592	0.7339	1.071	28.6	0.00230	0.02822	0.0282	1.0000	0.02592

Table 4-22. Condenser Material Balance at Completion of Iterations

Iteration 6	Feed	Condensate Out		Vapor Out		$L_i + V_i$	Material Balance
	F_i, lb	$n_{i,L}$ lb-mole	L_i, lb	$n_{i,V}$ lb-mole	V_i, lb		
Nitrogen	1.56	0	0	0.0557	1.56	1.5600	100%
Ethyl Acetate	1.10	0.0094	0.8282	0.0031	0.27	1.1000	100%
Ethanol	1.30	0.0259	1.1942	0.0023	0.11	1.3000	100%

Table 4-23. Exit Vent Stream Analysis Table
(Based on the final results from Table 4-22 and Iteration #6)

Compound	p_i, mm Hg	M. Wt.	Lb-Moles	V_i
Nitrogen	693.0	28.013	0.0557	1.56 lb
Ethyl Acetate	38.4	88.1	0.0031	0.27 lb
Ethanol	28.6	46.07	0.0023	0.11 lb

4.2.4 Vent Condenser with Two Phase Condensate

When two liquid phases are generated, the problem can be solved algebraically because the two liquid phases must be in equilibrium. This situation is examined in illustration 4-9. The problem is more complicated with additional liquid phases. The modified Rachford Rice equation would not be applicable, but either the vapor pressure correction method or the material balance correction method could be used. This more complicated situation is beyond the current scope of this document.

Illustration 4-9: Vent condenser with two phase condensate

A condenser is used at atmospheric pressure (760 mm Hg). The inlet process gas stream contains nitrogen (5.0 lb/hr), water (10.0 lb/hr), and toluene (20.0 lb/hr). The condenser temperature is such that the exit streams are at 20°C.

Using the simplified condensate analysis approach, calculate the emissions (V_i) and the material balance for this condenser.

Data Provided

P_t	21.827 mm Hg	20°C
P_w	17.351 mm Hg	20°C
P_{sys}	760 mm Hg	System pressure
Time	1 hr	Time for event

Inlet Stream:

Compound	Rate (lb/hr)	Molecular Weight
Nitrogen	5.0 lb/hr	28.013
Water	10.0 lb/hr	18.02
Toluene	20.0 lb/hr	92.13

The inlet gas stream at the condenser is analyzed and the rate in lb-mole/hr, mole fraction, and partial pressures are calculated using the standard equations.

$$n_{i,F} = \frac{F_i}{MWt_i} \quad y_i = \frac{n_{i,F}}{\sum n_F} \quad p_i = y_i P_i$$

Table 4-24. Inlet Stream Analysis over 1.0 Hour

Compound	F_i Rate (lb/hr)	Molecular Weight	$n_{i,F}$ (lb-mole)	Mole Fraction	Partial Pressure (mm Hg)
Nitrogen	5.0 lb/hr	28.013	0.1785	0.188	142.72

Water	10.0 lb/hr	18.02	0.5549	0.584	443.69
Toluene	20.0 lb/hr	92.13	0.2171	0.228	173.59
Totals			0.9505	1.000	760.00

Equilibrium Considerations

For a single liquid phase, the following equation can be used to calculate the equilibrium vapor pressure p_i for component i in the liquid.

$$x_i \gamma_i P_i = p_i \qquad \text{Eq. 4-55}$$

Where x_i is the liquid mole fraction of component i,

γ_i is the activity coefficient of component i,

P_i is the pure component vapor pressure of component i at the mixture temperature, and

For two liquid phases in equilibrium, the vapor pressure p_i of component i is the same for each phase.

$$p_{i,1} = p_{i,2} \qquad \text{Eq. 4-56}$$

Where x_i is the liquid mole fraction of component i,

γ_i is the activity coefficient of component i,

P_i is the pure component vapor pressure of component i at the mixture temperature.

Substituting the

$$x_{i,1}\gamma_{i,1}P_i = x_{i,2}\gamma_{i,2}P_i \qquad \text{Eq. 4-57}$$

$$x_{i,1}\gamma_{i,1} = x_{i,2}\gamma_{i,2} \qquad \text{Eq. 4-58}$$

Therefore, if a two phase liquid exists of known composition and the activity coefficient $\gamma_{i,1}$ is known then $\gamma_{i,2}$ may be estimated as shown.

$$\gamma_{i,1} = \frac{x_{i,2}\gamma_{i,2}P_i}{x_{i,1}P_i} = \frac{x_{i,2}\gamma_{i,2}}{x_{i,1}} \qquad \text{Eq. 4-59}$$

Activity coefficients for water and toluene in a two liquid phase mixture can be estimated using these relationships between the two liquid phases. At 20°C water and toluene form a two liquid phase mixture with the following composition.

Table 4-25. Liquid Phase Solubility Data for 20°C

	NonAqueous Phase	Aqueous Phase
Toluene	0.9995 (wt/wt)	0.000515 (wt/wt)

Water	0.0005 (wt/wt)	0.999485 (wt/wt)

The equilibrium concentrations listed in Table 4-26 can be converted to equivalent mole fractions using Eq. 4-.

$$x_i = \frac{wt_i / MWt_i}{wt_i / MWt_i + wt_j / MWt_j} \qquad \text{Eq. 4-13}$$

Table 4-26. Equilibrium Mole Fraction Concentrations

	Non-Aqueous Phase molar concentration	Aqueous Phase molar concentration
Toluene	99.745%	0.010%
Water	0.255%	99.990%

Estimating activity coefficients for liquid phase components

The activity coefficients for toluene and water can be estimated for each liquid phase using the relationship in Eq. 4-58. For the aqueous phase it is reasonable to assume that water exhibits an ideal behavior and that the activity coefficient for water is 1.0 since the concentration of water is close to 100%. Similarly, the activity coefficient for toluene in the non-aqueous phase can be assumed to be 1.0. The activity coefficient for toluene in the aqueous phase may then be calculated.

$$\gamma_{i,1} = \frac{x_{i,2}\gamma_{i,2}}{x_{i,1}} \qquad \gamma_{i,2} = \frac{x_{i,1}\gamma_{i,1}}{x_{i,2}} \qquad \text{Eq. 4-61}$$

Calculate the activity coefficient for toluene in the aqueous phase (phase #1) by applying Eq. 4-61.

$$\gamma_{t,1} = \frac{(0.99745)(1.0)}{(0.0001)} = 9974.5 \qquad \text{Eq. 4-62}$$

Calculate the activity coefficient for water in the non-aqueous phase (phase #2) using Eq. 4-61.

$$\gamma_{w,2} = \frac{(0.9999)(1.0)}{(0.00255)} = 392.1 \qquad \text{Eq. 4-63}$$

Table 4-27. Estimated Activity Coefficients

	Non-Aqueous Phase	Aqueous Phase
Toluene	1.0	9974.5
Water	392.1	1.0

Evaluating whether condensation will take place in the condenser and if so will one or two liquid phases be formed

For this problem, the combined process stream through the condenser (air leakage, toluene vapors, and water vapors) has been analyzed and is shown in Table 4-24. Now that the activity coefficients for toluene and water have been estimated and are shown in Table 4-27 for a two liquid phase mixture, it is important to evaluate whether condensation will occur in the condenser at all or if so, will one or two liquid phases be formed.

At equilibrium conditions, Eq. 4-55 applies for each liquid phase that might be present. Eq. 4-55 can be modified so that x_i can be calculated from the conditions at equilibrium. The sum of all components in the liquid phase must equal to 1.0 and so Eq. 4-66 can be written.

However, at this stage of the problem, equilibrium compositions have not yet been determined for the problem. Eq. 4-66 can be used in conjunction with the component partial pressures in the inlet stream and the pure component vapor pressures at the condenser temperature to determine if condensation should be considered for a specific liquid phase. If the calculated value for Eq. 4-66 is greater than 1.0, then one can initially assume that condensation will occur for the liquid phase being considered. On the other hand, if the calculated value for Eq. 4-66 is less than 1.0 then one can assume that condensate will not occur for the liquid phase being studied.

$$x_i \gamma_i P_i = p_i \qquad \text{Eq. 4-64}$$

$$x_i = \frac{p_i}{\gamma_i P_i} \qquad \text{Eq. 4-65}$$

$$\left[\sum_{i=1}^{n} x_i = \sum_{i=1}^{n} \frac{p_i}{\gamma_i P_i} = 1.0\right]_{liquid\ phase} \qquad \text{Eq. 4-66}$$

The feasibility that condensate will form in the condenser is determined for an aqueous liquid phase and a non-aqueous liquid phase using Eq. 4-66. Results from these calculations are shown in Table 4-28 and Table 4-29.

Table 4-28. Aqueous Phase Condensate Feasibility Analysis

	Inlet Partial Pressure (mm Hg)	Activity Coefficient	Pure Component Vapor Pressure mm Hg@ 20°C	Mole Fraction x_i
Water	443.69	1	17.351	25.57
Toluene	173.59	9974.5	21.827	0.0008
			$\sum_{i=1}^{n} x_i =$	25.57

The sum of the theoretical liquid phase mole fractions for an aqueous phase condensate is 25.57 and greater than 1.0. Therefore, we can assume that a condensate liquid mixture will form and contain at least an aqueous phase.

Table 4-29. Non-Aqueous Phase Condensate Feasibility Analysis

	Inlet Partial Pressure (mm Hg)	Activity Coefficient	Pure Component Vapor Pressure mm Hg@ 20°C	Calculated Mole Fraction x_i
Water	443.69	392.1	17.351	0.07
Toluene	173.59	1.0	21.827	7.95
			$\sum_{i=1}^{n} x_i =$	8.02

The sum of the theoretical liquid phase mole fractions for a non-aqueous phase is 8.02 and also greater then 1.0. Therefore, a condensate mixture from this condenser will likely have a non-aqueous phase as well as an aqueous liquid phase.

During the course of iterating to determine the condenser solution, it is possible for the sum of the x_i values might fall below 1.0 for one of the liquid phases, in which case that phase would no longer be considered as feasible. This is because, as iterations are taking place and the separate liquid phases are being formed (by way of the math), it is possible for the residual amount of material in vapor phase to fall below a level that can continue to support the presence of one of the liquid phases.

Solving for a two liquid phase condensate

The condenser is being treated as a single stage device and so equilibrium is assumed to exist between the exit vent gas and the liquid condensate. Equilibrium is also assumed to exist between the two separate liquid phases in the condensate as well. Therefore, the vapor pressure of toluene and water for each liquid phase is identical as shown by Eq. 4-56 and Eq. 4-57. Phase solubility data for toluene and water at 20°C are given in Table 4-25 and Table 4-26 while the activity coefficients are calculated and shown in Table 4-27. As long as there is enough toluene and water in the system to support two separate liquid phases in the condensate then the molar composition of each phase is governed by the phase solubility data. The calculated partial pressure shown in Table 4-30 will be the same regardless how much toluene and water are present in the system as long as there is enough to support two liquid phases in the condensate.

Table 4-30. Composition and Vapor Pressure Analysis of the Two Phase Condensate

	Nonaqueous Phase		Aqueous Phase		Pure VP_i	Partial VP_i
Component	X_i	γ_i	X_i	γ_i	P_i	p_i
Toluene	0.9975	1.0	0.0001	9974.5	21.827	21.772
Water	0.0025	392.1	0.9999	1.0	17.351	17.349

One can calculate the partial pressure of nitrogen in the exit vapor stream by subtracting the partial pressure of toluene and water from the system pressure as shown.

Exit Vapor Analysis

$$p_{N2} = 760.0 - p_t - p_w \quad \text{Eq. 4-67}$$

$$p_{N2} = 760.0 - 21.772 - 17.349 = 720.879\ mmHg$$

$$n_{t,V} = n_{N2}\frac{p_t}{p_{N2}} = 0.1785\frac{21.772}{720.879} = 0.0054\ lb - moles$$

$$n_{w,V} = n_{N2}\frac{p_w}{p_{N2}} = 0.1785\frac{17.349}{720.879} = 0.0043\ lb - moles$$

Exit Liquid Analysis

The moles of condensate can be determined by subtracting the moles of toluene and water that exit in the vapor phase from the moles of toluene and water that exit in the two liquid phases.

$$n_{t,1\&2} = n_{t,F} - n_{t,V} = 0.2171 - 0.0054 = 0.2117\ \ lb - moles \qquad \text{Eq. 4-68}$$

$$n_{w,1\&2} = n_{w,F} - n_{w,V} = 0.5549 - 0.0043 = 0.5506\ \ lb - moles \qquad \text{Eq. 4-69}$$

$n_{T,1\&2}$ and $n_{W,1\&2}$ are the moles of toluene and water that are contained in the combined two liquid phases. Equations can be written that relate the composition of the aqueous phase and the nonaqueous phase to the total moles of toluene and water as liquid.

$$x_{t,1}L_1 + x_{t,2}L_2 = n_{t,1\&2} \qquad \text{Eq. 4-70}$$

$$x_{w,1}L_1 + x_{w,2}L_2 = n_{w,1\&2} \qquad \text{Eq. 4-71}$$

L_1 are the moles of nonaqueous phase and L_2 are the moles of aqueous phase in the condensate. The objective is to now solve Eq. 4-70 and Eq. 4-71 for L_1 and L_2 and then calculate the moles of toluene and water that are contained in each phase based on the known solubility data. This can be accomplished through algebraic manipulation of Eq. 4-70 and Eq. 4-71 as shown:

$$x_{w,2}x_{t,1}L_1 + x_{w,2}x_{t,2}L_2 = x_{w,2}n_{t,1\&2} \qquad \text{Eq. 4-72}$$

$$x_{t,2}x_{w,1}L_1 + x_{t,2}x_{w,2}L_2 = x_{t,2}n_{w,1\&2} \qquad \text{Eq. 4-73}$$

$$x_{w,2}x_{t,1}L_1 - x_{t,2}x_{w,1}L_1 = x_{w,2}n_{t,1\&2} - x_{t,2}n_{w,1\&2} \qquad \text{Eq. 4-74}$$

$$L_1 = \frac{x_{w,2}n_{t,1\&2} - x_{t,2}n_{w,1\&2}}{x_{w,2}x_{t,1} - x_{t,2}x_{w,1}} \qquad \text{Eq. 4-75}$$

L_1 and L_2 can finally be calculated using Eq. 4-76 and Eq. 4-77. Molar quantities of toluene and water can then be calculated once L_1 and L_2 are known.

$$L_1 = \frac{0.9999 * 0.2117 - 0.0001 * 0.5506}{0.9999 * 0.9975 - 0.0001 * 0.0025} = \frac{0.2116}{0.9998} = 0.2117\ lb - moles \qquad \text{Eq. 4-76}$$

$$L_2 = L_{1\&2} - L_1 = 0.7623 - 0.2067 = 0.5506\ \ lb - moles \qquad \text{Eq. 4-77}$$

Nonaqueous Phase

$$n_{t,1} = x_{t,1} * L_1 = 0.9975 * 0.2117 = 0.2111 \ \ lb-moles$$

$$n_{w,1} = x_{w,1} * L_1 = 0.0025 * 0.2117 = 5.292 x 10^{-4} \ \ lb-moles$$

Aqueous Phase

$$n_{t,2} = x_{t,2} * L_2 = 0.0001 * 0.5506 = 5.506 x 10^{-5} \ \ lb-moles$$

$$n_{w,2} = x_{w,2} * L_2 = 0.9999 * 0.5506 = 0.5506 \ \ lb-moles$$

Table 4-31. Exit Liquid Stream Analysis

	Nonaqueous		Aqueous	
	X_i	n_1 (lb-moles)	X_i	n_2 (lb-moles)
Toluene	0.9975	0.2111	0.0001	5.5506 x 10^{-5}
Water	0.0025	5.292 x 10^{-4}	0.9999	0.5506
Totals		0.2117		0.5507

Table 4-32. Condenser Material Balance at Completion of Iterations

	Nonaqueous		Aqueous		Vapor		Total In	Total Out	Material
	$n_{i,1}$	lb	$n_{i,2}$	lb	$n_{i,v}$	lb	Lb	Lb	Balance
Nitrogen		0.000		0.000	0.1785	5.00	5.000	5.00	100.0%
Toluene	0.2111	19.45	5.5506x10^{-5}	5.11x10^{-3}	0.0054	0.498	20.000	19.95	99.8%
Water	5.292x10^{-4}	9.54x10^{-3}	0.5506	9.92	0.0043	0.077	10.000	10.01	100.1%
	0.2117		0.5507						

Table 4-33. Exit Vent Stream Analysis Table
(Based on the final results from Table 4-32)

Compound	mm Hg	MWt	Lb-Moles	Lb
Nitrogen	720.9	28.013	0.1785	5.000
Toluene	21.8	92.13	0.0054	0.498
Water	17.4	18.02	0.0043	0.077

4.2.5 Liquid-Ring Vacuum Pump

In a liquid-ring vacuum pump the gas stream mixes with the fluid (typically water) used to operate the pump. As a result some of the soluble compounds in the gas stream will be absorbed into the fluid. The procedures for estimating the amount of each soluble compound that is absorbed and emitted is the same as for the condensers described in previous sections in this document. Just as in the condenser examples, the composition of the exit liquid from the liquid-ring vacuum pump is unknown and must be determined by trial and error. The modified Rachford-Rice equation, the partial pressure correction method, or the material balance correction method could be used to solve the problem. Illustration 4-10 uses the partial pressure correction method.

Illustration 4-10: Liquid-Ring Vacuum Pump with multi-component process stream.

A liquid-ring vacuum pump is being used to maintain a distillation operation at 100 mm Hg absolute pressure. The inlet process vapor stream at the vacuum pump consists of air (0.95 lb/hr), methanol (8.56 lb/hr), ethanol (6.35 lb/hr), and isopropyl alcohol (4.25 lb/hr) vapors. The exit liquid and vapor from the vacuum pump discharges to atmospheric conditions at 25°C.

External air is being bleed into the vacuum pump at a rate of 2.60 lb/hr for control purposes to help maintain the 100 mm Hg absolute pressure. The liquid-ring vacuum pump is operated using water with a fresh water make-up rate of 480.0 lb/hr. Spent water from the vacuum pump and travels to waste treatment at 25°C.

What would the emissions and the material balance for the vacuum pump be over a one hour period under these operating conditions? Assume that liquid phase in the vacuum pump behaves as an ideal mixture.

An analysis of the problem requires that the inlet process stream, the air bleed, and the make-up water must all be taken into account. The three streams enter the vacuum pump, become mixed, and then separate out as they exit the unit. The resulting gas and liquid streams that exit the vacuum pump are considered to be in equilibrium. Table 4-34 provides a component break down of the combined process stream present in the vacuum pump.

Table 4-34. Analysis of the Inlet Stream to the Liquid-Ring Vacuum Pump

	Source	F_i lb/hr	MWt	$n_{i,F}$ lb-m/hr	z_i
Noncondensable					
Air	Process	0.95			
Air	External Bleed	2.60			
Air (total)		3.55	28.97	0.1225	0.0045
Condensable					
Methanol	Process	8.56	32.04	0.2672	0.0098
Ethanol	Process	6.35	46.07	0.1378	0.0051
Isopropyl Alcohol	Process	4.25	60.096	0.0707	0.0026
Water	External Make-Up	480.00	18.02	26.6371	0.9780

Solution

In preparing to solve this problem using the Partial Pressure Correction method, we must first arrive at an initial guess for the composition of the liquid that will discharge from the vacuum pump. Upon inspection of Table 4-34, it becomes apparent that the bulk of the inlet stream (97.8%) consists of water (480 lb/hr) and that the remainder of the components (including air) makes up only 2.2%. Additionally, the water exits the vacuum pump at 25°C and at atmospheric pressure which means that approximately 97.8% of the total discharge from the vacuum pump will be in the form of liquid. Additionally, the vacuum pump discharges at 760 mm Hg pressure which is significantly higher than the vapor pressure of water (23.6 mm Hg). Therefore, one would not be very far away from the discharge liquid composition if 100% of the condensable components were chosen as an initial guess.

Table 4-35. Analysis of the Inlet Stream and Initial Guess of the Exit Liquid Composition

Component	P_i @ 25°C mm Hg	Feed from Table 4-34 $n_{i,F}$ lb-moles/hr	Initial Guess $n_{i,L}$ lb-moles/hr
Noncondensable			
Air (total)	N/A	0.1225	N/A
Condensable			
Methanol	122.278	0.2672	0.2672
Ethanol	57.6	0.1378	0.1378
Isopropyl Alcohol	45.152	0.0707	0.0707
Water	23.575	26.6371	26.6371

Newton's method can readily accommodate this initial guess since it would result in $(p_{i,L} - p_{i,V}) = p_{i,L}$ since $p_{i,V}$ would be initially set to 0. Moles of each component would immediately begin being moved from the liquid phase to the vapor phase upon the first iteration. Only three iterations were required to calculate a solution to the desired tolerance as shown:

Iteration 1

Components	$n_{i,L,k}$	x_i	$p_{i,L}$	$n_{i,V}$	y_i	$p_{i,V}$	$p_{i,L} - p_{i,V}$	$\Delta n_{i,L}$	$n_{i,L,k+1}$
Air			735.223	0.1225	1.0000	760.000			
Methanol	0.2672	0.00985	1.205	0.0000	0.00E+00	0.000	1.20E+00	1.94E-04	0.2670
Ethanol	0.1378	0.00508	0.293	0.0000	0.00E+00	0.000	2.93E-01	4.72E-05	0.1378
IPA	0.0707	0.00261	0.118	0.0000	0.00E+00	0.000	1.18E-01	1.90E-05	0.0707
Water	26.6371	0.98245	23.161	0.0000	0.00E+00	0.000	2.32E+01	3.69E-03	26.6334

Iteration 2

Components	$n_{i,L,k}$	x_i	$p_{i,L}$	$n_{i,V}$	y_i	$p_{i,V}$	$p_{i,L} - p_{i,V}$	$\Delta n_{i,L}$	$n_{i,L,k+1}$
Air			735.224	0.1225	0.9688	736.263			
methanol	0.2670	0.00985	1.204	0.0002	1.53E-03	1.166	3.78E-02	6.29E-06	0.2670
ethanol	0.1378	0.00508	0.293	0.0000	3.73E-04	0.284	9.18E-03	1.53E-06	0.1378
IPA	0.0707	0.00261	0.118	0.0000	1.50E-04	0.114	3.69E-03	6.15E-07	0.0707
water	26.6334	0.98246	23.162	0.0037	2.92E-02	22.173	9.89E-01	1.68E-04	26.6332

Iteration 3

Components	$n_{i,L,k}$	x_i	$p_{i,L}$	$n_{i,V}$	y_i	$p_{i,V}$	$p_{i,L} - p_{i,V}$	$\Delta n_{i,L}$	$n_{i,L,k+1}$
air			735.224	0.1225	0.9674	735.240			
methanol	0.2670	0.00985	1.204	0.0002	1.58E-03	1.203	1.62E-03	2.71E-07	0.2670
ethanol	0.1378	0.00508	0.293	0.0000	3.85E-04	0.292	4.05E-04	6.76E-08	0.1378
IPA	0.0707	0.00261	0.118	0.0000	1.55E-04	0.118	1.64E-04	2.73E-08	0.0707
water	26.6332	0.98246	23.162	0.0039	3.05E-02	23.148	1.38E-02	2.35E-06	26.6332

The material balance and composition equilibrium can be evaluated for iteration 3 to ensure that the convergence has been adequately met. The material balance can be checked for each component by dividing the sum of the moles in the liquid and the vapor by the moles in the inlet stream for each component. A 100% material balance is an integral part of the Partial Pressure Correction method since the moles of each component in the vapor phase are calculated by subtracting the moles that have been assigned to the liquid phase from the moles that are in the feed. This is reflected in Table 4-36 under material accountability column.

Table 4-36. Material Balance Accountability

Component	ni,F	ni,L	ni,V	ni,L+ni,V	Accountability
Air	0.1225	0.0000	0.1225	0.1225	100.00%
Methanol	0.2672	0.2670	2.01E-04	0.2672	100.00%
Ethanol	0.1378	0.1378	4.88E-05	0.1378	100.00%
IPA	0.0707	0.0707	1.96E-05	0.0707	100.00%
Water	26.6371	26.6332	3.86E-03	26.6371	100.00%
	27.2353	27.1087	0.1267	27.2353	100.00%

The Partial Pressure Correction method works to minimize the difference between the calculated partial pressure for each component based on the liquid phase composition with the calculated partial pressure of each component based on the vapor phase makeup. This convergence technique was fairly efficient for this vacuum pump problem since the two partial pressures agreed within 0.00213% after only three iterations.

Table 4-37. Partial Pressure Equilibrium Accountability

Component	piL	piV	%error
Air	735.2238	735.2240	-3.43E-05
Methanol	1.2042	1.2042	1.94E-03
Ethanol	0.2928	0.2928	2.10E-03
IPA	0.1178	0.1178	2.13E-03
Water	23.1615	23.1613	9.50E-04

Additional considerations regarding numerical convergence techniques

The Partial Pressure Correction method proved to be a very efficient approach for this problem. When this same problem is solved using the Modified Rachford-Rice model then as many as 100 iterations are required to achieve the same degree of convergence. A main reason that the Modified Rachford-Rice method was less efficient was due to the large amount of water that was in the system. Since the process stream consists of 97.8% water then the remaining components (methanol, ethanol, and isopropyl alcohol) became very small numbers to work with. The Modified Rachford-Rice approach adjusts V/F until the complete based equation is solved. However, since V/F includes the methanol, ethanol, and isopropyl alcohol along with the large amount of water then V/F needs to be evaluated to a much greater precision to accommodate for the loss in accuracy of the convergence.

The Partial Pressure Correction method focuses on the convergence of each individual component in a concurrent fashion. So regardless whether the component occupied as much as 97.8% (as in the case of water) of the process or as little as 0.0026% (as in the case of the isopropyl alcohol) convergence process was carried out to the same degree of precision for each component.

4.2.6 Vacuum Steam Jets

In a vacuum steam jet steam is mixed with the process gas stream and then condensed. As for the condensers described in earlier sections in this chapter, the composition of the condensate may be unknown, which means the composition of the exit gas stream must be determined through trial and error. The modified Rachford-Rice equation, partial pressure correction method, or material balance correction method could be used to solve this problem. The problem in illustration 4-11 is solved using the material balance correction method.

Illustration 4-11: Vacuum steam jet – material balance correction method.

A vacuum steam jet is used to maintain 100 mm Hg for a process. The inlet process gas stream contains air (1.61 lb/hr) and toluene vapors (1.53 lb/hr). Steam is feed to the vacuum jet at a rate of 120 lb/hr and is condensed in the unit as part of the normal operation. An external air bleed (1.0 lb/hr) is used to help maintain the controlled 100 mm Hg absolute pressure at the process.

The liquid condensate and the exit vapors discharge to atmospheric pressure at 55°C.

Estimate the discharge vent emissions from the vacuum steam jet.

Data Provided:

P_T	113.8 mm Hg	55°C
P_W	118.0 mm Hg	55°C
P_{sys}	760 mm Hg	discharge pressure
Time	1 hr	Time for event

Solubility data at 55°C:

$X_{T,ph\text{-}1}$	0.000168 mole fraction	aqueous phase
$X_{W,\,ph\,2}$	0.0063 mole fraction	non-aqueous phase

Inlet process stream to the vacuum steam jet:

Compound	Rate (lb/hr)	Molecular Weight
Air	1.61 lb/hr	28.97
Toluene	1.53 lb/hr	92.13

Steam and external air bleed rate to the vacuum steam jet:

Compound	Rate (lb/hr)	Molecular Weight
Water	120.0 lb/hr	18.02
Air	1.0 lb/hr	28.97

The inlet gas stream at the condenser is analyzed as follows using standard equations and relationships:

$$n_{i,F} = \frac{F_i}{MWt_i} \quad y_i = \frac{n_{i,F}}{\sum n_F} \quad p_i = y_i P_i$$

Table 4-38. Steam Jet Process Stream Analysis for 1.0 Hour of Operation

Compound	F_i lb/hr	Molecular Weight	$n_{i,F}$ lb-mole	y_i mole Fraction	p_i, mm Hg
Air from process	1.61				
Air from bleed	1.00				
Total Air	2.61	28.970	0.090	0.013	10.12
Water	120.00	18.020	6.659	0.984	748.02
Toluene	1.53	92.13	0.017	0.001	1.86
Totals			6.766	1.000	760.00

Equilibrium Considerations and Estimating Activity Coefficients

Table 4-39. Equilibrium Mole Fraction Concentrations

	Aqueous Phase mole fraction	Non-Aqueous Phase mole fraction
Toluene	0.000168	0.993697
Water	0.999832	0.006303

The activity coefficients for toluene and water can be estimated for each liquid phase using Eq. 4-78. For the aqueous phase it is reasonable to assume that water exhibits ideal behavior and that the activity coefficient is 1.0 since the concentration of water is close to 100%. Similarly, one can assume that the activity coefficient for toluene in a non-aqueous phase would be approximately 1.0. The activity coefficient for toluene in the aqueous phase and the activity coefficient for water in a non-aqueous phase may then be calculated from equations that were previously developed.

$$\gamma_{i,1} = \frac{x_{i,2}\gamma_{i,2}}{x_{i,1}} \quad \gamma_{i,2} = \frac{x_{i,1}\gamma_{i,1}}{x_{i,2}} \qquad \text{Eq. 4-78}$$

Where the activity coefficient for toluene in the aqueous phase (phase #1) is calculated as follows:

$$\gamma_{t,1} = \frac{(0.993697)(1.0)}{(0.000168)} = 5903$$

Similarly, the activity coefficient for water in the non-aqueous phase (phase #2) is calculated.

$$\gamma_{w,2} = \frac{(0.999832)(1.0)}{(0.006303)} = 159 \qquad \text{Eq. 4-79}$$

Table 4-40. Estimated Activity Coefficients

	Aqueous Phase	Non-Aqueous Phase
Toluene	5903.0	1.0
Water	1.0	159.0

Testing for condensation at steam jet discharge conditions

For this problem, the combined process stream through the vacuum jet (air leakage, toluene vapors, and water vapors) has been analyzed and is shown in Table 4-38. Now that the activity coefficients for toluene and water have been estimated and are shown in Table 4-40 for a two liquid phase mixture, it is important to test to know if the process discharge stream will contain one or more liquid phases.

Results from this analysis are shown in Table 4-41 and Table 4-42.

Table 4-41. Aqueous Phase Condensate Feasibility Analysis

	Inlet Partial Pressure (mm Hg)	Activity Coefficient	Pure Component Vapor Pressure mm Hg@ 20°C	Mole Fraction x_i
Water	748.02	1	118.0	6.34
Toluene	1.86	5903	113.8	2.8E-06
				$\sum_{i=1}^{n} x_i = 6.34$

The sum of the theoretical liquid phase mole fractions for an aqueous phase condensate is 6.34. Therefore, we can assume that the discharge process stream from the vacuum jet will at least contain an aqueous phase which will consist mostly of water.

Table 4-42. Non-Aqueous Phase Condensate Feasibility Analysis

	Inlet Partial Pressure (mm Hg)	Activity Coefficient	Pure Component Vapor Pressure mm Hg@ 20°C	Calculated Mole Fraction x_i
Water	748.02	1.0	118.0	0.04
Toluene	1.86	159.0	113.8	0.02
				$\sum_{i=1}^{n} x_i = 0.06$

The sum of the theoretical liquid phase mole fractions for a non-aqueous phase is 0.06. Therefore, we can conclude that the discharge process stream will not contain a non-aqueous phase since the sum of the mole fractions is less than 1.0.

Solving for a single phase condensate using the Material Balance Correction Method

$$\frac{n_{i,L} + n_{i,V}}{n_{i,F}} = \phi_i \qquad \text{Eq. 4-80}$$

$$n_{i,L,k+1} = \frac{n_{i,L,k}}{\phi_{i,k}} \qquad \text{Eq. 4-81}$$

For each condensable component in the inlet stream, the following steps are followed until the error of estimate for each component has fallen within an acceptable tolerance.

Iterating to solve the condenser problem

The iteration results are presented in Table 4-43 for the solution. The equilibrium mole fractions in the aqueous solution at 55°C (see Table 4-39) are used to determine the number of moles of condensables (i.e., water and toluene) in the condensate for the first iteration. The partial pressures of toluene and water in the outlet vapor, assuming equilibrium with the condensate are estimated using Eq. 4-6; the partial pressure of air is determined as the difference between the system pressure and the sum of the partial pressures for toluene and water. Moles of toluene and water in the outlet vapor are estimated using Eq. 4-5. The value of Φ, the ratio of the estimated sum of moles of a condensable in condensate and outlet vapor to the known feed moles, is estimated for both condensable compounds using Eq. 4-80. New estimates of the number of moles of each condensable in the condensate are calculated using Eq. 4-81. These estimates are used as the starting values for the second iteration. The process repeats until convergence is obtained. The resulting composition of the condensate and the outlet gas stream are shown in Tables 4-44 and 4-45.

Table 4-43. Iterative Solution to Vacuum Steam Jet Problem with Aqueous Phase Condensate

Iteration 1	$n_{i,L,k}$	x_i	p_i	$n_{i,V}$	$n_{i,L+V}$	$n_{i,F}$	$\Phi_{i,k}$	$n_{i,L,,k+1}$
Air			528.9	0.09009	0.09009	0.0901	1.0000	0.09009
Water	6.65927	0.9998	118.0	0.02010	6.67936	6.6593	0.9970	6.63923
Toluene	1.119E-03	1.68E-04	113.1	0.01926	0.02038	0.0166	0.8147	0.00091

Iteration 2	$n_{i,L,k}$	x_i	p_i	$n_{i,V}$	$n_{i,L+V}$	$n_{i,F}$	$\Phi_{i,k}$	$n_{i,L,,k+1}$
Air			549.6	0.09009	0.09009	0.0901	1.0000	0.09009
Water	6.63923	0.9999	118.0	0.01934	6.65857	6.6593	1.0001	6.63993
Toluene	9.116E-04	1.37E-04	92.4	0.01515	0.01606	0.0166	1.0339	0.00094

Iteration 3	$n_{i,L,k}$	x_i	p_i	$n_{i,V}$	$n_{i,L+V}$	$n_{i,F}$	$\Phi_{i,k}$	$n_{i,L,,k+1}$
Air			546.5	0.09009	0.09009	0.0901	1.0000	0.09009
Water	6.63993	0.9999	118.0	0.01945	6.65938	6.6593	1.0000	6.63982
Toluene	9.425E-04	1.42E-04	95.5	0.01575	0.01669	0.0166	0.9947	0.00094

Iteration 4	$n_{i,L,k}$	x_i	p_i	$n_{i,V}$	$n_{i,L+V}$	$n_{i,F}$	$\Phi_{i,k}$	$n_{i,L,,k+1}$
Air			547.0	0.09009	0.09009	0.0901	1.0000	0.09009
Water	6.63982	0.9999	118.0	0.01943	6.65925	6.6593	1.0000	6.63983
Toluene	9.375E-04	1.41E-04	95.0	0.01565	0.01659	0.0166	1.0008	0.00094

Iteration 5	$n_{i,L,k}$	x_i	p_i	$n_{i,V}$	$n_{i,L+V}$	$n_{i,F}$	$\Phi_{i,k}$	$n_{i,L,,k+1}$
Air			546.9	0.09009	0.09009	0.0901	1.0000	0.09009
Water	6.63983	0.9999	118.0	0.01944	6.65927	6.6593	1.0000	6.63983
Toluene	9.383E-04	1.41E-04	95.1	0.01567	0.01661	0.0166	0.9999	0.00094

Iteration 6	$n_{i,L,k}$	x_i	p_i	$n_{i,V}$	$n_{i,L+V}$	$n_{i,F}$	$\Phi_{i,k}$	$n_{i,L,,k+1}$
Air			546.9	0.09009	0.09009	0.0901	1.0000	0.09009
Water	6.63983	0.9999	118.0	0.01944	6.65927	6.6593	1.0000	6.63983
Toluene	9.382E-04	1.41E-04	95.1	0.01566	0.01660	0.0166	1.0000	0.00094

Table 4-44. Condenser Material Balance at Completion of Iterations

Iteration 6	Total In (lb)	$n_{i,1}$	(lb)	$n_{i,V}$	(lb)	Total Out (lb)	Material Balance
Air	2.61		0.00	0.09009	2.61	2.61	100%
Water	120	6.63983	119.65	0.01944	0.35	120.00	100%
Toluene	1.53	9.382E-04	0.09	0.01566	1.44	1.53	100%

Table 4-45. Exit Vent Stream Analysis Table
(Based on the final results from Table 4-44)

Compound	mm Hg	MWt	Lb-Moles	Lb
Air	546.9	28.013	0.09009	2.61
Water	118.0	18.02	0.01944	0.35
Toluene	95.1	92.13	0.01566	1.44

5.0 Basic Process Operations

5.1 Emission Calculations from Solvent Reclamation Systems

After being collected from manufacturing processes, waste solvents are frequently purified and reused in the factory. Distillation is one of the most common means of purifying solvents for reuse. Many forms of distillation are used including simple batch, continuous, or steam distillation.

For emissions modeling, a typical distillation process involves several separate emission modeling steps:

1. The initial filling step when waste solvent is charged to the empty distillation vessel.
2. A heating step when the waste solvent is raised to the solvent boiling point temperature.
3. The recovery phase when purified distillate is collected in the receiving vessel.
4. At the completion of the distillation process any remaining waste solvent in the still is normally cooled. The emissions from cooling are assumed to be zero unless a nitrogen sweep that would overcome gas contraction is being applied.
5. A final drumming step when the recovered solvent is transferred to a solvent holding area or to drums.

Illustration 5-1: Estimating emissions from a batch distillation operation.

One hundred gallons of waste toluene are to be charged to a batch still for distillation recovery. The toluene to be charged is at 18°C and contains 1.5% (mole/mole) dissolved non-volatile waste solids. A boiling point check shows that the waste toluene has a normal boiling point of 111.2°C. The still vessel has a gas space volume of 220 gallons when empty. An overhead heat exchanger is used to condense the pure toluene distillate at 20°C. What are the vent emissions from this event?

5.1.1 Emissions from Charging the Distillation Vessel with Cold Solvent for Recovery

The standard charging model is used to calculate the vent emissions that occur from charging the cold waste solvent to the distillation vessel. Basic values that will be used in the calculation are first calculated.

Determine T(°K): $T(°K) = 18.0°C + 273.15 = 291.25°K$

Antoine Equation: $$P_{toluene} = \exp\left(16.0137 - \frac{3096.52}{291.15 - 53.67}\right) = \exp(2.975) = 19.582\ mmHg$$

Raoult's Law: $p_{toluene} = 0.985\ P_{toluene} = (0.985)(19.582\text{ mm Hg}) = 19.288\text{ mm Hg}.$

Displacement Vol. $V\ (ft^3) = 100\text{ gallons} * 0.13368\ (ft^3/gal) = 13.368\ ft^3$

Ideal Gas Constant $R = 998.9\text{ mmHg}\cdot ft^3 / \text{lb-mole}\cdot°K$

Moles of toluene emitted per batch: $$n_i = \frac{19.288 \cdot 13.368}{998.9 \cdot 291.15} = 0.000887\ \text{lb-moles}$$

Weight of toluene emitted per batch: $wt_i = (0.000887\text{ lb-moles})(92.13\text{ lb/lb-mole}) = 0.082\text{ lbs}$

5.1.2 Heating the Solvent for Distillation

Since the distillation system contains a process condenser operating at 20°C then we can assume that the exit vent gas caused by heating will leave the equipment system saturated with toluene vapors at the 20°C temperature. It should be noted that during the initial heating process between 18°C and 20°C that the toluene content of the condenser exit gas will be less than the 20°C saturation level. However, this error is considered to be in significant when compared to the total emissions that occur while heating to the final 111.2°C boiling point temperature prior to distillation.

T_i	=	18°C	=	291.15°K	(Initial temperature)
P_T	=	1.0 atm	=	760 mm Hg	(Total system pressure)
V_{gas}	=	120 gallons	=	16.04 ft^3	(Gas space volume)
R	=	998.9 (mmHg-ft^3)/(lb-mole-°K)			(Universal gas constant)
$P_{toluene,\ 18°C}$	=	19.906 mm Hg.			(Antoine Equation)

The partial pressure of nitrogen at 18°C is the difference between the total system pressure and the partial pressure of toluene: $p_{nc,1} = 760 - p_{toluene,1} = 760 - 19.6 = 740.4\ mmHg$

Gas Law: $n = \frac{PV}{RT}$, also $n_i = \frac{p_i V}{RT}$ for a single component, *i*, in the gas space.

Calculate the total amount of nitrogen that is displaced from the still during the heating activity using the ideal gas law at the initial conditions. When the waste toluene temperature reaches the boiling point, it is assumed that all of the nitrogen has been expelled and that the head space in the distillation vessel contains only saturated toluene vapors. Therefore the ideal gas law is used to calculate the moles of nitrogen that is displaced.

Nitrogen discharged from heating: $n_{N2} = \frac{p_{n2}V}{RT} = \frac{740.4 * 16.04}{998.9 * 291.15} = 0.041$ lb-moles

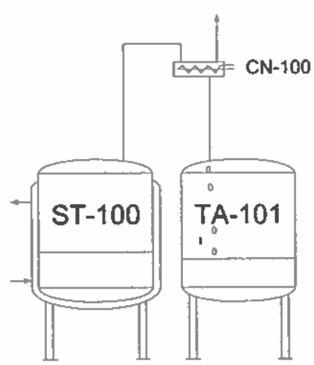
The condenser has an outlet vent temperature of 20°C. It is assumed that the outlet vent gas is saturated with toluene vapors. Therefore the quantity of toluene that is finally emitted from the process system is calculated by multiplying the moles of nitrogen by the ratio of the toluene and nitrogen partial pressures.

Partial pressure of toluene at 20°C (Antoine Equation): 21.8 mm Hg
Partial pressure of nitrogen at 20°C by difference: (760 – 21.8) = 738.2 mm Hg.

Final toluene emission: $n_{toluene} = \left(\frac{21.8\ mmHg}{738.2\ mmHg}\right) 0.041 = 0.00121\ lb - moles$

Final toluene emission:

$$wt_{toluene} = (0.00121\ lb - moles)(92.13 lb / lb - mole) = 0.0012\ lbs$$



5.1.3 Receiving the Solvent from Distillation

If the initial waste toluene to be distilled contains 1.5% non-volatile impurities and the composition of the final still bottoms is estimated to be 50% toluene and 50% non-volatile impurities, then the expected volume of toluene to be recovered will be 97 gallons. The emissions that are associated with the actual distillation operation are calculated using the filling or charging model for TA-101. It is estimated that the distillate toluene enters TA-101 from the condenser at 20°C based on earlier discussions.

Vapor pressure of toluene at 20°C: 21.85 mm Hg.

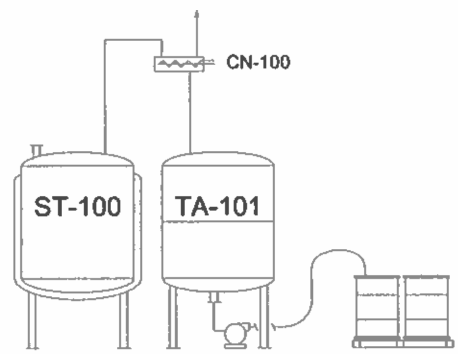
Displacement volume: 97 gallons * 0.133680555 (gal/ft^3) = 12.967 ft^3

Toluene emitted per batch: $n_i = \frac{P_i V}{RT} = \frac{21.85 * 12.967}{998.9 * 291.15} = 0.001048$ lb-moles

Toluene emitted per batch: $wt_{toluene} = (0.001048\ lb-moles)(92.13 lb/lb-mole) = 0.097\ lbs$

5.1.4 Drumming the Purified Toluene

Once the 97 gallons of toluene have been purified and collected in TA-101, the batch will be drummed in 50 gallon drums. Unless spot ventilation is provided for the drums then the emission losses that occur during drumming would be considered to be fugitive emissions. Emissions for this operation are calculated as a simple filling operation. As the 97 gallons of toluene are transferred from the receiver into drums then 97 gallons of saturated solvent vapor are displaced from the drums. The emissions are calculated using the ideal gas law as before.



Toluene emitted per batch:

$$n_i = \frac{P_i V}{RT} = \frac{21.85 * 12.967}{998.9 * 291.15} = 0.001048 \text{ lb-moles}$$

Toluene emitted per batch: $wt_{toluene} = (0.001048\ lb-moles)(92.13 lb/lb-mole) = 0.097\ lbs$

5.1.5 Solvent Emissions from the Overall Toluene Recovery Process

Solvent emissions from the overall toluene recovery process are estimated by adding the emissions from each of the individual steps.

Activity Description	Amount
Initial charging of 100 gallons of waste toluene solvent	0.0820 lbs
Heating the batch for distillation	0.0012 lbs
Receiving toluene in receiver TA-101	0.0970 lbs
Drumming 97 gallons of recovered toluene	0.0970 lbs
Total Emissions from process	0.2772 lbs

5.2 Filtration Operations

Filtration is an operation that is commonly used when it is desired to separate the solids portion of a process slurry from the liquid portion. Most filtrations involve a slurry feed vessel, a filter, and a filtrate receiving vessel. In some cases the slurry is passed through the filter by pressurizing the feed tank while in other operations the slurry may be pumped. Different types of filters may be used depending upon the processing requirements. For example, the filter may be a bag filter, filter press, leaf filter, centrifuge, or another design.

Examples of batch filtration might include processing when crystalline product that has formed during the process must be isolated from the batch slurry. Other filtration operations are performed when the product is dissolved in the primary processing solvent and the solids are either waste compounds or materials that have added to help purify the dissolved product such as diamatious earth or activated carbon.

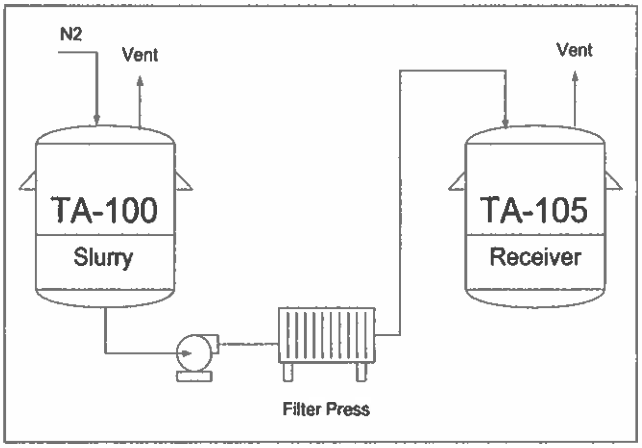


Figure 5-1. Example filtration equipment arrangement.

Batch filtration consists of at least three separate modeling activities including sending the process slurry to the filter initially with process mother liquors being directed into the receiver. The charging or filling model is used to calculate the process vent emissions that occur during this processing step. Since the filter is connected directly to the filtrate receiving vessel then all emissions exit through the receiver process vent. In this case the emissions from the operation are based on the total volume of slurry being processed forward.

A fresh solvent (normally the same solvent that is contained in the process) is passed through the filter cake to the filtrate receiver. The emissions from this operation may also be calculated using a filling model for the filtrate receiver based on the volume of solvent that is used during the wash.

Air or nitrogen gas is usually passed through the filter to displace the residual liquid from the solids filter cake. Displaced liquid from the filter cake is sent to the filtrate receiver. Emissions that occur from this operation may be calculated using the standard filling model that also includes a gas sweep for the filtrate receiver. An exit gas saturation level of 100% is used based on the process filtrate composition.

5.3 Centrifuge Operations

Centrifugation is an operation that is commonly used when it is desired to separate the solids portion of a process slurry from the liquid portion. Most centrifuge operations contain a slurry feed vessel, a centrifuge, and a filtrate receiving vessel. In most cases the slurry is passed to the centrifuge by way of a centrifugal pump. Centrifuge operations normally include a feed step (when slurry is feed to the centrifuge so that the internal basket can be loaded), a spin step (when filtrate is permitted to exit the centrifuge cake), a washing step (when water or process solvent is feed to the centrifuge), a final spin step (when the wash liquor is allowed to separate from the centrifuge cake), followed by a plowing step (when the solid cake is removed from the centrifuge).

Processing when centrifugation might be used would be for situations when crystallized material that has formed during the process must be isolated from the batch. Several centrifuge loads must usually be processed from a single batch of slurry material depending upon the batch size.

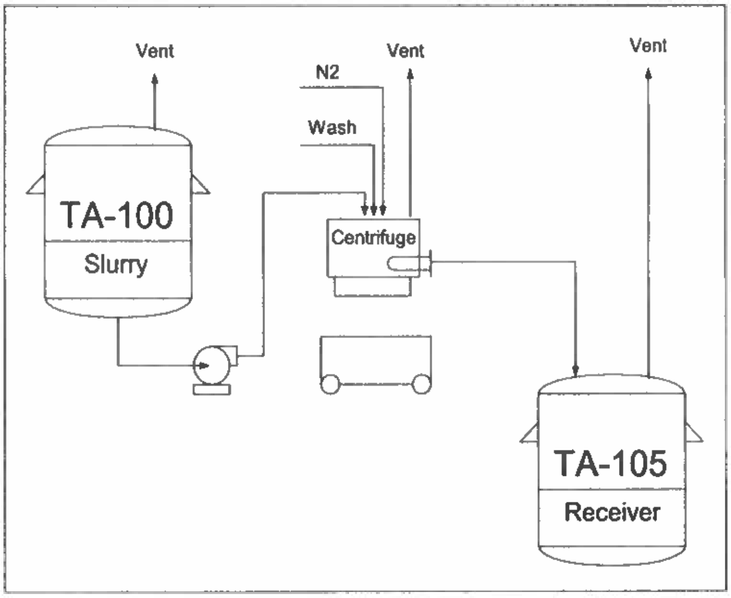


Figure 5-2. Typical centrifuge equipment arrangement.

Centrifugation consists of at least three separate modeling activities.

Feed Step. The initial feed step is when the centrifuge is being loaded with process slurry from the feed vessel and filtrate is being directed to the filtrate receiver from the centrifuge. The charging or filling with gas sweep model is used to calculate the process vent emissions that occur from the centrifuge as well as from the filtrate receiver.

The volumetric capacity of the centrifuge basket is used as the filling volume for the centrifuge and any additional ventilation rate (as established through plant data) is used for the gas sweep portion of the centrifuge emission calculation. If the centrifuge is tightly connected to other ancillary equipment such as an enclosed bottom hopper then the gas sweep rate may be negligible.

Similarly, the volume of filtrate that enters the filtrate receiver from the centrifuge in addition to any gas sweep that is present are the basis for the emission calculation for this vessel.

Wash step. Fresh solvent (normally the same solvent as is contained in the process) is passed through the centrifuge cake to the filtrate receiver. During this phase of the operation the centrifuge basket is already full of product solids so the emissions that occur from the centrifuge would be from the gas sweep assuming that a gas sweep exists. However, if the centrifuge is tightly connected to other ancillary equipment items and a gas purge is not being used at the centrifuge then the focus of the emission calculation would be placed on the filtrate receiver.

The volume of wash solvent that enters the filtrate receiver in conjunction with any gas sweep that also might be present forms the basis for the emission calculation from the filtrate receiver.

5.4 Vacuum Dryer Model

Examples of vacuum drying include processing when final product solids are dried in a vacuum tray dryer or rotary dryer.

The vacuum drying process consists of at least four separate activities and includes (1) placing the process material into the dryer, (2) reducing the system pressure to the design level (3) heating the batch for evaporation to take place, and (4) collecting the solvent distillate in the receiver.

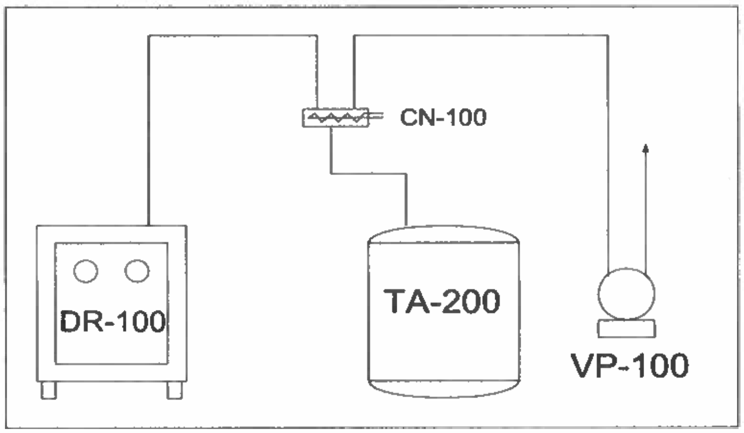


Figure 5-3. Diagram of a typical vacuum tray dryer system.

5.4.1 Information Needed to Model a Vacuum Tray Drying Operation

5.4.1.1 Placing the material to be dried into the vacuum oven

Product solids that are wet with solvent from the prior filtration or centrifugation step will undergo evaporation losses as they are being prepared for the vacuum dryer. Material to be dried is physically transferred from a hopper, drum, or other container onto trays and then spread evenly so that the drying process will be uniform.

It is difficult to predict the evaporation rate from wet solids because each process is different and the material being processed varies with respect to particle size, solvent content, exposure condition, and other variables. A conservative approach to estimating the evaporation losses from a wet product solids cake would be to apply the basic evaporation model as presented in Section 3.6 of this document.

$$Q_m = \frac{M_i K_i A\left(P_i^{sat} - P_i\right)}{RT_L} \qquad \text{Eq. 5-1}$$

where Q_m is the evaporation rate (mass/time).
M is the molecular weight of the volatile substance,
K is a mass transfer coefficient (length/time),
A is the evaporation surface area,
P_i^{sat} is the saturated solvent vapor pressure,
P_i is the actual vapor pressure near the liquid surface,

R is the ideal gas constant, and
T_L is the absolute temperature of the liquid.

Equation 5-1 would provide a conservative estimate of the evaporation rate because the solvent is distributed throughout the product cake as opposed to existing as a continuous liquid with a fixed surface area. As evaporation takes place the amount of solvent that is close to the surface of the cake becomes depleted and any remaining solvent must migrate to the surface for further evaporation. The evaporation process will also remove heat from the product cake and cause P_i^{sat} to reduce due to the lower temperature.

An alternative approach to quantifying the evaporation rate would be to perform a material balance study by making weight loss measurements using representative samples of wet cake. The results from wet loss studies could then be used to make future estimates.

5.4.1.2 Depressurization Step

The standard depressurization model is applied to calculate the solvent emissions from vacuum oven during the evacuation operation from one atmosphere down to the planned operating pressure. In many cases the planned operating pressure for the oven is less than the saturation vapor pressure of the solvent. In these cases, the depressurization model would be calculated between one atmosphere and the solvent saturated vapor pressure.

5.4.1.3 Heating Step

If the planned operating pressure of the vacuum oven is less than the solvent saturated vapor pressure at initial temperature conditions then the heating model can be used to estimate the emissions that occur during heat up. The heating model would be calculated between the initial temperature conditions and within 2°C of the boiling point temperature for the solvent at the planned operating pressure of the vacuum oven.

5.4.1.4 Distillation Step

Once the drying process is underway, solvent vapors are carried from the vacuum oven and into the heat exchanger where they condense and drain into the distillate receiver. The distillate receiver continues to fill with solvent as long as solvent is being removed from the product solids. Air emissions that occur while the vacuum drying process is ongoing originate from the distillate receiver. The vacuum pump continually removes air from the equipment to maintain the correct pressure of operation.

The filling model is used to estimate the solvent emissions during this part of the drying process. The composition and quantity of the distillate being collected is the same as the original amount of solvent that was contained in the wet cake. The fill volume is equal to the total volume of solvent that is collected. The temperature and pressure of the distillate receiver is used in the calculations as well as any estimated leak rate that the vacuum pump must overcome as part of the process operation.

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6.0 Physical Property Relationships

6.1 Basic Physical Properties Relationships

This section describes the equations and mathematical relationships that are used in calculating air emissions from point sources in chemical manufacturing processes.

6.1.1 Unit Conversations

The following relationships are helpful when converting from one unit system to another for temperatures, pressures, and volumes.

Temperature Conversions

T (°R) = T (°F) + 459.69 Eq. 6-1
T (°K) = T (°C) + 273.15
T (°K) = 1.8 * T (°R)
T (°K) = [T (°F) + 459.69] / 1.8
T (C) = T (°K) – 273.15
T (C) = [T (°F) – 32.0] / 1.8

Pressure Conversions

P (mm Hg) = 760.0 * P (atm) Eq. 6-2
P (mm Hg) = 51.7 * P (psia)
P (mm Hg) = 25.4 * P (in Hg)
P (mm Hg) = P (Pa) / 133.3

Volume Conversions

V ft^3 = 0.03531467 * V (liter) Eq. 6-3
V ft^3 = 0.133680555 * V (gal)

6.2 Basic Physical Property Relationships

6.2.1 Ideal Gas Law

The Ideal Gas Law is used to calculate the total number of moles in a gas space from known variables, such as pressure, volume, and temperature.

$$PV = nRT \qquad \text{Eq. 6-4}$$

where: n = moles of gas
P = pressure (absolute)
V = volume
T = temperature (absolute)
R = Universal Gas Constant

The following properties exist for ideal gases at the standard temperature and pressure condition:

Table 6-1. Standard Conditions for Ideal Gases

Mass	Pressure	Volume	Temperature	Ideal Gas Constant (R)
1.0 lb-mole	14.7 lb/in^2	359.046 ft^3	491.69°*R*	10.731
1.0 lb-mole	29.92 in Hg	359.046 ft^3	491.69°*R*	21.8484
1.0 lb-mole	760 mm Hg	359.046 ft^3	273.15°*K*	998.9
1.0 g-mole	760 mm Hg	22.414 liters	273.15°*K*	62.3637
1.0 g-mole	1.0 atm	22.414 liters	273.15°*K*	0.8206

Illustration 6-1: Calculating the moles of gas from volume, temperature, and pressure.

A process vessel has a void space volume of 1200 gallons when empty of liquid. Calculate the moles of gas that are discharged from the process vent if 550 gallons of liquid are charged into the vessel. Also calculate the moles of gas that are still contained in the vessel headspace at the completion of the filling operation. The batch temperature is 35°C and the system pressure is 760 mm Hg.

Assumptions: The vessel temperature and the batch temperature are the same 35°C before and after the addition is made. Additionally, any evaporation that may occur when the liquid enters the initially empty vessel is ignored.

Part A (Moles of gas displaced through the process vent).
Displacement Volume V_d = 550 gal = 0.133680555 ft^3/gal * 550 gal = 73.52 ft^3

Temperature T = 35°C = 35°C + 273.15°K = 308.15°K

Moles $$n = \left(\frac{PV}{RT}\right) = \left(\frac{760 * 73.52}{998.99 * 308.15}\right) = 0.182 \text{ lb-moles}$$

Part B (Moles of gas retained in the vessel headspace).
Gas Space Volume V_g = 1200 gal – 550 gal = 650 gal.
Volume conversion V_g = 0.133680555 ft^3/gal * 650 gal = 86.89 ft^3

Moles $$n = \left(\frac{PV}{RT}\right) = \left(\frac{760 \cdot 86.89}{998.99 \cdot 308.15}\right) = 0.215 \text{ lb-moles}$$

6.2.2 Dalton's Law

Equations based on Dalton's Law (*Eq. 6-5*) of partial pressure and Amagat's law (*Eq. 6-6*) of partial volume are used with the Ideal Gas Law to determine the number of moles of a specific compound in the vapor space of the vessel.

Dalton's Law $$n_i = \frac{p_i V}{RT}$$ Eq. 6-5

Amagat's Law $$n_i = \frac{P v_i}{RT}$$ Eq. 6-6

where: P = pressure
V = volume

T = temperature
R = Universal Gas Constant
n_i = moles of *i*
p_i = partial pressure of *i*
v_i = partial volume of *I*

Illustration 6-2: Calculating molar quantities for gas mixtures.

The headspace of a vessel contains the vapors of water (20 mm Hg), methanol (45 mm Hg), ethanol (40 mm Hg), and a non-condensable component nitrogen. How many moles of each compound are contained in the headspace if the batch temperature is 35°C, the head space volume is 453 gallons, and the total system pressure is 760 mm Hg.

Gas Volume: V = 453 gal * 0.133680555 ft³/gal = 60.56 ft³

Temperature (°K): T = 35°C = 35°C + 273.15°K = 308.15°K

Dalton's Law: $n_i = \frac{p_i V}{RT}$

Moles of water: $n_{water} = \left(\frac{p_i V}{RT}\right) = \left(\frac{20 * 60.56}{998.99 * 308.15}\right) = 0.00393 \text{ lb-moles}$

Moles of methanol: $n_{methanol} = \left(\frac{p_i V}{RT}\right) = \left(\frac{45 * 60.56}{998.99 * 308.15}\right) = 0.00885 \text{ lb-moles}$

Moles of ethanol: $n_{ethanol} = \left(\frac{p_i V}{RT}\right) = \left(\frac{40 * 60.56}{998.99 * 308.15}\right) = 0.00787 \text{ lb-moles}$

Partial pressure of nitrogen: $p_{nitrogen} = 760 - 20 - 40 - 45 = 655\, mmHg$

Moles of nitrogen: $n_{methanol} = \left(\frac{p_i V}{RT}\right) = \left(\frac{45 * 60.56}{998.99 * 308.15}\right) = 0.00885 \text{ lb-moles}$

6.2.3 Mole Fraction in a Liquid

The ratio of moles of *i* to the total moles in a single liquid phase is defined as mole fraction, X_i. The liquid mole fraction of a compound is used later for calculating the vapor pressure for the same compound using Raoult's Law.

Mole fraction $$x_i = \frac{n_i}{n_{total}}$$ Eq. 6-7

where: x_i = mole fraction for component *i*
n_i = moles of *i* in a single liquid phase
n_{total} = total moles in a single liquid phase

Illustration 6-3: Calculating mole fractions for liqiud mixtures.

A process batch consist of methanol (1,435 lb), isopropyl alcohol (546 lb), and acetone (584 lb). Determine the mole fraction (X_i) of each compound in the solution.

Compound	Weight	Molecular Weight
Methanol	1,435 lb	32.04
Isopropyl alcohol	546 lb	60.096
Acetone	584 lb	58.08

moles of methanol:

$$n = \frac{1{,}435\,lb}{32.04\,mwt} = 44.79 \text{ lb - moles}$$

moles of isopropyl alcohol:

$$n = \frac{546\,lb}{60.096\,mwt} = 9.09 \text{ lb - moles}$$

moles of acetone:

$$n = \frac{584\,lb}{58.08\,mwt} = 10.06 \text{ lb - moles}$$

Total moles in the batch: 44.79 + 60.096 + 10.03 = 69.93 lb-moles

mole fraction of methanol:

$$n = \frac{546 lb}{60.096 mwt} = 9.09 \text{ lb - moles}$$

mole fraction of isopropyl alcohol:

$$X_i = \frac{9.09\ lb - moles}{69.93\ \ lb - moles} = 0.142$$

mole fraction of acetone:

$$X_i = \frac{10.06\ lb - moles}{69.93\,lb - moles} = 0.157$$

6.3 Pure Component Vapor Pressure

6.3.1 Clapeyron Vapor Pressure Equation

Essentially, all liquids and some solids exhibit a vapor pressure that can be measured. The vapor pressure for any compound is a function of temperature and composition within a given solution. If the compound exists in pure form then the vapor pressure becomes only a function of temperature.

Many mathematical relationships have been formulated over the years that enable the pure component vapor pressure of a compound to be accurately estimated within a given temperature range. The Clapeyron Vapor Pressure Model (*Eq. 6-8*) is based upon the equality of chemical potential, temperature, and pressure in both liquid and gas phases. [Reid, Prausnitz, & Sherwood, 1977]

Clapeyron model

$$\ln(P_i) = A - \frac{B}{T} \qquad \text{Eq. 6-8}$$

where P_i = pure component vapor pressure
T = temperature, degrees Kelvin
A = empirical constant
B = $\Delta H_v / R \Delta Z_v$ (ΔH_v - heat of vaporization, ΔZ_v - compressibility factor).

Although the Clapeyron Vapor Pressure model is based on the heat of vaporization and the compressibility factor for a compound, this thermodynamic data is not needed. If two reliable vapor pressure data points can be obtained then A and B can be determined mathematically. However, one disadvantage to using this model is that the vapor pressure correlation may not be as accurate as other models that contain a greater number of empirical coefficients.

Illustration 6-4: Estimating Clapeyron vapor pressure model coefficients.

Toluene has a boiling point of 110.6°C at 760 mm Hg. and a boiling point of 31.8°C at 40 mm Hg. Determine A and B for the Clapeyron Vapor Pressure model and then calculate the vapor pressure of toluene at 51.9 C.

Clapeyron model $$\ln(P) = A - \frac{B}{T}$$

(a) Solve for B $$\ln(P_2) - \ln(P_1) = -B(T_2^{-1} - T_1^{-1})$$

T1 = 31.8 C = 31.8 + 273.15 = 304.95 K 1/T1 = 0.0032792
ln(P1) = ln(40) = 3.6888795 ln(P1) = 3.6888795
T2 = 110.6 C = 110.6 + 273.15 = 383.75 K 1/T2 = 0.0026059
ln(P2) = ln(760) = 6.6333184 ln(P2) = 6.6333184

Solve for B: $$B = -\left[\frac{\ln(P_2) - \ln(P_1)}{T_2^{-1} - T_1^{-1}}\right]$$

$$B = -\left[\frac{6.6333184 - 3.6888795}{0.0026059 - 0.0032792}\right] = 4372.7371$$

Solve for A $$A = \ln(P_2) + \frac{B}{T_2} = 6.6333184 + \frac{4372.7371}{383.75} = 18.0281$$

Calculate the vapor pressure of toluene at 59.9 C (325.05 K)

$$\ln(P) = A - \frac{B}{T} = 18.0281 - \frac{4372.7371}{325.05} = 4.575567$$

$P_{51.9 C}$=97.1 mm Hg.

Note that the vapor pressure of toluene from literature sources is 100 mm Hg for 51.9 C or 3% higher than the Clapeyron model prediction using this technique.

6.3.2 Antoine Equation

The Antoine equation is a modification of the Clapeyron model and is one of the most frequently used equations for estimating the vapor pressure of a pure compound. [Reid, Prausnitz, & Sherwood, 1977]

The Antoine equation is shown in the following general form:

$$\ln(P_i) = \left(a_i - \frac{b_i}{T + c_i}\right) \qquad \text{Eq. 6-9}$$

where: P_i = pure component pressure of compound *i*
T = absolute temperature
a_i, b_i, c_i = Antoine constants

Coefficients a_i, b_i, and c_i are published in several literature sources for many compounds. It is important to note the specific temperature and pressure units that are associated with the Antoine coefficients that are listed in the literature.

The reader should keep in mind that the Antoine equation is a general mathematical relationship and can be used with temperatures in either Centigrade, Kelvin, Fahrenheit, or Rankin units. Additionally, the equation can be used for calculating vapor pressures in different units (atm, mm Hg, and psia) and in the natural log (ln) or base 10 log form. It is always a good idea to calculate one or more known vapor pressure data points as a means of verifying that the model is consistent with respect to coefficients, temperature units, and pressure units being used.

Illustration 6-5: Calculating pure component vapor pressures from the Antoine model.

The Antoine coefficients for toluene are a = 16.0137, b = 3096.52, and c = –53.67. These coefficients were obtained from a source where the Antoine equation is in the natural log form, pressure is in mm Hg, and temperature is in Kelvin units. Additionally, these coefficients are valid between 7°C and 137°C. What is the pure component vapor pressure for toluene at 35°C and 70°C?

Antoine Equation

$$\ln(P_i) = \left(a_i - \frac{b_i}{T + c_i}\right)$$

Temperature (35°C)

$$T = 35°C = 35.0°C + 273.15°K = 308.15°K$$

$$\ln(P_i) = \left(16.0137 - \frac{3096.52}{308.15 - 53.67}\right) = 3.8457$$

$$P_{35°C} = e^{3.8457} = 46.79 \text{ mm Hg.}$$

Temperature (70°C)

$$T = 70°C = 70.0°C + 273.15°K = 343.15°K$$

$$\ln(P_i) = \left(16.0137 - \frac{3096.52}{343.15 - 53.67}\right) = 5.3169$$

$$P_{70°C} = e^{5.3169} = 203.74 \text{ mm Hg.}$$

6.3.3 Other Vapor-Pressure Equation Forms

Over the years researchers have published many different equations for calculating the vapor pressure of pure compounds as a function of temperature. [Reid, Prausnitz, & Sherwood, 1977] Among these include:

Riedel-Plank-Miller Equation: $$\ln P_{vp} = A + \frac{B}{T} + CT + DT^3$$ Eq. 6-10

Rankine-Kirchhoff Equation: $$\ln P_{vp} = A + \frac{B}{T} + C\ln T$$ Eq. 6-11

Riedel Equation: $$\ln P_{vp} = A + \frac{B}{T} + C\ln T + DT^6$$ Eq. 6-12

Coefficients that apply to each equation are normally provided through commercially available databases. The DIPPER Database (AIChE) provides modeling coefficients for an equation of the general form:

$$\ln P_{vp} = A + \frac{B}{T} + C\ln T + DT^E$$ Eq. 6-13

Where P_{vp} = vapor pressure in Pascal (Pa) units.
T = temperature in degrees Kelvin.

Illustration 6-6: Calculating vapor pressures using the AIChE DIPPR database model.

According to the AIChE DIPPR Database, the vapor pressure coefficients for acetone are as follows:

A = 69.006 B = -5599.6
C = -7.0985 D = 0.0000062237
E = 2.0000

What is the vapor pressure of acetone if the temperature of the liquid is 25°C?

$$T = 25°C + 273.15 = 298.15°K$$

$$\ln P_{vp} = 69.006 - \frac{5599.6}{T} - 7.098\ln T + 0.0000062237T^2$$

$$\ln P_{vp} = 69.006 - 18.781 - 40.444 + 0.553 = 10.334$$

$$P_{vp} = 3.074 \times 10^4\ Pa \times \frac{1\ mmHg}{133.35\ Pa} = 230.697\ mmHg$$

6.4 Component Vapor Pressure over Solutions

6.4.1 Equilibrium Conditions (Ideal) and Raoult's Law

Ideal vapor pressure conditions normally exist for a solution when strong molecular associations between molecules are not present. This is normally the case when the molecular sizes are approximately equal and the attractive forces between like and unlike molecules are equal as well. Ideal equilibrium conditions are typically present when the solution is made up completely of nonpolar compounds such as organic solvents (toluene, heptane, hexane, etc.).

A generalization know as Raoult's Law states that the equilibrium vapor pressure that is observed for a compound is proportional to the mole fraction of that compound in solution. For example, given an equal molar solution (0.5:0.5) of toluene and heptane at 35°C, the equilibrium vapor pressure of the toluene would be 101.87 mm Hg or one half of its pure component vapor pressure of 203.74 mm Hg at 35°C.

Raoult's Law $p_i = X_i P_i$

where: p_i = effective vapor pressure of i
P_i = pure component pressure i
X_i = mole fraction of component i

Illustration 6-7: Estimating component vapor pressures using Raloult's Law.

A solution contains 20% toluene (wt/wt), 50% heptane (wt/wt), 30% acetone. The solution temperature is 35°C. The pure component vapor pressures for toluene, heptane, and acetone are 46.79 mm Hg, 74.04 mm Hg, and 347.1 mm Hg respectively for the 35°C condition. The molecular weights for toluene, heptane, and acetone are 92.13, 100.205, and 58.08, respectively.

Calculate the moles and mole fraction of each component in the solution on a 100 lb basis.

Moles of toluene $n_{toluene} = \left(\frac{wt_{toluene}}{MWt_{toluene}}\right) = \left(\frac{20\ lb}{92.13}\right) = 0.22\ \text{lb - moles}$

Moles of heptane $n_{heptane} = \left(\frac{wt_{heptane}}{MWt_{heptane}}\right) = \left(\frac{50\ lb}{100.205}\right) = 0.50\ \text{lb - moles}$

Moles of acetone $n_{acetone} = \left(\frac{wt_{acetone}}{MWt_{acetone}}\right) = \left(\frac{30\ lb}{58.08}\right) = 0.52\ \text{lb - moles}$

Sum of moles $n_{total} = 0.22 + 0.50 + 0.52 = 1.23$ lb-moles

Mole fraction of toluene $X_{toluene} = \left(\frac{moles_{toluene}}{total\ moles}\right) = \left(\frac{0.22}{1.23}\right) = 0.176$

Mole fraction of heptane $X_{heptane} = \left(\frac{moles_{heptane}}{total\ moles}\right) = \left(\frac{0.50}{1.23}\right) = 0.405$

Mole fraction of acetone $X_{acetone} = \left(\frac{moles_{acetone}}{total\ moles}\right) = \left(\frac{0.52}{1.23}\right) = 0.419$

Calculate the equilibrium vapor pressure for each component.

Vapor pressure for of toluene $p_{toluene} = 0.176 * 46.79 = 8.24\ \text{mm Hg}$

Vapor pressure for of heptane $p_{heptane} = 0.405 * 74.04 = 29.97\ \text{mm Hg}$

Vapor pressure for of acetone $p_{acetone} = 0.419 * 347.1 = 145.46\ \text{mm Hg}$

6.4.1.1 Using Raoult's Law to determine molar concentration

In special cases, Raoult's Law can be used to determine the molar concentration of a single solvent solution. For example, suppose waste solvent from a process contains dissolved non-volatile or very low volatile compounds (such as heavy oil). The boiling point temperature of waste solvent and the pure solvent is measured. The molar concentration of the primary solvent in the waste solvent solution may be determined by dividing 760 mm Hg by the calculated vapor pressure of the pure solvent at the elevated temperature.

Illustration 6-8: Estimating liquid composition based on vapor pressure measurements.

The boiling point temperature of a sample of waste toluene was measured to be 112.3°C. The boiling point temperature of a sample of pure toluene was measured to be 110.8°C. (Note that measuring the boiling point temperature of a pure solvent can result in a different reading than the value that is contained in the literature due to atmospheric elevation differences and measurement accuracy issues.)

Boiling point difference between the two samples (112.3°C – 110.8°C): 1.5°C.
Normal boiling point temperature of toluene from the literature: 110.6°C.
Corrected boiling point of the waste toluene sample (110.6°C + 1.5°C): 112.1°C

$$\ln(P_i) = \left(16.0137 - \frac{3096.52}{385.25 - 53.67}\right) = 6.675$$

$$P_{112.1°C} = e^{6.675} = 792.362 \text{ mm Hg.}$$

Raoult's Law $p_i = x_i P_i$

Molar concentration: $x_i = \frac{p_i}{P_i} = \frac{760.0\ mmHg}{792.362\ mmHg} \times 100\% = 95.9\%$

Illustration 6-9: Determining the molar composition of a liquid from vapor pressure data.

A mixture has been prepared for processing at 35°C. The contents contain 850 lbs of toluene, 525 lbs of heptane, and 2,500 lbs of other non-volatile materials. Determine the vapor pressure of the mixture at 35°C and the mole fraction of toluene and heptane. The molecular weight of toluene is 92.13 and the molecular weight of heptane is 100.2.

The molar quantities of toluene and heptane are calculated

Moles of toluene $n_{toluene} = \left(\frac{wt_{toluene}}{MWt_{toluene}}\right) = \left(\frac{850\ lb}{92.13}\right) = 9.22 \text{ lb - moles}$

Moles of heptane $n_{heptane} = \left(\frac{wt_{heptane}}{MWt_{heptane}}\right) = \left(\frac{525\ lb}{100.205}\right) = 5.24 \text{ lb - moles}$

A sample of the process mixture is placed in a vacuum flask equip with a temperature probe, reflux condenser, vacuum pump, vacuum controller, and pressure gauge. The mixture is heated to 35°C and then placed under increasing vacuum until the mixture begins to boil with reflux present. The boiling point pressure is recorded from this experiment to be 40 mm Hg. The pure vapor pressures for toluene and heptane at 35°C are 45.79 mm Hg and 74.04 mm Hg, respectively.

For this mixture the volatile components have been identified to consist entirely of toluene and heptane. However, the mole fraction of these two components cannot be determined because the molecular weight data for the remaining components is not available. Therefore, the following general equation can be established that relates the unknown mole fraction to the partial pressure for each volatile compound.

Raoult's Law $p_i = x_i P_i = \frac{n_i}{\sum n} P_i$

Mole fraction is gas space $y_i = \frac{p_i}{\sum p}$

Combining equations $y_i = \frac{n_i P_i}{\sum n P_i}$ Eq. 6-14

Finally, the liquid mole fraction for each volatile component may be determined from Raoult's Law.

$$x_i = \frac{p_i}{P_i} = \frac{y_i P_T}{P_i}$$ Eq. 6-15

For this problem only toluene and heptane need to be considered. *Eq. 6-14* is customized to accommodate only toluene and heptane.

For toluene $y_i = \frac{n_i P_i}{n_i P_i + n_j P_j} = \frac{(9.22 \times 45.79)}{(9.22 \times 45.79) + (5.24 \times 74.04)} = 0.521$

For heptane $y_j = \frac{(5.24 \times 74.04)}{(9.22 \times 45.79) + (5.24 \times 74.04)} = 0.479$

Finally,

For toluene $x_i = \frac{y_i P_T}{P_i} = \frac{0.521 \times 40.0}{45.79} = 0.455$

For heptane $x_j = \frac{y_j P_T}{P_j} = \frac{0.479 \times 40.0}{74.04} = 0.258$

The results of these calculations suggest that 0.286 (or 1.0 – 0.455 – 0.258) mole fraction of the process mixture consist of other nonvolatile components.

6.4.2 Non-Ideal Equilibrium Conditions and Activity Coefficients

In many cases, ideal equilibrium relationships do not exist for solutions. This is especially true for solutions containing compounds that are polar in nature or have significant attraction to other compounds in the same solution. An example of a solution with highly non ideal equilibrium properties is aqueous hydrochloric acid with the vapor pressure of hydrogen chloride being orders of magnitude lower than expected by Raoult's Law. Other examples of solutions with non ideal vapor pressure behavior would include systems with azeotropic properties such as acetone – hexane.

Non ideal equilibrium systems should be calculated using an activity coefficient (or correction factor) as part of the basic equilibrium calculation. The equilibrium vapor pressure equation for ideal solutions has been modified to include the activity coefficient as part of the calculation. For solutions that exhibit ideal behavior the activity coefficient is defaulted to 1.0. For solutions that exhibit significant non ideal vapor pressure behavior the activity coefficient may be estimated from known vapor pressure data. *Eq. 6-16* shows how the vapor pressure of a component in solution would be calculated using the Antoine vapor pressure model.

$$p_i = X_i \gamma_i P_i = X_i \gamma_i \exp\left(a_i - \frac{b_i}{c_i + T}\right) \qquad \text{Eq. 6-16}$$

where: p_i = effective vapor pressure of i
P_i = pure component pressure i
X_i = mole fraction of component i
γ_i = activity coefficient for component i
T = absolute temperature
a_i, b_i, c_i = Antoine constants

Illustration 6-10: Estimating activity coefficients from solution measurements.

Using Raoult's Law the pure component vapor pressure of ammonia over a 19.1% (wt/wt) aqueous solution of ammonia acid at 21.1°C is 1308 mm Hg and the vapor pressure of water is 14.9 mm Hg. The measured vapor pressures of ammonia and water are 221.2 mm Hg and 14.5 mm Hg, respectively.

What are the activity coefficients for ammonia and water under these conditions?

Activity Coefficient $\gamma_{NH_3} = \frac{221.3\ mmHg}{1308\ mmHg} = 0.16917$

Activity Coefficient $\gamma_{Water} = \frac{14.47\ mmHg}{14.9\ mmHg} = 0.972$

Assuming that the activity coefficients remain constant between 10°C and 30°C, what would the vapor pressure of hydrogen chloride and water be for the same solution at 25°C?

Based on 100 lbs of solution,

Mole fraction of NH_3: $\frac{19.1/17.031}{19.1/17.031 + 79.9/18.02} = 0.20$

Mole fraction of H2O: $\frac{79.9/18.02}{79.9/18.02 + 19.1/17.031} = 0.80$

At 25 C the calculated pure vapor pressure for NH_3 and H_2O are 7,370 mm Hg and 23.58 mm Hg, respectively.

Vapor pressure of NH_3: $p_{NH3} = p_{NH3}\gamma_{NH3}P_{NH3} = 0.20 * 0.16917 * 7370 = 249.3\ mm\ Hg$

Vapor pressure of H_2O: $p_{H2O} = X_{H2O}\gamma_{H2O}P_{H2O} = 0.80 * 0.972 * 23.58 = 18.35\ mm\ Hg$

Illustration 6-11: Estimating activity coefficients from azeotropic mixtures.

The azeotropic composition of a solution containing heptane and methanol is 48.5% (wt/wt) and 51.5% (wt/wt), respectively. The azeotropic boiling point for the solution is 59.1°C and the system pressure is 760 mm Hg. Based on Raoult's Law, the calculated vapor pressures for the same solution of heptane and methanol are 47.9 mm Hg and 470.1 mm Hg, respectively. Note that the liquid and vapor compositions for an azeotropic system are the same at the boiling point.

For this problem the composition of heptane and methanol must be converted from weight percent to mole percent. This may be accomplished by basing the calculations for an arbitrary 100 lb of solution and then calculating the moles of each compound using the molecular weight. Finally, the mole fraction of each compound is calculated by dividing the moles of each compound by the total moles in the solution. The 48.5% (wt/wt) for heptane is converted to 23.1% (mole/mole), and the 51.5% (wt/wt) for methanol becomes 76.9% (mole/mole).

Calculate the activity coefficients for heptane and methanol under these conditions.

$\gamma_{heptane}$

$$\gamma_{heptane} = \frac{0.231 * 760\ mmHg}{47.9\ mmHg} = 3.672$$

$\gamma_{methanol}$

$$\gamma_{methanol} = \frac{0.769 * 760\ mmHg}{470\ mmHg} = 1.243$$

Illustration 6-12: Calculating vapor compositions using activity coefficients.

A solution of heptane and methanol was distilled at its azeotropic composition for 1 atm pressure. If the temperature of the recovered distillate is 30°C, what would be the vapor composition for this solution? The system pressure is 760 mm Hg and the vessel is blanketed with nitrogen.

Vapor pressures at 30°C:

Heptane	=	58.54 mm Hg.
Methanol	=	163.8 mm Hg.

Azetropic composition:

Heptane	=	48.5% (wt/wt)	=	23.1% (mole/mole)
Methanol	=	51.5% (wt/wt)	=	76.9% (mole/mole)

Component vapor pressure

$$p_{heptane} = X_{heptane}\gamma_{heptane}P_{heptane} = 0.231 * 3.672 * 58.54 = 50 \text{ mm Hg}$$

$$p_{methanol} = X_{methanol}\gamma_{methanol}P_{methanol} = 0.769 * 1.243 * 163.8 = 157 \text{ mm Hg}$$

$$p_{nitrogen} = 760 - 50 - 157 = 553 \text{ mm Hg}$$

Vapor space molal percentage compositions y_i:

$$y_{heptane} = \frac{50}{760} * 100\% = 6.6\%$$

$$y_{methanol} = \frac{156}{760} * 100\% = 20.5\%$$

$$y_{nitrogen} = \frac{553}{760} * 100\% = 72.9\%$$

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Attachment V

Pitch TO 2009 Stack Test

Response to Violation Notice A-2023-00162

Koppers Inc.

GE Energy

Justin Merryman
Technology Specialist 6

ISO 9001 Registered
Quality System

MON (SUBPART FFFF) PERFORMANCE TEST

Performed At

Koppers Inc.
Carbon Pitch Tank Vent Thermal Oxidizer
Stickney, Illinois

Test Date

April 29, 2009

Report No.

GE International, Inc. Report M22E1859A

Report Submittal Date

June 25, 2009

GE International, Inc.
1950 Griffith Boulevard, Suite A
Griffith, Indiana 46319
USA

T 219-838-6082
F 219-838-6083

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GE Energy

CERTIFICATION SHEET

Having reviewed the test program described in this report, I hereby certify the data, information, and results in this report to be accurate and true according to the methods and procedures used.

Data collected under the supervision of others is included in this report and is presumed to have been gathered in accordance with recognized standards.

GE INTERNATIONAL, INC.

Frank H. Jarke
Quality Operations Manager

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GE Energy

MON (SUBPART FFFF) PERFORMANCE TEST
Performed At
Koppers Inc.
Carbon Pitch Tank Vent Thermal Oxidizer
Stickney, Illinois
April 29, 2009

1.0 INTRODUCTION

GE International, Inc. (GEII) performed a MON (Subpart FFFF) Performance Test on Carbon Pitch Tank Vent Thermal Oxidizer (TO) at Koppers Inc. in Stickney, Illinois on April 29, 2009. The tests were authorized by and performed for Koppers Inc.

The purpose of this test program was to demonstration performance of the TO system with the requirements of the Miscellaneous Organic Chemical Manufacturing NESHAP (MON) during absolute worst-case operating conditions.

1.1 Project Contact Information

Location	Address	Contact
Test Facility	Koppers Inc. 3900 South Laramie Avenue Cicero, Illinois 60804	Ms. Stephanie Flynn Environmental Manager 708-222-3481 (phone) 708-656-6079 (fax) flynnsm@koppers.com
Testing Company Representative	GE International, Inc. 1950 Griffith Boulevard, Suite A Griffith, Indiana 46319	Mr. Justin Merryman Technology Specialist 6 219-838-6082 (phone) 219-838-6083 (fax) justin.merryman@ge.com

Messrs. G. Kvarta, G. Lewis, E. Peterson and J. Merryman of GEII conducted the tests.

2.0 SUMMARY OF RESULTS

During this test program, three (3) one-hour VOC tests were performed at the TO inlet and outlet test locations. The results for the tests conducted are summarized in the following table:

Parameter	TO Inlet	TO Outlet
VOC lb/hr as Propane	3.80	0.023
Destruction Efficiency %	99.38	

Complete test results are summarized in Section 6.0.

3.0 DISCUSSION OF RESULTS

No problems were encountered with the testing equipment during the test program. Source operation remained normal during the entire test program. The performance testing was conducted at worst-case operating conditions defined in §63.1257(b)(8)(i). Specifically, the testing was performed during absolute worst-case conditions in the 1-hr period of time in which the inlet contained the highest mass loading rate, in lb/hr, capable of being vented to the TO System. This condition occurs when the process is charging coal tar pitch to the tanks while venting the transfer rack as described in the test protocol "Emissions Test Plan for MON (Subpart FFFF) Performance Testing" submitted to the agency on February 17, 2009. During the performance test on April 29, 2009, Unit 2 was charging coal tar pitch (Type A) to Tank 47 while venting the transfer rack from Tank 41 to pitch trucks. Type A was being transferred from 46 Tank to 44 Tank. Fume System #5 Scrubber was in operation during the performance testing. Unit operating data was recorded by plant personnel and are appended to the report.

The diameter of both test locations was greater than 12 inches. Therefore, an s-type pitot and standard inclined manometer were used per EPA Method 1.

Moisture was determined according to EPA Method 4 at a single point in the approximate center of each duct. EPA Method 4 requires that samples are collected at a minimum of eight traverse points located per EPA Method 1 for circular ducts less than 24 inches in diameter. The test requested approval of the option to collect the samples for moisture content determinations at a single point located at the approximate center of each location. This was considered to be a request for a "minor change to test method" as defined in 40 CFR §63.90 and therefore, pursuant to 40 CFR §63.2545, did not require U.S. EPA approval.

There were no audit materials received from the Illinois Environmental Protection Agency (IEPA) and the requirement to conduct a performance audit was deemed waived.

4.0 SAMPLING AND ANALYSIS PROCEDURES

All testing, sampling, analytical, and calibration procedures used for this test program were performed in accordance with the methods presented in the following sections. Where applicable, the Quality Assurance Handbook for Air Pollution Measurement Systems, Volume III, Stationary Source Specific Methods, USEPA 600/R-94/038c, September 1994 was used to supplement procedures.

4.1 Determination of Sample Point Locations by USEPA Method 1

This method is applicable for gas streams flowing in ducts, stacks and flues. In order to qualify as an acceptable sample location, there must be a minimum of two stack or duct diameters between the location and any upstream flow disturbances; and a minimum of one-half diameters between the location and any downstream flow disturbances.

This method is designed to aid in the representative measurement of pollutant emissions and/or total volumetric flow rate from a stationary source. A measurement site where the effluent stream was flowing in a known direction was selected, and the cross-section of the stack was divided into a number of equal areas. Traverse points were then located in the center of these areas.

4.2 Volumetric Flow Rate Determination by USEPA Method 2

This method is applicable for the determination of the average velocity and the volumetric flow rate of a gas stream.

The gas velocity head (ΔP) and temperature were measured at traverse points defined by USEPA Method 1. The velocity head was measured with a Type S (Stausscheibe or reverse type) pitot tube and oil-filled manometer; and the gas temperature was measured with a Type K thermocouple. The average gas velocity in the flue was calculated based on: the gas density (as determined by USEPA Methods 3 and 4); the flue gas pressure; the average of the square roots of the velocity heads at each traverse point, and the average flue gas temperature.

4.3 CO_2 and O_2 Determination by USEPA Method 3

This method is applicable for the determination of carbon dioxide (CO_2) and oxygen (O_2) concentrations and dry molecular weight of a sample from an effluent gas stream of a fossil-fuel combustion process or other process.

A gas sample was extracted from a stack by one of the following methods: (1) single-point, grab sampling; (2) single-point, integrated sampling; or (3) multi-point, integrated sampling. The gas sample was analyzed for percent CO_2 and percent O_2 using a Fyrite gas analyzer.

4.4 Moisture Determination by USEPA Method 4

This method is applicable for the determination of the moisture content of stack gas.

A gas sample was extracted at a constant rate from the source. Moisture was removed from the sample stream by a series of pre-weighed impingers immersed in an ice bath. A minimum of 21 dry standard cubic feet of flue gas was collected during each sample run.

4.5 Total Organic Concentration Determination by USEPA Method 25A

This method is applicable for the determination of total gaseous organic concentration of vapors consisting primarily of alkanes, alkenes, and/or arenes (aromatic hydrocarbons). The concentration is expressed in terms of propane (or other appropriate organic calibration gas) or in terms of carbon.

A gas sample was extracted from the source through a heated sample line and glass fiber filter to a flame ionization analyzer (FIA). If necessary, a source-specific response factor was developed for the FIA.

5.0 QUALITY ASSURANCE PROCEDURES

GEII recognizes the previously described reference methods to be very technique oriented and attempts to minimize all factors which can increase error by implementing its Quality Assurance Program into every segment of its testing activities.

Calculations were performed on the computer. An explanation of the nomenclature and calculations along with the complete test results are included in the appendix. Also appended are calibration data and copies of the raw field data sheets.

Dry and wet test meters are calibrated according to methods described in the Quality Assurance Handbook for Air Pollution Measurement Systems, Volume III, Stationary Source Specific Methods, USEPA 600/R-94/038c, September 1994, Method 5. Percent error for the wet test meter according to the methods is less than the allowable error of 1.0%. The dry test meters measure the test sample volumes to within 2% at the flow rate and conditions encountered during sampling.

All calibration gases were certified in accordance with EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards, USEPA 600/R-97/121, September 1997.

6.0 TEST RESULTS SUMMARY

VOC TEST RESULTS SUMMARY

Koppers Inc.
Stickney, Illinois
April 29, 2009

Location	Test No.	Test Date(s)	Test Time		THC (ppmv as C_3H_8)	Volumetric Flow (SCFM)	THC Emissions (lb/hr as C_3H_8)	TO Temperature °F
			Begin	End				
Inlet 1	1	4/29/09	8:25	9:25	480.63	1,121	3.691	1350
	2	4/29/09	10:20	11:20	494.39	1,098	3.719	1350
	3	4/29/09	12:15	13:15	561.25	1,036	3.984	1350
	Average				512.09	1,085	3.798	1350

Location	Test No.	Test Date(s)	Test Time		THC (ppmv as C_3H_8)	Volumetric Flow (SCFM)	THC Emissions (lb/hr as C_3H_8)	TO Temperature °F
			Begin	End				
Outlet	1	4/29/09	8:25	9:25	2.17	2,335	0.035	1350
	2	4/29/09	10:20	11:20	1.23	2,359	0.020	1350
	3	4/29/09	12:15	13:15	0.98	2,282	0.015	1350
	Average				1.46	2,325	0.023	1350

Note: Run 1 flow value is the average pitot runs 1 through 4.
Run 2 flow value is the average pitot runs 5 through 8.
Run 3 flow value is the average pitot runs 9 through 12.

$$\text{Emission Rate (lb } C_3H_8\text{/hr)} = \frac{\text{THC Concentration (ppmv as } C_3H_8)}{8.7573 \times 10^6} \text{ Flow, scfm} \times 60 \text{ mins/hr}$$

Sample Calculation Inlet Test 1:

$$\text{Emission Rate (lb } C_3H_8\text{/hr)} = \frac{480.63 \text{ (ppmv as } C_3H_8)}{8.7573 \times 10^6} \times 1{,}121 \text{ scfm} \times 60 \text{ mins/hr}$$

Emission Rate (lb C_3H_8/hr) = 3.691

Destruction Efficiency				
Test No.	Inlet THC Emissions (lb/hr as C_3H_8)	Outlet THC Emissions (lb/hr as C_3H_8)	Efficiency (%)	TO Temperature °F
1	3.69	0.035	99.06	1350
2	3.72	0.020	99.47	1350
3	3.98	0.015	99.62	1350
Average	3.80	0.023	99.38	1350

$$\text{Destruction Efficiency (\%)} = \frac{\text{Inlet (lb/hr as } C_3H_8) - \text{Outlet (lb/hr as } C_3H_8)}{\text{Inlet (lb/hr as } C_3H_8)} \times 100\%$$

Sample Calculation Test 1:

$$\text{Destruction Efficiency (\%)} = \frac{3.69 \text{ lb/hr} - 0.035 \text{ lb/hr}}{3.69 \text{ lb/hr}} \times 100\%$$

Destruction Efficiency (%) = 99.06

APPENDIX

Koppers Inc.
Stickney, Illinois
4/29/2009
Thermal Oxidizer Temperature Summary

Test 1

Time	Temp
4/29/09 8:25 AM	1347
4/29/09 8:26 AM	1344
4/29/09 8:27 AM	1344
4/29/09 8:28 AM	1345
4/29/09 8:29 AM	1346
4/29/09 8:30 AM	1346
4/29/09 8:31 AM	1348
4/29/09 8:32 AM	1353
4/29/09 8:33 AM	1354
4/29/09 8:34 AM	1354
4/29/09 8:35 AM	1356
4/29/09 8:36 AM	1355
4/29/09 8:37 AM	1347
4/29/09 8:38 AM	1350
4/29/09 8:39 AM	1350
4/29/09 8:40 AM	1351
4/29/09 8:41 AM	1356
4/29/09 8:42 AM	1352
4/29/09 8:43 AM	1349
4/29/09 8:44 AM	1348
4/29/09 8:45 AM	1347
4/29/09 8:46 AM	1347
4/29/09 8:47 AM	1349
4/29/09 8:48 AM	1348
4/29/09 8:49 AM	1348
4/29/09 8:50 AM	1350
4/29/09 8:51 AM	1350
4/29/09 8:52 AM	1352
4/29/09 8:53 AM	1353
4/29/09 8:54 AM	1354
4/29/09 8:55 AM	1353
4/29/09 8:56 AM	1352
4/29/09 8:57 AM	1347
4/29/09 8:58 AM	1340
4/29/09 8:59 AM	1345
4/29/09 9:00 AM	1352
4/29/09 9:01 AM	1354
4/29/09 9:02 AM	1354
4/29/09 9:03 AM	1354
4/29/09 9:04 AM	1355
4/29/09 9:05 AM	1351
4/29/09 9:06 AM	1350
4/29/09 9:07 AM	1349
4/29/09 9:08 AM	1350

Koppers Inc.
Stickney, Illinois
4/29/2009
Thermal Oxidizer Temperature Summary

4/29/09 9:09 AM	1346
4/29/09 9:10 AM	1339
4/29/09 9:11 AM	1341
4/29/09 9:12 AM	1352
4/29/09 9:13 AM	1352
4/29/09 9:14 AM	1351
4/29/09 9:15 AM	1356
4/29/09 9:16 AM	1358
4/29/09 9:17 AM	1355
4/29/09 9:18 AM	1349
4/29/09 9:19 AM	1349
4/29/09 9:20 AM	1348
4/29/09 9:21 AM	1348
4/29/09 9:22 AM	1349
4/29/09 9:23 AM	1350
4/29/09 9:24 AM	1350
4/29/09 9:25 AM	1350
Average	**1350**

Koppers Inc.
Stickney, Illinois
4/29/2009
Thermal Oxidizer Temperature Summary

Test 2

Time	Temp
4/29/09 10:20 AM	1350
4/29/09 10:21 AM	1346
4/29/09 10:22 AM	1341
4/29/09 10:23 AM	1347
4/29/09 10:24 AM	1352
4/29/09 10:25 AM	1354
4/29/09 10:26 AM	1355
4/29/09 10:27 AM	1355
4/29/09 10:28 AM	1355
4/29/09 10:29 AM	1354
4/29/09 10:30 AM	1347
4/29/09 10:31 AM	1345
4/29/09 10:32 AM	1346
4/29/09 10:33 AM	1348
4/29/09 10:34 AM	1350
4/29/09 10:35 AM	1350
4/29/09 10:36 AM	1350
4/29/09 10:37 AM	1350
4/29/09 10:38 AM	1345
4/29/09 10:39 AM	1340
4/29/09 10:40 AM	1347
4/29/09 10:41 AM	1350
4/29/09 10:42 AM	1344
4/29/09 10:43 AM	1342
4/29/09 10:44 AM	1351
4/29/09 10:45 AM	1354
4/29/09 10:46 AM	1356
4/29/09 10:47 AM	1358
4/29/09 10:48 AM	1359
4/29/09 10:49 AM	1359
4/29/09 10:50 AM	1358
4/29/09 10:51 AM	1352
4/29/09 10:52 AM	1349
4/29/09 10:53 AM	1349
4/29/09 10:54 AM	1348
4/29/09 10:55 AM	1347
4/29/09 10:56 AM	1348
4/29/09 10:57 AM	1349
4/29/09 10:58 AM	1348
4/29/09 10:59 AM	1347
4/29/09 11:00 AM	1347
4/29/09 11:01 AM	1346
4/29/09 11:02 AM	1347
4/29/09 11:03 AM	1349

Koppers Inc.
Stickney, Illinois
4/29/2009
Thermal Oxidizer Temperature Summary

4/29/09 11:04 AM	1350
4/29/09 11:05 AM	1351
4/29/09 11:06 AM	1352
4/29/09 11:07 AM	1352
4/29/09 11:08 AM	1351
4/29/09 11:09 AM	1352
4/29/09 11:10 AM	1353
4/29/09 11:11 AM	1353
4/29/09 11:12 AM	1354
4/29/09 11:13 AM	1355
4/29/09 11:14 AM	1353
4/29/09 11:15 AM	1349
4/29/09 11:16 AM	1347
4/29/09 11:17 AM	1348
4/29/09 11:18 AM	1349
4/29/09 11:19 AM	1350
4/29/09 11:20 AM	1350
Average	**1350**

Koppers Inc.
Stickney, Illinois
4/29/2009
Thermal Oxidizer Temperature Summary

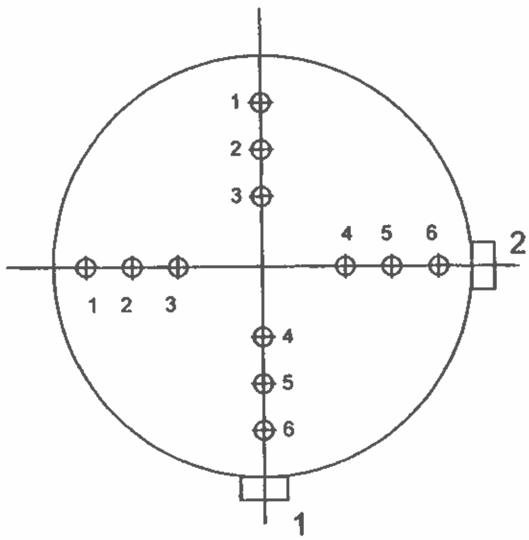
Test 3

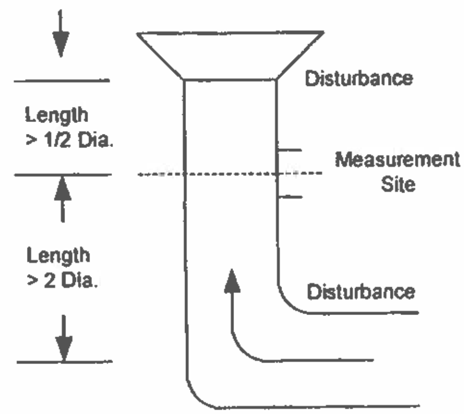
Time	Temp
4/29/09 12:15 PM	1353
4/29/09 12:16 PM	1354
4/29/09 12:17 PM	1356
4/29/09 12:18 PM	1357
4/29/09 12:19 PM	1355
4/29/09 12:20 PM	1351
4/29/09 12:21 PM	1350
4/29/09 12:22 PM	1346
4/29/09 12:23 PM	1335
4/29/09 12:24 PM	1340
4/29/09 12:25 PM	1351
4/29/09 12:26 PM	1355
4/29/09 12:27 PM	1364
4/29/09 12:28 PM	1361
4/29/09 12:29 PM	1349
4/29/09 12:30 PM	1340
4/29/09 12:31 PM	1338
4/29/09 12:32 PM	1345
4/29/09 12:33 PM	1355
4/29/09 12:34 PM	1357
4/29/09 12:35 PM	1358
4/29/09 12:36 PM	1356
4/29/09 12:37 PM	1349
4/29/09 12:38 PM	1343
4/29/09 12:39 PM	1339
4/29/09 12:40 PM	1346
4/29/09 12:41 PM	1345
4/29/09 12:42 PM	1349
4/29/09 12:43 PM	1349
4/29/09 12:44 PM	1349
4/29/09 12:45 PM	1349
4/29/09 12:46 PM	1349
4/29/09 12:47 PM	1350
4/29/09 12:48 PM	1349
4/29/09 12:49 PM	1349
4/29/09 12:50 PM	1349
4/29/09 12:51 PM	1348
4/29/09 12:52 PM	1349
4/29/09 12:53 PM	1349
4/29/09 12:54 PM	1350
4/29/09 12:55 PM	1349
4/29/09 12:56 PM	1350
4/29/09 12:57 PM	1353
4/29/09 12:58 PM	1354

Koppers Inc.
Stickney, Illinois
4/29/2009
Thermal Oxidizer Temperature Summary

4/29/09 12:59 PM	1355
4/29/09 1:00 PM	1355
4/29/09 1:01 PM	1357
4/29/09 1:02 PM	1357
4/29/09 1:03 PM	1361
4/29/09 1:04 PM	1344
4/29/09 1:05 PM	1329
4/29/09 1:06 PM	1340
4/29/09 1:07 PM	1350
4/29/09 1:08 PM	1354
4/29/09 1:09 PM	1355
4/29/09 1:10 PM	1358
4/29/09 1:11 PM	1359
4/29/09 1:12 PM	1354
4/29/09 1:13 PM	1349
4/29/09 1:14 PM	1348
4/29/09 1:15 PM	1347
Average	1350

EQUAL AREA TRAVERSE FOR ROUND DUCTS





Job: Koppers Inc.
Stickney, Illinois

Date: April 29, 2009

Test Location: TO Inlet

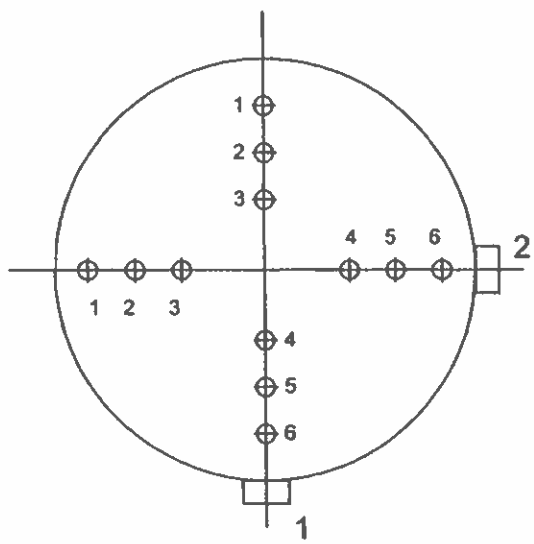
Diameter: 12.36 Inches

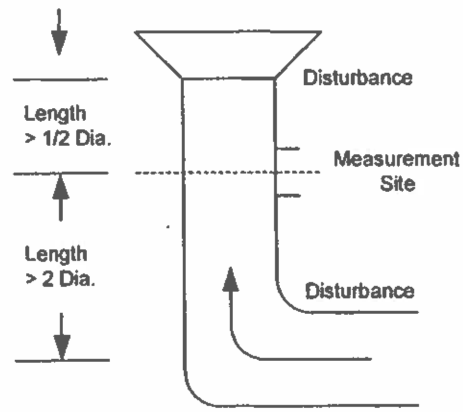
Area: 0.83 Square Feet

No. of Points Across Diameter: 6

No. of Ports: 2

EQUAL AREA TRAVERSE FOR ROUND DUCTS





Job: Koppers Inc.
Stickney, Illinois

Date: April 29, 2009

Test Location: TO Outlet

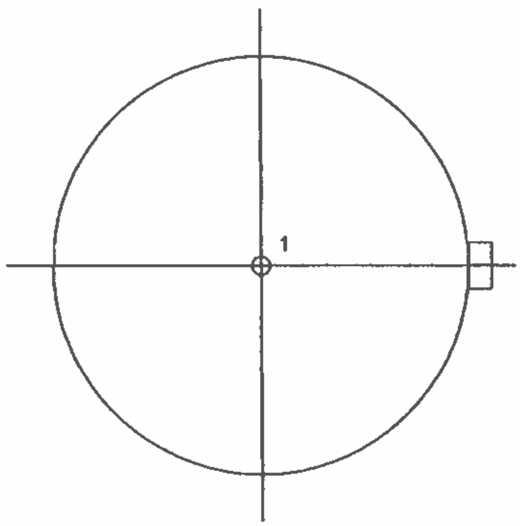
Diameter: 15.48 Inches

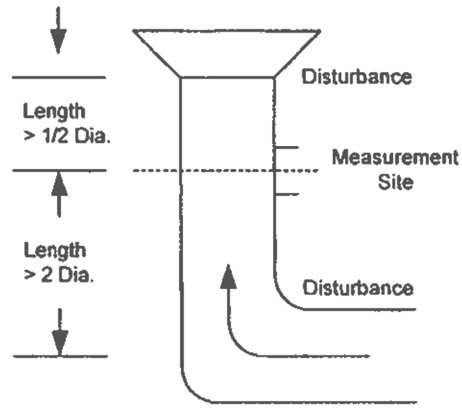
Area: 1.31 Square Feet

No. of Points Across Diameter: 6

No. of Ports: 2

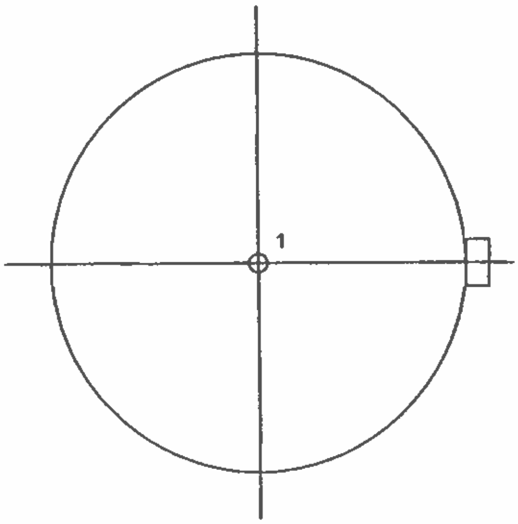
GASEOUS TRAVERSE FOR ROUND DUCTS

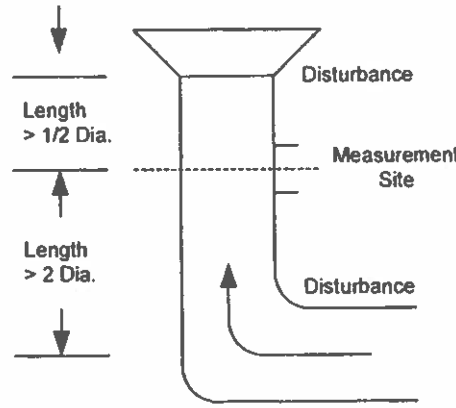




Job:	Koppers Inc. Stickney, Illinois
Date:	April 29, 2009
Test Location:	TO Inlet
Diameter:	12.36 Inches
Area:	0.83 Square Feet
No. Sample Points:	1

GASEOUS TRAVERSE FOR ROUND DUCTS





Job: Koppers Inc.
Stickney, Illinois

Date: April 29, 2009

Test Location: TO Outlet

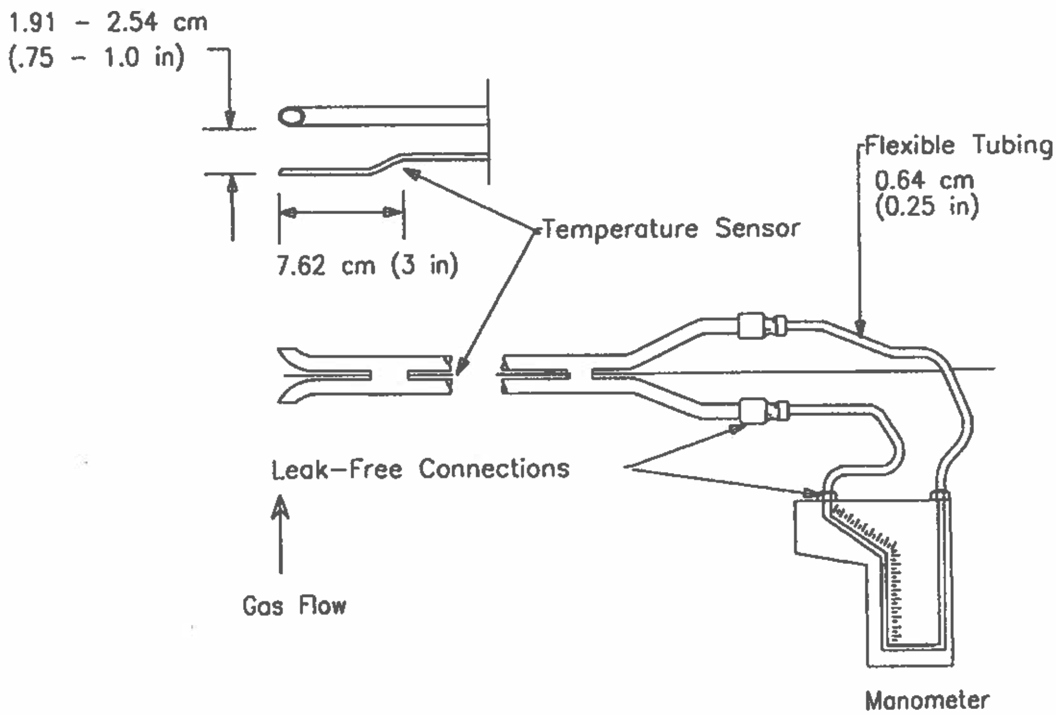
Diameter: 15.48 Inches

Area: 1.31 Square Feet

No. Sample Points: 1

S-Type Pitot Tube Manometer Assembly

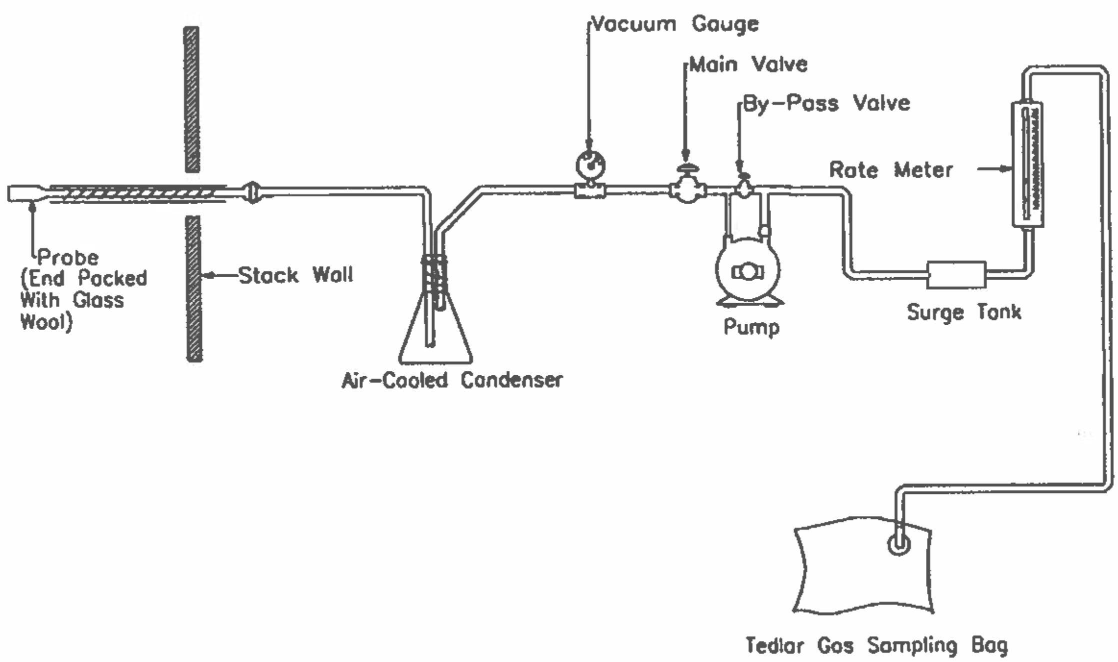
USEPA Method 2



Dwg - AD

Sampling Train for Integrated Gas Sampling

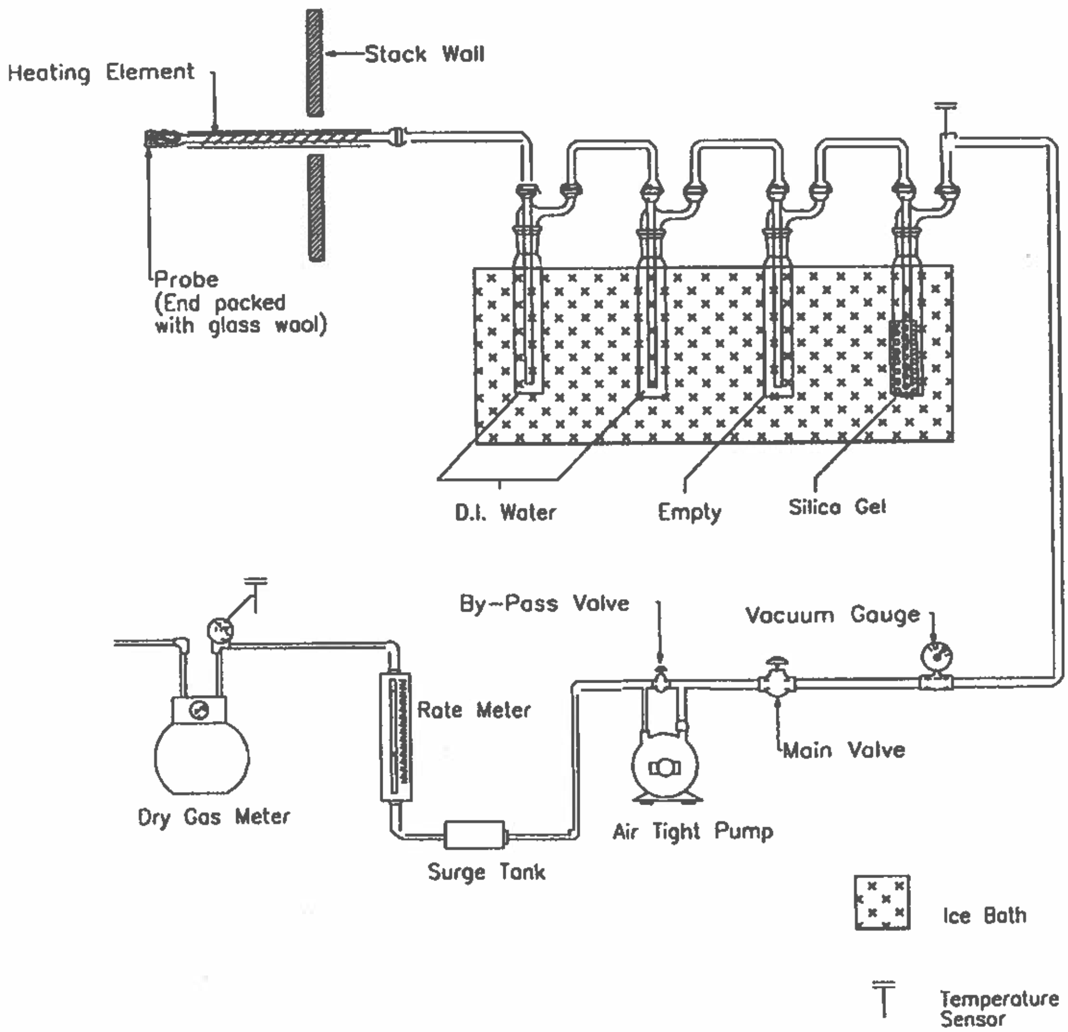
USEPA Method 3



Dwg - E

Determination of Moisture Content in Stack Gases

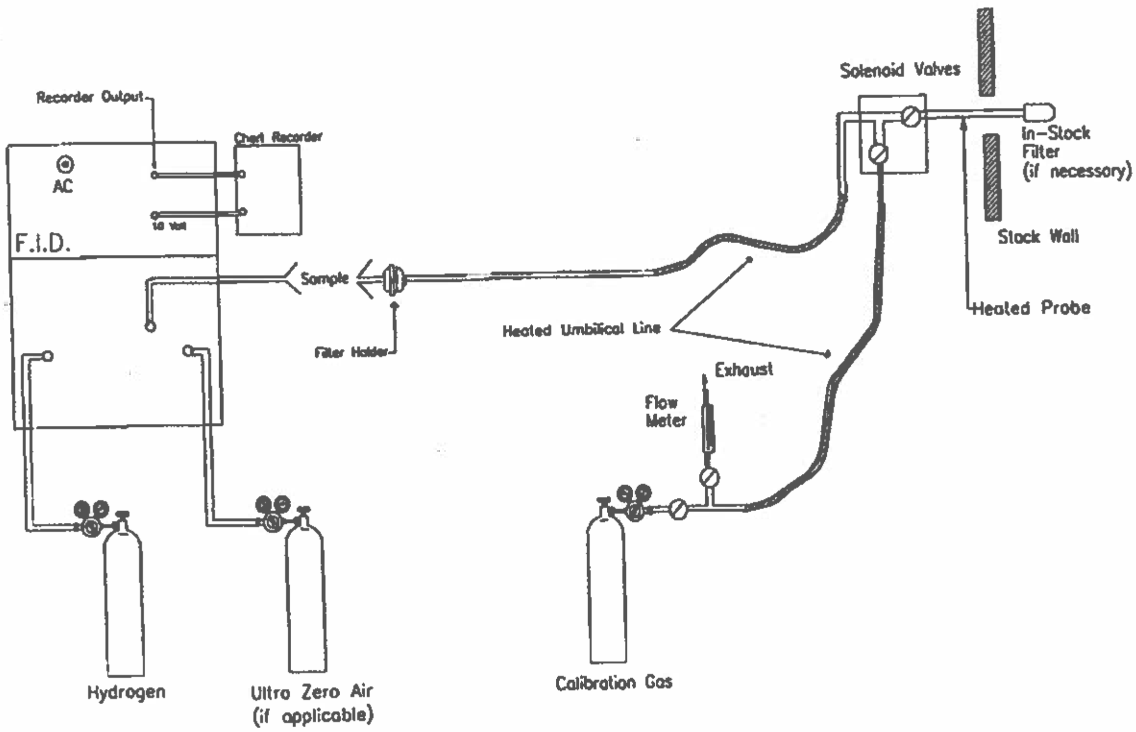
USEPA Method 4



Dwg - T

Total Gaseous Organic Concentration Using a Flame Ionization Analyzer

USEPA Method 25A



Dwg - AI

Example Calculations - Volumetric Flow

Company: Koppers Inc.
Plant: Stickney, Illinois
Source: TO Inlet
Run: 1
Date: 04/29/09

Moisture Content

$$V_{m(std)} = \frac{528}{29.92} \times V_m \times \frac{P_{bar} + \frac{DH}{13.6}}{(460 + T_m)} \times Y_d$$

$$V_{w(std)} = (0.04707 \times V_{lc} \text{ net } H_2O) + (0.04715 \times V_{lc} \text{ silica net } H_2O)$$

$$Bws = \frac{V_{w(std)}}{V_{w(std)} + V_{m(std)}}$$

$V_{w(std)}$ = 1.144 $V_{m(std)}$ = 28.921

B_{ws} = **0.038**

Dry Molecular Weight

$$M_d = 0.44 \times (\%CO_2) + 0.32 \times (\%O_2) + 0.28 \times \%N_2$$

$\%CO_2$ = 0.0 $\%O_2$ = 20.0 $\%N_2$ = 80.0

M_d = **28.80**

Wet Molecular Weight

$$M_s = M_d \times (1-B_{ws}) + (18.0 \times B_{ws})$$

M_d = 28.80 B_{ws} = 0.038

M_s = **28.39**

Average Duct Velocity

$$V_s = 85.49 \times C_p \times (\text{Sqrt } DP)_{avg} \times (T_{s\,(avg)} + 460 / (P_s \times M_s))^{1/2}$$

C_p = 0.840 $T_{s\,(avg)}$ = 191.8 $(\text{Sqrt } DP)_{avg}$: 0.443
P_s = 29.94 M_s = 28.39

V_s = **27.86**

Volumetric Flow Rate

$$Q_{(Actual\ Basis)} = V_s \times A \times 60$$

V_s = 27.86 A = 0.833

Q = **1393** acfm

$$Q_{s\,(Standard\ Basis)} = \frac{528}{29.92} \times \frac{Q(\text{Actual Basis}) \times Ps}{460 + T_{s\,(avg)}}$$

$Q_{(Actual\ Basis)}$ = 1393 P_s = 29.94 $T_{s(avg)}$ = 191.8

Q_s = **1129** scfm

$$Q_{std\,(Standard\ Basis)} = \text{scfm} \times 60 \text{ min/hr}$$

Q_s = **67740** scfh

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VOLUMETRIC AIR FLOW CALCULATIONS

$$Vm\ (std) = \frac{528}{29.92} \times Vm \times \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{(460 + Tm)}\right] \times Y$$

$$Vw\ (std) = 0.0471 \times Vlc$$

Vlc = water + silica net

$$Bws = \left[\frac{Vw\ (std)}{Vw\ (std) + Vm\ (std)}\right]$$

$$Md = (0.44 \times \%CO_2) + (0.32 \times \%O_2) + [0.28 \times (100 - \%CO_2 - \%O_2)]$$

$$MS = Md \times (1 - Bws) + (18 \times Bws)$$

$$Vs = \sqrt{\frac{(Ts + 460)}{Ms \times Ps}} \times \sqrt{\Delta P} \times Cp \times 85.49$$

Cp = pitot tube correction factor
Ps = absolute flue gas pressure
Ms = molecular weight of gas (lb/lb mole)
Md = dry molecular weight of gas (lb/lb mole)
Bws = water vapor in gas stream proportion by volume

$$Acfm = Vs \times Area\ (of\ stack\ or\ duct) \times 60$$

$$Dscfm = Acfm \times \frac{528}{29.92} \times \left[\frac{Ps}{(460 + Ts)}\right] \times (1 - Bws)$$

$$Scfm = Acfm \times \frac{528}{29.92} \times \left[\frac{Ps}{(460 + Ts)}\right]$$

$$Scfh = Scfm \times 60 \frac{min}{hr}$$

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MOISTURE CALCULATIONS

$$V_{wc(std)} = \frac{(V_f - V_i)\,\rho_w\, R\, T_{std}}{P_{std} M_w} = 0.04707(V_f - V_i)$$

$$V_{wsg(std)} = \frac{(W_f - W_i) R\, T_{std}}{P_{std}\, M_w} = 0.04715\ (W_f - W_i)$$

$$V_{m(std)} = \frac{528}{29.92}\, V_m\, Y \frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}$$

$$B_{ws} = \frac{V_{wc(std)} + V_{wsg(std)}}{V_{wc(std)} + V_{wsg(std)} + V_{m(std)}}$$

Where:

B_{ws} = Water vapor in gas stream, proportion by volume
M_w = Molecular weight of water, 18.015 lb/lb-mole
P_{bar} = Barometric pressure at the testing site, in. Hg
P_{std} = Standard absolute pressure, 29.92 in. Hg
R = Ideal gas constant, 0.048137 (in. Hg)(ft³)/(g-mole)(°R) =
[21.8348(in. Hg)(ft³)/(lb-mole)(°R)]/453.592 g-mole/lb-mole
T_m = Absolute average dry gas meter temperature, °R
T_{std} = Standard absolute temperature, 528 °R
V_f = Final volume of condenser water, ml
V_i = Initial volume of condenser water, ml
V_m = Dry gas volume measured by dry gas meter, dcf
$V_{m(std)}$ = Dry gas volume measured by dry gas meter, corrected to standard conditions, scf
$V_{wc(std)}$ = Volume of condensed water vapor, corrected to standard conditions, scf
$V_{wsg(std)}$ = Volume of water vapor collected in silica gel, corrected to standard conditions, scf
W_f = Final weight of silica gel, g
W_i = Initial weight of silica gel, g
Y = Dry gas meter calibration factor
ΔH = Average pressure exerted on dry gas meter outlet by gas sample bag, in. H_2O
ρ_w = Density of water, 0.9982 g/ml
13.6 = Specific gravity of mercury (Hg)
17.64 = T_{std}/P_{std}
0.04707 = ft^3/ml
0.04715 = ft^3/g

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Instrumental Reference Method Field Data

Project Number:	M22E1859	Test Dates:	April 29, 2009
Customer:	Koppers Inc.	Facility:	Stickney, Illinois
Unit Identification:	Thermal Oxidizer	Recorded by:	EAP

Location				Inlet 1	Inlet 2	Inlet 3	Inlet 4	Outlet
Calibration Span				1700	-	-	-	60
Upscale Gas Used for Calibration				Low	-	-	-	Low
Run Average Raw Analyzer Responses								
Run 1	8:25	-	9:25	480.63	-	-	-	2.17
Run 2	10:20	-	11:20	494.39	-	-	-	1.23
Run 3	12:15	-	13:15	561.25	-	-	-	0.98

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Koppers Inc.
Stickney, Illinois
Thermal Oxidizer
04/29/09

Test 1

Time	Inlet VOC	Stack VOC
8:25	434.43	3.31
8:26	442.46	3.71
8:27	450.65	3.86
8:28	439.46	3.45
8:29	457.54	3.13
8:30	443.10	2.97
8:31	447.54	2.25
8:32	449.89	2.34
8:33	453.29	2.13
8:34	456.53	2.10
8:35	455.99	2.36
8:36	448.04	3.25
8:37	457.82	2.76
8:38	456.33	2.45
8:39	458.96	2.80
8:40	468.18	1.96
8:41	479.20	2.32
8:42	469.76	3.11
8:43	475.65	3.10
8:44	481.43	2.95
8:45	474.15	2.81
8:46	478.75	2.88
8:47	481.12	2.73
8:48	471.47	2.84
8:49	475.87	2.47
8:50	480.73	2.45
8:51	479.22	2.12
8:52	475.37	1.86
8:53	471.40	1.55
8:54	470.97	1.47
8:55	472.26	2.08
8:56	482.37	2.70
8:57	455.39	3.27
8:58	459.94	2.50
8:59	459.76	1.44
9:00	463.09	1.26
9:01	467.08	1.91
9:02	468.61	1.30
9:03	468.48	1.30
9:04	468.81	1.58
9:05	469.66	1.66
9:06	467.76	1.59
9:07	467.52	1.47

Koppers Inc.
Stickney, Illinois
Thermal Oxidizer
04/29/09

Test 1

Time	Inlet VOC	Stack VOC
9:08	468.70	1.85
9:09	466.22	3.13
9:10	466.12	2.67
9:11	468.42	1.19
9:12	461.99	1.43
9:13	464.95	1.82
9:14	477.08	1.09
9:15	488.24	1.08
9:16	496.35	1.32
9:17	497.99	1.54
9:18	497.59	1.70
9:19	518.18	1.68
9:20	552.10	1.62
9:21	580.80	1.41
9:22	601.13	1.33
9:23	613.03	1.34
9:24	619.97	1.34
9:25	623.30	1.37
Average	**480.63**	**2.17**

Koppers Inc.
Stickney, Illinois
Thermal Oxidizer
04/29/09

Test 2

Time	Inlet VOC	Stack VOC
10:20	395.68	1.27
10:21	408.10	2.25
10:22	418.88	1.19
10:23	429.88	2.27
10:24	436.02	0.78
10:25	441.47	0.77
10:26	446.73	0.82
10:27	452.81	0.95
10:28	457.82	0.92
10:29	464.49	1.24
10:30	468.58	1.38
10:31	470.98	1.27
10:32	473.22	1.64
10:33	475.79	1.18
10:34	477.61	1.22
10:35	478.97	1.39
10:36	479.10	1.35
10:37	480.85	1.99
10:38	479.64	2.69
10:39	477.02	1.51
10:40	476.67	1.11
10:41	476.94	2.38
10:42	479.01	2.84
10:43	479.71	1.42
10:44	478.72	1.01
10:45	480.26	0.83
10:46	483.45	0.74
10:47	486.85	0.73
10:48	490.18	0.65
10:49	492.39	1.00
10:50	492.34	1.89
10:51	498.00	2.13
10:52	507.70	1.18
10:53	511.32	1.21
10:54	514.59	1.28
10:55	518.27	1.12
10:56	520.93	1.19
10:57	522.19	1.38
10:58	521.21	1.38
10:59	519.75	1.22
11:00	516.63	1.34
11:01	512.93	1.28
11:02	513.46	1.01

Koppers Inc.
Stickney, Illinois
Thermal Oxidizer
04/29/09

Test 2

Time	Inlet VOC	Stack VOC
11:03	512.02	0.92
11:04	513.15	0.88
11:05	516.57	1.02
11:06	519.02	0.98
11:07	521.81	0.83
11:08	525.13	0.82
11:09	526.67	0.75
11:10	527.42	0.88
11:11	528.23	0.77
11:12	529.43	0.70
11:13	531.24	0.81
11:14	532.53	1.14
11:15	532.26	1.03
11:16	536.96	1.06
11:17	542.03	0.93
11:18	548.01	1.26
11:19	552.23	1.06
11:20	555.94	0.85
Average	**494.39**	**1.23**

Koppers Inc.
Stickney, Illinois
Thermal Oxidizer
04/29/09

Test 3

Time	Inlet VOC	Stack VOC
12:15	415.55	0.53
12:16	422.76	0.70
12:17	429.59	2.13
12:18	436.52	0.93
12:19	442.56	1.27
12:20	448.11	0.70
12:21	455.09	0.82
12:22	459.88	2.47
12:23	459.39	1.59
12:24	456.36	0.95
12:25	458.64	1.70
12:26	466.45	1.05
12:27	475.91	0.64
12:28	483.15	0.74
12:29	490.76	1.22
12:30	497.30	1.22
12:31	502.89	0.80
12:32	508.20	0.48
12:33	513.52	0.43
12:34	515.61	0.44
12:35	525.71	0.71
12:36	517.61	0.91
12:37	520.20	1.27
12:38	522.88	1.83
12:39	518.71	0.83
12:40	518.70	0.89
12:41	549.53	0.91
12:42	521.29	0.91
12:43	550.41	0.87
12:44	505.24	0.91
12:45	501.32	0.90
12:46	635.52	0.94
12:47	682.69	1.06
12:48	701.55	1.28
12:49	731.19	0.80
12:50	735.12	0.98
12:51	736.68	1.23
12:52	743.77	0.87
12:53	738.49	0.73
12:54	696.21	0.93
12:55	641.05	1.06
12:56	623.47	0.71
12:57	605.56	0.83

Koppers Inc.
Stickney, Illinois
Thermal Oxidizer
04/29/09

Test 3

Time	Inlet VOC	Stack VOC
12:58	599.21	0.55
12:59	579.06	0.59
13:00	575.22	0.51
13:01	573.95	0.55
13:02	563.10	0.62
13:03	562.98	1.24
13:04	530.75	3.12
13:05	455.00	1.56
13:06	550.61	0.86
13:07	643.96	0.65
13:08	668.95	0.55
13:09	673.84	0.97
13:10	675.80	0.51
13:11	691.94	0.59
13:12	671.18	0.83
13:13	630.21	0.94
13:14	623.00	0.95
13:15	606.37	0.79
Average	**561.25**	**0.98**

Koppers Inc.
Stickney, Illinois
4/29/2009
Flow Summary

Inlet Run 1		Outlet 1	
Pitot Times (08:34-09:29)		Pitot Times (08:28-09:23)	
Run	SCFM	Run	SCFM
1-1	1,129	1-1	2,337
1-2	1,164	1-2	2,375
1-3	1,117	1-3	2,312
1-4	1,075	1-4	2,314
Average	**1,121**	**Average**	**2,335**

Inlet Run 2		Outlet 2	
Pitot Times (10:20-11:26)		Pitot Times (10:26-11:20)	
2-1	1,152	2-1	2,291
2-2	1,123	2-2	2,331
2-3	1,105	2-3	2,429
2-4	1,013	2-4	2,383
Average	**1,098**	**Average**	**2,359**

Inlet Run 3		Outlet 3	
Pitot Times (12:21-13:11)		Pitot Times (12:27-13:17)	
3-1	995	3-1	2,189
3-2	1,061	3-2	2,316
3-3	1,043	3-3	2,283
3-4	1,046	3-4	2,338
Average	**1,036**	**Average**	**2,282**

METHOD 2 VOLUMETRIC FLOW DATA

Project No:	M22E1859		
Company:	Koppers Inc.	**Run No.:**	1
Plant:	Stickney, Illinois	**Date:**	4/29/2009
Source:	TO Inlet	**Start Time:**	08:34
Source Condition:	Normal	**End Time:**	08:39
Pitot ID:	838A	**RM Testers:**	GL/JMM
Pitot Coefficient:	0.84		

Test Parameters		**Moisture Determination**	
P_{bar} - Barometric pressure, inches Hg	29.98	Method Used:	4
P_g - Stack Pressure, inches of H_2O	-0.55	Meter Calibration:	1.005
P_s - Absolute stack pressure, inches Hg	29.94	Initial Meter Volume (cf):	361.290
t_s - Average stack temperature, °F	191.8	Final Meter Volume (cf):	389.361
% CO_2	0.0	Meter Temperature, deg F:	56.9
% O_2	20.0	Meter Volume Vm(std):	28.921
% N_2	80.0	Meter Volume Vw(std):	1.144
Md - dry basis lb/lb mole	28.800	Delta H:	0.65
Ms - wet basis lb/lb mole	28.390	Train Initial Weight, g:	211.9
Stack Diameter, Feet	1.03	Train Final Weight, g:	216.2
Cross Sectional Area of Stack, Ft^2	0.83	Condensate Initial Vol, mL:	200.0
Bws - Moisture content fraction	0.038	Condensate Final Vol, mL:	220.0

Port Point	DP (in. H_2O)	Sqrt. DP	Temp (°F)	Velocity (V)
A 01	0.23	0.4796	209	30.55
A 02	0.30	0.5477	209	34.90
A 03	0.20	0.4472	208	28.47
A 04	0.25	0.5000	206	31.78
A 05	0.21	0.4583	195	28.89
A 06	0.14	0.3742	154	22.84
B 01	0.22	0.4690	208	29.86
B 02	0.23	0.4796	208	30.53
B 03	0.23	0.4796	207	30.51
B 04	0.18	0.4243	202	26.89
B 05	0.14	0.3742	170	23.13
B 06	0.08	0.2828	126	16.86

Port	Point	DP (in. H_2O)	Sqrt. DP	Temp (°F)	Velocity (V)

Method 2 Results	
Average DP	0.2008
Average SqrtDP	0.4430
Average Velocity Vs (ft/sec)	27.86
Q - ACFM	1,393
Qsd - DSCFM	1,086
Qs - SCFM	1,129
Qs - SCFH	67,740

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METHOD 2 VOLUMETRIC FLOW DATA

Project No:	M22E1859		
Company:	Koppers Inc.	**Run No.:**	2
Plant:	Stickney, Illinois	**Date:**	4/29/2009
Source:	TO Inlet	**Start Time:**	08:54
Source Condition:	Normal	**End Time:**	08:59
Pitot ID:	838A	**RM Testers:**	GL/JMM
Pitot Coefficient:	0.84		

Test Parameters	
P_{bar} - Barometric pressure, inches Hg	29.98
P_g - Stack Pressure, inches of H_2O	-0.55
P_s - Absolute stack pressure, inches Hg	29.94
t_s - Average stack temperature, °F	202.7
% CO_2	0.0
% O_2	20.0
% N_2	80.0
Md - dry basis lb/lb mole	28.800
Ms - wet basis lb/lb mole	28.390
Stack Diameter, Feet	1.03
Cross Sectional Area of Stack, Ft^2	0.83
Bws - Moisture content fraction	0.038

Moisture Determination	
Method Used:	4
Meter Calibration:	1.005
Initial Meter Volume (cf):	361.290
Final Meter Volume (cf):	389.361
Meter Temperature, deg F:	56.9
Meter Volume Vm(std):	28.921
Meter Volume Vw(std):	1.144
Delta H:	0.65
Train Initial Weight, g:	211.9
Train Final Weight, g:	216.2
Condensate Initial Vol, mL:	200.0
Condensate Final Vol, mL:	220.0

Port Point	DP (in. H_2O)	Sqrt. DP	Temp (°F)	Velocity (V)
A 01	0.21	0.4583	209	29.20
A 02	0.24	0.4899	209	31.21
A 03	0.22	0.4690	209	29.88
A 04	0.18	0.4243	202	26.89
A 05	0.17	0.4123	202	26.13
A 06	0.14	0.3742	183	23.37
B 01	0.23	0.4796	209	30.55
B 02	0.29	0.5385	209	34.31
B 03	0.27	0.5196	209	33.10
B 04	0.24	0.4899	205	31.12
B 05	0.22	0.4690	196	29.59
B 06	0.16	0.4000	190	25.12

Port	Point	DP (in. H_2O)	Sqrt. DP	Temp (°F)	Velocity (V)

Method 2 Results	
Average DP	0.2142
Average SqrtDP	0.4604
Average Velocity Vs (ft/sec)	29.19
Q - ACFM	1,459
Qsd - DSCFM	1,119
Qs - SCFM	1,164
Qs - SCFH	69,815

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METHOD 2 VOLUMETRIC FLOW DATA

Project No:	M22E1859		
Company:	Koppers Inc.	**Run No.:**	3
Plant:	Stickney, Illinois	**Date:**	4/29/2009
Source:	TO Inlet	**Start Time:**	09:08
Source Condition:	Normal	**End Time:**	09:13
Pitot ID:	838A	**RM Testers:**	GL/JMM
Pitot Coefficient:	0.84		

Test Parameters		**Moisture Determination**	
P_{bar} - Barometric pressure, inches Hg	29.98	Method Used:	4
P_g - Stack Pressure, inches of H_2O	-0.55	Meter Calibration:	1.005
P_s - Absolute stack pressure, inches Hg	29.94	Initial Meter Volume (cf):	361.290
t_s - Average stack temperature, °F	193.7	Final Meter Volume (cf):	389.361
% CO_2	0.0	Meter Temperature, deg F:	56.9
% O_2	20.0	Meter Volume Vm(std):	28.921
% N_2	80.0	Meter Volume Vw(std):	1.144
Md - dry basis lb/lb mole	28.800	Delta H:	0.65
Ms - wet basis lb/lb mole	28.390	Train Initial Weight, g:	211.9
Stack Diameter, Feet	1.03	Train Final Weight, g:	216.2
Cross Sectional Area of Stack, Ft^2	0.83	Condensate Initial Vol, mL:	200.0
Bws - Moisture content fraction	0.038	Condensate Final Vol, mL:	220.0

Port Point	DP (in. H_2O)	Sqrt. DP	Temp (°F)	Velocity (V)
A 01	0.25	0.5000	209	31.85
A 02	0.29	0.5385	208	34.28
A 03	0.26	0.5099	207	32.44
A 04	0.23	0.4796	203	30.42
A 05	0.21	0.4583	200	29.00
A 06	0.17	0.4123	170	25.49
B 01	0.19	0.4359	209	27.77
B 02	0.22	0.4690	209	29.88
B 03	0.18	0.4243	209	27.03
B 04	0.18	0.4243	202	26.89
B 05	0.11	0.3317	158	20.31
B 06	0.08	0.2828	140	17.07

Port	Point	DP (in. H_2O)	Sqrt. DP	Temp (°F)	Velocity (V)

Method 2 Results	
Average DP	0.1975
Average SqrtDP	0.4389
Average Velocity Vs (ft/sec)	27.64
Q - ACFM	1,382
Qsd - DSCFM	1,074
Qs - SCFM	1,117
Qs - SCFH	67,010

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METHOD 2 VOLUMETRIC FLOW DATA

Project No:	M22E1859		
Company:	Koppers Inc.	**Run No.:**	4
Plant:	Stickney, Illinois	**Date:**	4/29/2009
Source:	TO Inlet	**Start Time:**	09:24
Source Condition:	Normal	**End Time:**	09:29
Pitot ID:	838A	**RM Testers:**	GL/JMM
Pitot Coefficient:	0.84		

Test Parameters		**Moisture Determination**	
P_{bar} - Barometric pressure, inches Hg	29.98	Method Used:	4
P_g - Stack Pressure, inches of H_2O	-0.55	Meter Calibration:	1.005
P_s - Absolute stack pressure, inches Hg	29.94	Initial Meter Volume (cf):	361.290
t_s - Average stack temperature, °F	205.3	Final Meter Volume (cf):	389.361
% CO_2	0.0	Meter Temperature, deg F:	56.9
% O_2	20.0	Meter Volume Vm(std):	28.921
% N_2	80.0	Meter Volume Vw(std):	1.144
Md - dry basis lb/lb mole	28.800	Delta H:	0.65
Ms - wet basis lb/lb mole	28.390	Train Initial Weight, g:	211.9
Stack Diameter, Feet	1.03	Train Final Weight, g:	216.2
Cross Sectional Area of Stack, Ft^2	0.83	Condensate Initial Vol, mL:	200.0
Bws - Moisture content fraction	0.038	Condensate Final Vol, mL:	220.0

Port	Point	DP (in. H_2O)	Sqrt. DP	Temp (°F)	Velocity (V)
A	01	0.23	0.4796	208	30.53
A	02	0.23	0.4796	208	30.53
A	03	0.14	0.3742	208	23.82
A	04	0.16	0.4000	207	25.45
A	05	0.14	0.3742	206	23.78
A	06	0.07	0.2646	200	16.74
B	01	0.24	0.4899	209	31.21
B	02	0.24	0.4899	209	31.21
B	03	0.24	0.4899	209	31.21
B	04	0.20	0.4472	206	28.43
B	05	0.19	0.4359	204	27.67
B	06	0.15	0.3873	190	24.32

Port	Point	DP (in. H_2O)	Sqrt. DP	Temp (°F)	Velocity (V)

Method 2 Results	
Average DP	0.1858
Average SqrtDP	0.4260
Average Velocity Vs (ft/sec)	27.07
Q - ACFM	1,353
Qsd - DSCFM	1,034
Qs - SCFM	1,075
Qs - SCFH	64,473

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METHOD 2 VOLUMETRIC FLOW DATA

Project No:	M22E1859
Company:	Koppers Inc.
Plant:	Stickney, Illinois
Source:	TO Inlet
Source Condition:	Normal
Pitot ID:	838A
Pitot Coefficient:	0.84

Run No.:	5
Date:	4/29/2009
Start Time:	10:20
End Time:	10:25
RM Testers:	GL/JMM

Test Parameters	
P_{bar} - Barometric pressure, inches Hg	29.98
P_g - Stack Pressure, inches of H_2O	-0.55
P_s - Absolute stack pressure, inches Hg	29.94
t_s - Average stack temperature, °F	190.2
% CO_2	0.0
% O_2	20.0
% N_2	80.0
Md - dry basis lb/lb mole	28.800
Ms - wet basis lb/lb mole	28.357
Stack Diameter, Feet	1.03
Cross Sectional Area of Stack, Ft^2	0.83
Bws - Moisture content fraction	0.041

Moisture Determination	
Method Used:	4
Meter Calibration:	1.005
Initial Meter Volume (cf):	389.435
Final Meter Volume (cf):	417.218
Meter Temperature, deg F:	64.1
Meter Volume Vm(std):	28.231
Meter Volume Vw(std):	1.210
Delta H:	0.65
Train Initial Weight, g:	210.7
Train Final Weight, g:	216.4
Condensate Initial Vol, mL:	200.0
Condensate Final Vol, mL:	220.0

Port Point	DP (in. H_2O)	Sqrt. DP	Temp (°F)	Velocity (V)
A 01	0.22	0.4690	209	29.90
A 02	0.26	0.5099	209	32.50
A 03	0.25	0.5000	208	31.85
A 04	0.26	0.5099	204	32.38
A 05	0.21	0.4583	170	28.35
A 06	0.20	0.4472	140	27.00
B 01	0.25	0.5000	209	31.87
B 02	0.26	0.5099	209	32.50
B 03	0.21	0.4583	209	29.21
B 04	0.19	0.4359	200	27.60
B 05	0.11	0.3317	168	20.48
B 06	0.08	0.2828	147	17.17

Port	Point	DP (in. H_2O)	Sqrt. DP	Temp (°F)	Velocity (V)

Method 2 Results	
Average DP	0.2083
Average SqrtDP	0.4511
Average Velocity Vs (ft/sec)	28.35
Q - ACFM	1,417
Qsd - DSCFM	1,104
Qs - SCFM	1,152
Qs - SCFH	69,097

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METHOD 2 VOLUMETRIC FLOW DATA

Project No:	M22E1859			
Company:	Koppers Inc.		**Run No.:**	6
Plant:	Stickney, Illinois		**Date:**	4/29/2009
Source:	TO Inlet		**Start Time:**	10:38
Source Condition:	Normal		**End Time:**	10:43
Pitot ID:	838A		**RM Testers:**	GL/JMM
Pitot Coefficient:	0.84			

Test Parameters		**Moisture Determination**	
P_{bar} - Barometric pressure, inches Hg	29.98	Method Used:	4
P_g - Stack Pressure, inches of H_2O	-0.55	Meter Calibration:	1.005
P_s - Absolute stack pressure, inches Hg	29.94	Initial Meter Volume (cf):	389.435
t_s - Average stack temperature, °F	195.4	Final Meter Volume (cf):	417.218
% CO_2	0.0	Meter Temperature, deg F:	64.1
% O_2	20.0	Meter Volume Vm(std):	28.231
% N_2	80.0	Meter Volume Vw(std):	1.210
Md - dry basis lb/lb mole	28.800	Delta H:	0.65
Ms - wet basis lb/lb mole	28.357	Train Initial Weight, g:	210.7
Stack Diameter, Feet	1.03	Train Final Weight, g:	216.4
Cross Sectional Area of Stack, Ft^2	0.83	Condensate Initial Vol, mL:	200.0
Bws - Moisture content fraction	0.041	Condensate Final Vol, mL:	220.0

Port Point	DP (in. H_2O)	Sqrt. DP	Temp (°F)	Velocity (V)
A 01	0.28	0.5292	209	33.73
A 02	0.27	0.5196	209	33.12
A 03	0.11	0.3317	209	21.14
A 04	0.21	0.4583	207	29.17
A 05	0.18	0.4243	200	26.86
A 06	0.13	0.3606	163	22.18
B 01	0.25	0.5000	208	31.85
B 02	0.28	0.5292	208	33.71
B 03	0.25	0.5000	208	31.85
B 04	0.14	0.3742	204	23.76
B 05	0.16	0.4000	190	25.13
B 06	0.14	0.3742	130	22.40

Port	Point	DP (in. H_2O)	Sqrt. DP	Temp (°F)	Velocity (V)

Method 2 Results	
Average DP	0.2000
Average SqrtDP	0.4417
Average Velocity Vs (ft/sec)	27.87
Q - ACFM	1,393
Qsd - DSCFM	1,077
Qs - SCFM	1,123
Qs - SCFH	67,397

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METHOD 2 VOLUMETRIC FLOW DATA

Project No:	M22E1859		
Company:	Koppers Inc.	**Run No.:**	7
Plant:	Stickney, Illinois	**Date:**	4/29/2009
Source:	TO Inlet	**Start Time:**	10:57
Source Condition:	Normal	**End Time:**	11:02
Pitot ID:	838A	**RM Testers:**	GL/JMM
Pitot Coefficient:	0.84		

Test Parameters		**Moisture Determination**	
P_{bar} - Barometric pressure, inches Hg	29.98	Method Used:	4
P_g - Stack Pressure, inches of H_2O	-0.55	Meter Calibration:	1.005
P_s - Absolute stack pressure, inches Hg	29.94	Initial Meter Volume (cf):	389.435
t_s - Average stack temperature, °F	191.1	Final Meter Volume (cf):	417.218
% CO_2	0.0	Meter Temperature, deg F:	64.1
% O_2	20.0	Meter Volume Vm(std):	28.231
% N_2	80.0	Meter Volume Vw(std):	1.210
Md - dry basis lb/lb mole	28.800	Delta H:	0.65
Ms - wet basis lb/lb mole	28.357	Train Initial Weight, g:	210.7
Stack Diameter, Feet	1.03	Train Final Weight, g:	216.4
Cross Sectional Area of Stack, Ft^2	0.83	Condensate Initial Vol, mL:	200.0
Bws - Moisture content fraction	0.041	Condensate Final Vol, mL:	220.0

Port	Point	DP (in. H_2O)	Sqrt. DP	Temp (°F)	Velocity (V)
A	01	0.25	0.5000	209	31.87
A	02	0.24	0.4899	210	31.25
A	03	0.24	0.4899	210	31.25
A	04	0.19	0.4359	208	27.77
A	05	0.19	0.4359	200	27.60
A	06	0.14	0.3742	149	22.76
B	01	0.24	0.4899	209	31.23
B	02	0.25	0.5000	209	31.87
B	03	0.20	0.4472	209	28.51
B	04	0.16	0.4000	180	24.94
B	05	0.15	0.3873	160	23.77
B	06	0.06	0.2449	140	14.79

Port	Point	DP (in. H_2O)	Sqrt. DP	Temp (°F)	Velocity (V)

Method 2 Results	
Average DP	0.1925
Average SqrtDP	0.4329
Average Velocity Vs (ft/sec)	27.23
Q - ACFM	1,361
Qsd - DSCFM	1,059
Qs - SCFM	1,105
Qs - SCFH	66,270

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METHOD 2 VOLUMETRIC FLOW DATA

Project No:	M22E1859		
Company:	Koppers Inc.	**Run No.:**	8
Plant:	Stickney, Illinois	**Date:**	4/29/2009
Source:	TO Inlet	**Start Time:**	11:21
Source Condition:	Normal	**End Time:**	11:26
Pitot ID:	838A	**RM Testers:**	GL/JMM
Pitot Coefficient:	0.84		

Test Parameters		**Moisture Determination**	
P_{bar} - Barometric pressure, inches Hg	29.98	Method Used:	4
P_g - Stack Pressure, inches of H_2O	-0.55	Meter Calibration:	1.005
P_s - Absolute stack pressure, inches Hg	29.94	Initial Meter Volume (cf):	389.435
t_s - Average stack temperature, °F	197.2	Final Meter Volume (cf):	417.218
% CO_2	0.0	Meter Temperature, deg F:	64.1
% O_2	20.0	Meter Volume Vm(std):	28.231
% N_2	80.0	Meter Volume Vw(std):	1.210
Md - dry basis lb/lb mole	28.800	Delta H:	0.65
Ms - wet basis lb/lb mole	28.357	Train Initial Weight, g:	210.7
Stack Diameter, Feet	1.03	Train Final Weight, g:	216.4
Cross Sectional Area of Stack, Ft^2	0.83	Condensate Initial Vol, mL:	200.0
Bws - Moisture content fraction	0.041	Condensate Final Vol, mL:	220.0

Port Point	DP (in. H_2O)	Sqrt. DP	Temp (°F)	Velocity (V)
A 01	0.22	0.4690	205	29.81
A 02	0.23	0.4796	209	30.57
A 03	0.22	0.4690	206	29.83
A 04	0.21	0.4583	206	29.15
A 05	0.10	0.3162	200	20.02
A 06	0.06	0.2449	179	15.26
B 01	0.21	0.4583	205	29.12
B 02	0.24	0.4899	205	31.14
B 03	0.21	0.4583	209	29.21
B 04	0.13	0.3606	202	22.86
B 05	0.09	0.3000	180	18.70
B 06	0.08	0.2828	160	17.36

Port	Point	DP (in. H_2O)	Sqrt. DP	Temp (°F)	Velocity (V)

Method 2 Results	
Average DP	0.1667
Average SqrtDP	0.3989
Average Velocity Vs (ft/sec)	25.20
Q - ACFM	1,260
Qsd - DSCFM	971
Qs - SCFM	1,013
Qs - SCFH	60,780

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METHOD 2 VOLUMETRIC FLOW DATA

Project No:	M22E1859
Company:	Koppers Inc.
Plant:	Stickney, Illinois
Source:	TO Inlet
Source Condition:	Normal
Pitot ID:	838A
Pitot Coefficient:	0.84

Run No.:	9
Date:	4/29/2009
Start Time:	12:21
End Time:	12:26
RM Testers:	GL/JMM

Test Parameters	
P_{bar} - Barometric pressure, inches Hg	29.98
P_g - Stack Pressure, inches of H_2O	-0.55
P_s - Absolute stack pressure, inches Hg	29.94
t_s - Average stack temperature, °F	192.4
% CO_2	0.0
% O_2	20.0
% N_2	80.0
Md - dry basis lb/lb mole	28.800
Ms - wet basis lb/lb mole	28.357
Stack Diameter, Feet	1.03
Cross Sectional Area of Stack, Ft^2	0.83
Bws - Moisture content fraction	0.041

Moisture Determination	
Method Used:	4
Meter Calibration:	1.005
Initial Meter Volume (cf):	417.338
Final Meter Volume (cf):	446.835
Meter Temperature, deg F:	66.8
Meter Volume Vm(std):	29.819
Meter Volume Vw(std):	1.286
Delta H:	0.65
Train Initial Weight, g:	210.9
Train Final Weight, g:	218.2
Condensate Initial Vol, mL:	200.0
Condensate Final Vol, mL:	220.0

Port Point	DP (in. H_2O)	Sqrt. DP	Temp (°F)	Velocity (V)
A 01	0.18	0.4243	212	27.11
A 02	0.26	0.5099	213	32.60
A 03	0.25	0.5000	212	31.94
A 04	0.12	0.3464	203	21.98
A 05	0.12	0.3464	174	21.50
A 06	0.07	0.2646	157	16.20
B 01	0.21	0.4583	212	29.28
B 02	0.22	0.4690	212	29.97
B 03	0.19	0.4359	210	27.81
B 04	0.16	0.4000	200	25.33
B 05	0.08	0.2828	168	17.47
B 06	0.06	0.2449	136	14.74

Port	Point	DP (in. H_2O)	Sqrt. DP	Temp (°F)	Velocity (V)

Method 2 Results	
Average DP	0.1600
Average SqrtDP	0.3902
Average Velocity Vs (ft/sec)	24.56
Q - ACFM	1,228
Qsd - DSCFM	954
Qs - SCFM	995
Qs - SCFH	59,671

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METHOD 2 VOLUMETRIC FLOW DATA

Project No:	M22E1859		
Company:	Koppers Inc.	**Run No.:**	10
Plant:	Stickney, Illinois	**Date:**	4/29/2009
Source:	TO Inlet	**Start Time:**	12:41
Source Condition:	Normal	**End Time:**	12:46
Pitot ID:	838A	**RM Testers:**	GL/JMM
Pitot Coefficient:	0.84		

Test Parameters	
P_{bar} - Barometric pressure, inches Hg	29.98
P_g - Stack Pressure, inches of H_2O	-0.55
P_s - Absolute stack pressure, inches Hg	29.94
t_s - Average stack temperature, °F	190.8
% CO_2	0.0
% O_2	20.0
% N_2	80.0
Md - dry basis lb/lb mole	28.800
Ms - wet basis lb/lb mole	28.357
Stack Diameter, Feet	1.03
Cross Sectional Area of Stack, Ft^2	0.83
Bws - Moisture content fraction	0.041

Moisture Determination	
Method Used:	4
Meter Calibration:	1.005
Initial Meter Volume (cf):	417.338
Final Meter Volume (cf):	446.835
Meter Temperature, deg F:	66.8
Meter Volume Vm(std):	29.819
Meter Volume Vw(std):	1.286
Delta H:	0.65
Train Initial Weight, g:	210.9
Train Final Weight, g:	218.2
Condensate Initial Vol, mL:	200.0
Condensate Final Vol, mL:	220.0

Port	Point	DP (in. H_2O)	Sqrt. DP	Temp (°F)	Velocity (V)
A	01	0.21	0.4583	214	29.32
A	02	0.23	0.4796	214	30.69
A	03	0.20	0.4472	212	28.57
A	04	0.19	0.4359	200	27.60
A	05	0.11	0.3317	161	20.37
A	06	0.06	0.2449	140	14.79
B	01	0.22	0.4690	214	30.01
B	02	0.24	0.4899	214	31.35
B	03	0.23	0.4796	210	30.59
B	04	0.20	0.4472	200	28.32
B	05	0.13	0.3606	163	22.18
B	06	0.12	0.3464	147	21.03

Port	Point	DP (in. H_2O)	Sqrt. DP	Temp (°F)	Velocity (V)

Method 2 Results	
Average DP	0.1783
Average SqrtDP	0.4159
Average Velocity Vs (ft/sec)	26.15
Q - ACFM	1,307
Qsd - DSCFM	1,018
Qs - SCFM	1,061
Qs - SCFH	63,674

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METHOD 2 VOLUMETRIC FLOW DATA

Project No:	M22E1859		
Company:	Koppers Inc.	**Run No.:**	11
Plant:	Stickney, Illinois	**Date:**	4/29/2009
Source:	TO Inlet	**Start Time:**	12:54
Source Condition:	Normal	**End Time:**	12:59
Pitot ID:	838A	**RM Testers:**	GL/JMM
Pitot Coefficient:	0.84		

Test Parameters		**Moisture Determination**	
P_{bar} - Barometric pressure, inches Hg	29.98	Method Used:	4
P_g - Stack Pressure, inches of H_2O	-0.55	Meter Calibration:	1.005
P_s - Absolute stack pressure, inches Hg	29.94	Initial Meter Volume (cf):	417.338
t_s - Average stack temperature, °F	198.8	Final Meter Volume (cf):	446.835
% CO_2	0.0	Meter Temperature, deg F:	66.8
% O_2	20.0	Meter Volume Vm(std):	29.819
% N_2	80.0	Meter Volume Vw(std):	1.286
Md - dry basis lb/lb mole	28.800	Delta H:	0.65
Ms - wet basis lb/lb mole	28.357	Train Initial Weight, g:	210.9
Stack Diameter, Feet	1.03	Train Final Weight, g:	218.2
Cross Sectional Area of Stack, Ft^2	0.83	Condensate Initial Vol, mL:	200.0
Bws - Moisture content fraction	0.041	Condensate Final Vol, mL:	220.0

Port Point	DP (in. H_2O)	Sqrt. DP	Temp (°F)	Velocity (V)
A 01	0.21	0.4583	212	29.28
A 02	0.23	0.4796	211	30.62
A 03	0.21	0.4583	211	29.26
A 04	0.15	0.3873	206	24.63
A 05	0.14	0.3742	200	23.69
A 06	0.13	0.3606	171	22.32
B 01	0.22	0.4690	212	29.97
B 02	0.22	0.4690	212	29.97
B 03	0.20	0.4472	209	28.51
B 04	0.16	0.4000	202	25.36
B 05	0.12	0.3464	179	21.58
B 06	0.08	0.2828	160	17.36

Port	Point	DP (in. H_2O)	Sqrt. DP	Temp (°F)	Velocity (V)

Method 2 Results	
Average DP	0.1725
Average SqrtDP	0.4111
Average Velocity Vs (ft/sec)	26.00
Q - ACFM	1,300
Qsd - DSCFM	1,000
Qs - SCFM	1,043
Qs - SCFH	62,555

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METHOD 2 VOLUMETRIC FLOW DATA

Project No:	M22E1859		
Company:	Koppers Inc.	**Run No.:**	12
Plant:	Stickney, Illinois	**Date:**	4/29/2009
Source:	TO Inlet	**Start Time:**	13:06
Source Condition:	Normal	**End Time:**	13:11
Pitot ID:	838A	**RM Testers:**	GL/JMM
Pitot Coefficient:	0.84		

Test Parameters	
P_{bar} - Barometric pressure, inches Hg	29.98
P_g - Stack Pressure, inches of H_2O	-0.55
P_s - Absolute stack pressure, inches Hg	29.94
t_s - Average stack temperature, °F	197.3
% CO_2	0.0
% O_2	20.0
% N_2	80.0
Md - dry basis lb/lb mole	28.800
Ms - wet basis lb/lb mole	28.357
Stack Diameter, Feet	1.03
Cross Sectional Area of Stack, Ft^2	0.83
Bws - Moisture content fraction	0.041

Moisture Determination	
Method Used:	4
Meter Calibration:	1.005
Initial Meter Volume (cf):	417.338
Final Meter Volume (cf):	446.835
Meter Temperature, deg F:	66.8
Meter Volume Vm(std):	29.819
Meter Volume Vw(std):	1.286
Delta H:	0.65
Train Initial Weight, g:	210.9
Train Final Weight, g:	218.2
Condensate Initial Vol, mL:	200.0
Condensate Final Vol, mL:	220.0

Port Point	DP (in. H_2O)	Sqrt. DP	Temp (°F)	Velocity (V)
A 01	0.21	0.4583	213	29.30
A 02	0.22	0.4690	213	29.99
A 03	0.22	0.4690	213	29.99
A 04	0.18	0.4243	189	26.64
A 05	0.14	0.3742	176	23.26
A 06	0.10	0.3162	151	19.26
B 01	0.21	0.4583	213	29.30
B 02	0.22	0.4690	213	29.99
B 03	0.20	0.4472	213	28.59
B 04	0.18	0.4243	200	26.86
B 05	0.11	0.3317	194	20.90
B 06	0.09	0.3000	180	18.70

Port	Point	DP (in. H_2O)	Sqrt. DP	Temp (°F)	Velocity (V)

Method 2 Results	
Average DP	0.1733
Average SqrtDP	0.4118
Average Velocity Vs (ft/sec)	26.02
Q - ACFM	1,301
Qsd - DSCFM	1,003
Qs - SCFM	1,046
Qs - SCFH	62,734

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METHOD 2 VOLUMETRIC FLOW DATA

Project No:	M22E1859
Company:	Koppers Inc.
Plant:	Stickney, Illinois
Source:	TO Outlet
Source Condition:	Normal
Pitot ID:	840A
Pitot Coefficient:	0.84

Run No.:	1
Date:	4/29/2009
Start Time:	08:28
End Time:	08:33
RM Testers:	GL/GRK

Test Parameters	
P_{bar} - Barometric pressure, inches Hg	29.98
P_g - Stack Pressure, inches of H_2O	-0.50
P_s - Absolute stack pressure, inches Hg	29.94
t_s - Average stack temperature, °F	470.3
% CO_2	1.0
% O_2	18.0
% N_2	81.0
Md - dry basis lb/lb mole	28.880
Ms - wet basis lb/lb mole	28.412
Stack Diameter, Feet	1.29
Cross Sectional Area of Stack, Ft^2	1.31
Bws - Moisture content fraction	0.043

Moisture Determination	
Method Used:	4
Meter Calibration:	1.014
Initial Meter Volume (cf):	978.650
Final Meter Volume (cf):	1007.724
Meter Temperature, deg F:	59.9
Meter Volume Vm(std):	30.048
Meter Volume Vw(std):	1.356
Delta H:	0.65
Train Initial Weight, g:	211.6
Train Final Weight, g:	220.4
Condensate Initial Vol, mL:	200.0
Condensate Final Vol, mL:	220.0

Port Point	DP (in. H_2O)	Sqrt. DP	Temp (°F)	Velocity (V)
A 01	0.50	0.7071	485	53.52
A 02	0.54	0.7348	485	55.62
A 03	0.54	0.7348	496	55.94
A 04	0.39	0.6245	500	47.64
A 05	0.47	0.6856	440	50.64
A 06	0.46	0.6782	380	48.40
B 01	0.51	0.7141	490	54.19
B 02	0.57	0.7550	485	57.14
B 03	0.60	0.7746	495	58.93
B 04	0.54	0.7348	490	55.76
B 05	0.42	0.6481	457	48.32
B 06	0.35	0.5916	440	43.70

Port	Point	DP (in. H_2O)	Sqrt. DP	Temp (°F)	Velocity (V)

Method 2 Results	
Average DP	0.4908
Average SqrtDP	0.6986
Average Velocity Vs (ft/sec)	52.46
Q - ACFM	4,114
Qsd - DSCFM	2,236
Qs - SCFM	2,337
Qs - SCFH	140,208

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METHOD 2 VOLUMETRIC FLOW DATA

Project No:	M22E1859		
Company:	Koppers Inc.	**Run No.:**	2
Plant:	Stickney, Illinois	**Date:**	4/29/2009
Source:	TO Outlet	**Start Time:**	08:46
Source Condition:	Normal	**End Time:**	08:52
Pitot ID:	840A	**RM Testers:**	GL/GRK
Pitot Coefficient:	0.84		

Test Parameters	
P_{bar} - Barometric pressure, inches Hg	29.98
P_g - Stack Pressure, inches of H_2O	-0.50
P_s - Absolute stack pressure, inches Hg	29.94
t_s - Average stack temperature, °F	480.1
% CO_2	1.0
% O_2	18.0
% N_2	81.0
Md - dry basis lb/lb mole	28.880
Ms - wet basis lb/lb mole	28.412
Stack Diameter, Feet	1.29
Cross Sectional Area of Stack, Ft^2	1.31
Bws - Moisture content fraction	0.043

Moisture Determination	
Method Used:	4
Meter Calibration:	1.014
Initial Meter Volume (cf):	978.650
Final Meter Volume (cf):	1007.724
Meter Temperature, deg F:	59.9
Meter Volume Vm(std):	30.048
Meter Volume Vw(std):	1.356
Delta H:	0.65
Train Initial Weight, g:	211.6
Train Final Weight, g:	220.4
Condensate Initial Vol, mL:	200.0
Condensate Final Vol, mL:	220.0

Port Point	DP (in. H_2O)	Sqrt. DP	Temp (°F)	Velocity (V)
A 01	0.64	0.8000	503	61.12
A 02	0.61	0.7810	500	59.58
A 03	0.57	0.7550	502	57.65
A 04	0.55	0.7416	504	56.69
A 05	0.41	0.6403	468	48.02
A 06	0.38	0.6164	456	45.93
B 01	0.48	0.6928	474	52.13
B 02	0.57	0.7550	486	57.17
B 03	0.56	0.7483	495	56.94
B 04	0.56	0.7483	490	56.79
B 05	0.47	0.6856	468	51.42
B 06	0.36	0.6000	415	43.70

Port	Point	DP (in. H_2O)	Sqrt. DP	Temp (°F)	Velocity (V)

Method 2 Results	
Average DP	0.5133
Average SqrtDP	0.7137
Average Velocity Vs (ft/sec)	53.88
Q - ACFM	4,225
Qsd - DSCFM	2,273
Qs - SCFM	2,375
Qs - SCFH	142,485

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METHOD 2 VOLUMETRIC FLOW DATA

Project No:	M22E1859		
Company:	Koppers Inc.	**Run No.:**	3
Plant:	Stickney, Illinois	**Date:**	4/29/2009
Source:	TO Outlet	**Start Time:**	09:02
Source Condition:	Normal	**End Time:**	09:07
Pitot ID:	840A	**RM Testers:**	GL/GRK
Pitot Coefficient:	0.84		

Test Parameters		**Moisture Determination**	
P_{bar} - Barometric pressure, inches Hg	29.98	Method Used:	4
P_g - Stack Pressure, inches of H_2O	-0.50	Meter Calibration:	1.014
P_s - Absolute stack pressure, inches Hg	29.94	Initial Meter Volume (cf):	978.650
t_s - Average stack temperature, °F	474.9	Final Meter Volume (cf):	1007.724
% CO_2	1.0	Meter Temperature, deg F:	59.9
% O_2	18.0	Meter Volume Vm(std):	30.048
% N_2	81.0	Meter Volume Vw(std):	1.356
Md - dry basis lb/lb mole	28.880	Delta H:	0.65
Ms - wet basis lb/lb mole	28.412	Train Initial Weight, g:	211.6
Stack Diameter, Feet	1.29	Train Final Weight, g:	220.4
Cross Sectional Area of Stack, Ft^2	1.31	Condensate Initial Vol, mL:	200.0
Bws - Moisture content fraction	0.043	Condensate Final Vol, mL:	220.0

Port Point	DP (in. H_2O)	Sqrt. DP	Temp (°F)	Velocity (V)
A 01	0.44	0.6633	489	50.31
A 02	0.49	0.7000	494	53.23
A 03	0.55	0.7416	498	56.51
A 04	0.35	0.5916	490	44.89
A 05	0.44	0.6633	432	48.78
A 06	0.50	0.7071	384	50.58
B 01	0.50	0.7071	490	53.66
B 02	0.51	0.7141	494	54.31
B 03	0.55	0.7416	499	56.54
B 04	0.56	0.7483	490	56.79
B 05	0.51	0.7141	476	53.79
B 06	0.39	0.6245	463	46.71

Port	Point	DP (in. H_2O)	Sqrt. DP	Temp (°F)	Velocity (V)

Method 2 Results	
Average DP	0.4825
Average SqrtDP	0.6931
Average Velocity Vs (ft/sec)	52.17
Q - ACFM	4,091
Qsd - DSCFM	2,213
Qs - SCFM	2,312
Qs - SCFH	138,748

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METHOD 2 VOLUMETRIC FLOW DATA

Project No:	M22E1859			
Company:	Koppers Inc.		Run No.:	4
Plant:	Stickney, Illinois		Date:	4/29/2009
Source:	TO Outlet		Start Time:	09:17
Source Condition:	Normal		End Time:	09:23
Pitot ID:	840A		RM Testers:	GL/GRK
Pitot Coefficient:	0.84			

Test Parameters		Moisture Determination	
P_{bar} - Barometric pressure, inches Hg	29.98	Method Used:	4
P_g - Stack Pressure, inches of H_2O	-0.50	Meter Calibration:	1.014
P_s - Absolute stack pressure, inches Hg	29.94	Initial Meter Volume (cf):	978.650
t_s - Average stack temperature, °F	478.4	Final Meter Volume (cf):	1007.724
% CO_2	1.0	Meter Temperature, deg F:	59.9
% O_2	18.0	Meter Volume Vm(std):	30.048
% N_2	81.0	Meter Volume Vw(std):	1.356
Md - dry basis lb/lb mole	28.880	Delta H:	0.65
Ms - wet basis lb/lb mole	28.412	Train Initial Weight, g:	211.6
Stack Diameter, Feet	1.29	Train Final Weight, g:	220.4
Cross Sectional Area of Stack, Ft^2	1.31	Condensate Initial Vol, mL:	200.0
Bws - Moisture content fraction	0.043	Condensate Final Vol, mL:	220.0

Port Point	DP (in. H_2O)	Sqrt. DP	Temp (°F)	Velocity (V)
A 01	0.51	0.7141	500	54.48
A 02	0.56	0.7483	497	57.00
A 03	0.57	0.7550	500	57.59
A 04	0.57	0.7550	505	57.74
A 05	0.49	0.7000	487	53.04
A 06	0.44	0.6633	465	49.67
B 01	0.51	0.7141	498	54.42
B 02	0.54	0.7348	495	55.91
B 03	0.49	0.7000	496	53.29
B 04	0.45	0.6708	487	50.82
B 05	0.37	0.6083	420	44.43
B 06	0.33	0.5745	391	41.26

Port	Point	DP (in. H_2O)	Sqrt. DP	Temp (°F)	Velocity (V)

Method 2 Results	
Average DP	0.4858
Average SqrtDP	0.6949
Average Velocity Vs (ft/sec)	52.41
Q - ACFM	4,110
Qsd - DSCFM	2,215
Qs - SCFM	2,314
Qs - SCFH	138,846

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METHOD 2 VOLUMETRIC FLOW DATA

Project No:	M22E1859		
Company:	Koppers Inc.	**Run No.:**	5
Plant:	Stickney, Illinois	**Date:**	4/29/2009
Source:	TO Outlet	**Start Time:**	10:26
Source Condition:	Normal	**End Time:**	10:33
Pitot ID:	840A	**RM Testers:**	GL/GRK
Pitot Coefficient:	0.84		

Test Parameters		**Moisture Determination**	
P_{bar} - Barometric pressure, inches Hg	29.98	Method Used:	4
P_g - Stack Pressure, inches of H_2O	-0.50	Meter Calibration:	1.014
P_s - Absolute stack pressure, inches Hg	29.94	Initial Meter Volume (cf):	8.052
t_s - Average stack temperature, °F	483.7	Final Meter Volume (cf):	37.221
% CO_2	1.0	Meter Temperature, deg F:	68.2
% O_2	18.0	Meter Volume Vm(std):	29.673
% N_2	81.0	Meter Volume Vw(std):	1.093
Md - dry basis lb/lb mole	28.880	Delta H:	0.65
Ms - wet basis lb/lb mole	28.488	Train Initial Weight, g:	210.8
Stack Diameter, Feet	1.29	Train Final Weight, g:	219.0
Cross Sectional Area of Stack, Ft^2	1.31	Condensate Initial Vol, mL:	200.0
Bws - Moisture content fraction	0.036	Condensate Final Vol, mL:	215.0

Port Point	DP (in. H_2O)	Sqrt. DP	Temp (°F)	Velocity (V)
A 01	0.44	0.6633	493	50.35
A 02	0.57	0.7550	494	57.34
A 03	0.54	0.7348	496	55.86
A 04	0.37	0.6083	500	46.34
A 05	0.45	0.6708	487	50.76
A 06	0.47	0.6856	425	50.15
B 01	0.49	0.7000	494	53.16
B 02	0.60	0.7746	498	58.95
B 03	0.58	0.7616	498	57.96
B 04	0.54	0.7348	490	55.69
B 05	0.38	0.6164	489	46.69
B 06	0.34	0.5831	440	43.01

Port	Point	DP (in. H_2O)	Sqrt. DP	Temp (°F)	Velocity (V)

Method 2 Results	
Average DP	0.4808
Average SqrtDP	0.6907
Average Velocity Vs (ft/sec)	52.17
Q - ACFM	4,091
Qsd - DSCFM	2,208
Qs - SCFM	2,291
Qs - SCFH	137,446

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METHOD 2 VOLUMETRIC FLOW DATA

Project No:	M22E1859		
Company:	Koppers Inc.	**Run No.:**	6
Plant:	Stickney, Illinois	**Date:**	4/29/2009
Source:	TO Outlet	**Start Time:**	10:44
Source Condition:	Normal	**End Time:**	10:49
Pitot ID:	840A	**RM Testers:**	GL/GRK
Pitot Coefficient:	0.84		

Test Parameters		**Moisture Determination**	
P_{bar} - Barometric pressure, inches Hg	29.98	Method Used:	4
P_g - Stack Pressure, inches of H_2O	-0.50	Meter Calibration:	1.014
P_s - Absolute stack pressure, inches Hg	29.94	Initial Meter Volume (cf):	8.052
t_s - Average stack temperature, °F	485.4	Final Meter Volume (cf):	37.221
% CO_2	1.0	Meter Temperature, deg F:	68.2
% O_2	18.0	Meter Volume Vm(std):	29.673
% N_2	81.0	Meter Volume Vw(std):	1.093
Md - dry basis lb/lb mole	28.880	Delta H:	0.65
Ms - wet basis lb/lb mole	28.488	Train Initial Weight, g:	210.8
Stack Diameter, Feet	1.29	Train Final Weight, g:	219.0
Cross Sectional Area of Stack, Ft^2	1.31	Condensate Initial Vol, mL:	200.0
Bws - Moisture content fraction	0.036	Condensate Final Vol, mL:	215.0

Port Point	DP (in. H_2O)	Sqrt. DP	Temp (°F)	Velocity (V)
A 01	0.43	0.6557	492	49.75
A 02	0.61	0.7810	498	59.44
A 03	0.62	0.7874	495	59.83
A 04	0.43	0.6557	505	50.09
A 05	0.53	0.7280	480	54.88
A 06	0.41	0.6403	476	48.17
B 01	0.48	0.6928	493	52.59
B 02	0.57	0.7550	499	57.49
B 03	0.54	0.7348	500	55.98
B 04	0.48	0.6928	502	52.83
B 05	0.42	0.6481	455	48.20
B 06	0.45	0.6708	430	49.21

Port	Point	DP (in. H_2O)	Sqrt. DP	Temp (°F)	Velocity (V)

Method 2 Results	
Average DP	0.4975
Average SqrtDP	0.7036
Average Velocity Vs (ft/sec)	53.19
Q - ACFM	4,171
Qsd - DSCFM	2,247
Qs - SCFM	2,331
Qs - SCFH	139,874

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METHOD 2 VOLUMETRIC FLOW DATA

Project No:	M22E1859		
Company:	Koppers Inc.	**Run No.:**	7
Plant:	Stickney, Illinois	**Date:**	4/29/2009
Source:	TO Outlet	**Start Time:**	11:03
Source Condition:	Normal	**End Time:**	11:08
Pitot ID:	840A	**RM Testers:**	GL/GRK
Pitot Coefficient:	0.84		

Test Parameters		**Moisture Determination**	
P_{bar} - Barometric pressure, inches Hg	29.98	Method Used:	4
P_g - Stack Pressure, inches of H_2O	-0.50	Meter Calibration:	1.014
P_s - Absolute stack pressure, inches Hg	29.94	Initial Meter Volume (cf):	8.052
t_s - Average stack temperature, °F	478.5	Final Meter Volume (cf):	37.221
% CO_2	1.0	Meter Temperature, deg F:	68.2
% O_2	18.0	Meter Volume Vm(std):	29.673
% N_2	81.0	Meter Volume Vw(std):	1.093
Md - dry basis lb/lb mole	28.880	Delta H:	0.65
Ms - wet basis lb/lb mole	28.488	Train Initial Weight, g:	210.8
Stack Diameter, Feet	1.29	Train Final Weight, g:	219.0
Cross Sectional Area of Stack, Ft^2	1.31	Condensate Initial Vol, mL:	200.0
Bws - Moisture content fraction	0.036	Condensate Final Vol, mL:	215.0

Port Point	DP (in. H_2O)	Sqrt. DP	Temp (°F)	Velocity (V)
A 01	0.53	0.7280	494	55.29
A 02	0.54	0.7348	494	55.81
A 03	0.52	0.7211	503	55.02
A 04	0.51	0.7141	500	54.40
A 05	0.33	0.5745	415	41.78
A 06	0.53	0.7280	389	52.16
B 01	0.53	0.7280	494	55.29
B 02	0.66	0.8124	490	61.57
B 03	0.62	0.7874	495	59.83
B 04	0.62	0.7874	498	59.92
B 05	0.58	0.7616	490	57.71
B 06	0.47	0.6856	480	51.68

Port	Point	DP (in. H_2O)	Sqrt. DP	Temp (°F)	Velocity (V)

Method 2 Results	
Average DP	0.5367
Average SqrtDP	0.7302
Average Velocity Vs (ft/sec)	55.00
Q - ACFM	4,313
Qsd - DSCFM	2,341
Qs - SCFM	2,429
Qs - SCFH	145,716

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METHOD 2 VOLUMETRIC FLOW DATA

Project No:	M22E1859		
Company:	Koppers Inc.	**Run No.:**	8
Plant:	Stickney, Illinois	**Date:**	4/29/2009
Source:	TO Outlet	**Start Time:**	11:14
Source Condition:	Normal	**End Time:**	11:20
Pitot ID:	840A	**RM Testers:**	GL/GRK
Pitot Coefficient:	0.84		

Test Parameters		**Moisture Determination**	
P_{bar} - Barometric pressure, inches Hg	29.98	Method Used:	4
P_g - Stack Pressure, inches of H_2O	-0.50	Meter Calibration:	1.014
P_s - Absolute stack pressure, inches Hg	29.94	Initial Meter Volume (cf):	8.052
t_s - Average stack temperature, °F	474.2	Final Meter Volume (cf):	37.221
% CO_2	1.0	Meter Temperature, deg F:	68.2
% O_2	18.0	Meter Volume Vm(std):	29.673
% N_2	81.0	Meter Volume Vw(std):	1.093
Md - dry basis lb/lb mole	28.880	Delta H:	0.65
Ms - wet basis lb/lb mole	28.488	Train Initial Weight, g:	210.8
Stack Diameter, Feet	1.29	Train Final Weight, g:	219.0
Cross Sectional Area of Stack, Ft^2	1.31	Condensate Initial Vol, mL:	200.0
Bws - Moisture content fraction	0.036	Condensate Final Vol, mL:	215.0

Port Point	DP (in. H_2O)	Sqrt. DP	Temp (°F)	Velocity (V)
A 01	0.49	0.7000	480	52.77
A 02	0.63	0.7937	480	59.83
A 03	0.65	0.8062	473	60.55
A 04	0.61	0.7810	470	58.56
A 05	0.53	0.7280	504	55.58
A 06	0.43	0.6557	470	49.17
B 01	0.42	0.6481	480	48.85
B 02	0.58	0.7616	486	57.59
B 03	0.53	0.7280	500	55.46
B 04	0.33	0.5745	486	43.44
B 05	0.49	0.7000	452	51.98
B 06	0.49	0.7000	409	50.74

Port	Point	DP (in. H_2O)	Sqrt. DP	Temp (°F)	Velocity (V)

Method 2 Results	
Average DP	0.5150
Average SqrtDP	0.7147
Average Velocity Vs (ft/sec)	53.71
Q - ACFM	4,212
Qsd - DSCFM	2,297
Qs - SCFM	2,383
Qs - SCFH	142,952

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METHOD 2 VOLUMETRIC FLOW DATA

Project No:	M22E1859		
Company:	Koppers Inc.	**Run No.:**	9
Plant:	Stickney, Illinois	**Date:**	4/29/2009
Source:	TO Outlet	**Start Time:**	12:27
Source Condition:	Normal	**End Time:**	12:32
Pitot ID:	840A	**RM Testers:**	GL/GRK
Pitot Coefficient:	0.84		

Test Parameters		**Moisture Determination**	
P_{bar} - Barometric pressure, inches Hg	29.98	Method Used:	4
P_g - Stack Pressure, inches of H_2O	-0.50	Meter Calibration:	1.014
P_s - Absolute stack pressure, inches Hg	29.94	Initial Meter Volume (cf):	37.465
t_s - Average stack temperature, °F	468.4	Final Meter Volume (cf):	67.354
% CO_2	1.0	Meter Temperature, deg F:	68.8
% O_2	18.0	Meter Volume Vm(std):	30.371
% N_2	81.0	Meter Volume Vw(std):	1.295
Md - dry basis lb/lb mole	28.880	Delta H:	0.65
Ms - wet basis lb/lb mole	28.434	Train Initial Weight, g:	220.4
Stack Diameter, Feet	1.29	Train Final Weight, g:	227.9
Cross Sectional Area of Stack, Ft^2	1.31	Condensate Initial Vol, mL:	200.0
Bws - Moisture content fraction	0.041	Condensate Final Vol, mL:	220.0

Port Point	DP (in. H_2O)	Sqrt. DP	Temp (°F)	Velocity (V)
A 01	0.46	0.6782	493	51.53
A 02	0.51	0.7141	492	54.23
A 03	0.52	0.7211	493	54.79
A 04	0.39	0.6245	485	47.25
A 05	0.39	0.6245	454	46.47
A 06	0.38	0.6164	380	43.97
B 01	0.43	0.6557	493	49.82
B 02	0.51	0.7141	493	54.26
B 03	0.50	0.7071	493	53.72
B 04	0.44	0.6633	480	50.05
B 05	0.34	0.5831	445	43.17
B 06	0.30	0.5477	420	39.99

Port	Point	DP (in. H_2O)	Sqrt. DP	Temp (°F)	Velocity (V)

Method 2 Results	
Average DP	0.4308
Average SqrtDP	0.6542
Average Velocity Vs (ft/sec)	49.06
Q - ACFM	3,847
Qsd - DSCFM	2,100
Qs - SCFM	2,189
Qs - SCFH	131,368

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METHOD 2 VOLUMETRIC FLOW DATA

Project No:	M22E1859		
Company:	Koppers Inc.	**Run No.:**	10
Plant:	Stickney, Illinois	**Date:**	4/29/2009
Source:	TO Outlet	**Start Time:**	12:47
Source Condition:	Normal	**End Time:**	12:52
Pitot ID:	840A	**RM Testers:**	GL/GRK
Pitot Coefficient:	0.84		

Test Parameters		**Moisture Determination**	
P_{bar} - Barometric pressure, inches Hg	29.98	Method Used:	4
P_g - Stack Pressure, inches of H_2O	-0.50	Meter Calibration:	1.014
P_s - Absolute stack pressure, inches Hg	29.94	Initial Meter Volume (cf):	37.465
t_s - Average stack temperature, °F	487.2	Final Meter Volume (cf):	67.354
% CO_2	1.0	Meter Temperature, deg F:	68.8
% O_2	18.0	Meter Volume Vm(std):	30.371
% N_2	81.0	Meter Volume Vw(std):	1.295
Md - dry basis lb/lb mole	28.880	Delta H:	0.65
Ms - wet basis lb/lb mole	28.434	Train Initial Weight, g:	220.4
Stack Diameter, Feet	1.29	Train Final Weight, g:	227.9
Cross Sectional Area of Stack, Ft^2	1.31	Condensate Initial Vol, mL:	200.0
Bws - Moisture content fraction	0.041	Condensate Final Vol, mL:	220.0

Port Point	DP (in. H_2O)	Sqrt. DP	Temp (°F)	Velocity (V)
A 01	0.50	0.7071	496	53.81
A 02	0.49	0.7000	502	53.43
A 03	0.64	0.8000	503	61.10
A 04	0.52	0.7211	490	54.70
A 05	0.46	0.6782	492	51.50
A 06	0.35	0.5916	466	44.31
B 01	0.51	0.7141	497	54.37
B 02	0.52	0.7211	500	54.99
B 03	0.54	0.7348	500	56.03
B 04	0.42	0.6481	490	49.16
B 05	0.51	0.7141	480	53.89
B 06	0.43	0.6557	430	48.15

Port	Point	DP (in. H_2O)	Sqrt. DP	Temp (°F)	Velocity (V)

Method 2 Results	
Average DP	0.4908
Average SqrtDP	0.6988
Average Velocity Vs (ft/sec)	52.93
Q - ACFM	4,151
Qsd - DSCFM	2,221
Qs - SCFM	2,316
Qs - SCFH	138,943

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METHOD 2 VOLUMETRIC FLOW DATA

Project No:	M22E1859		
Company:	Koppers Inc.	**Run No.:**	11
Plant:	Stickney, Illinois	**Date:**	4/29/2009
Source:	TO Outlet	**Start Time:**	13:00
Source Condition:	Normal	**End Time:**	13:05
Pitot ID:	840A	**RM Testers:**	GL/GRK
Pitot Coefficient:	0.84		

Test Parameters		**Moisture Determination**	
P_{bar} - Barometric pressure, inches Hg	29.98	Method Used:	4
P_g - Stack Pressure, inches of H_2O	-0.50	Meter Calibration:	1.014
P_s - Absolute stack pressure, inches Hg	29.94	Initial Meter Volume (cf):	37.465
t_s - Average stack temperature, °F	476.8	Final Meter Volume (cf):	67.354
% CO_2	1.0	Meter Temperature, deg F:	68.8
% O_2	18.0	Meter Volume Vm(std):	30.371
% N_2	81.0	Meter Volume Vw(std):	1.295
Md - dry basis lb/lb mole	28.880	Delta H:	0.65
Ms - wet basis lb/lb mole	28.434	Train Initial Weight, g:	220.4
Stack Diameter, Feet	1.29	Train Final Weight, g:	227.9
Cross Sectional Area of Stack, Ft^2	1.31	Condensate Initial Vol, mL:	200.0
Bws - Moisture content fraction	0.041	Condensate Final Vol, mL:	220.0

Port Point	DP (in. H_2O)	Sqrt. DP	Temp (°F)	Velocity (V)
A 01	0.48	0.6928	490	52.55
A 02	0.51	0.7141	488	54.11
A 03	0.53	0.7280	500	55.51
A 04	0.34	0.5831	481	44.02
A 05	0.31	0.5568	443	41.18
A 06	0.34	0.5831	400	42.08
B 01	0.48	0.6928	492	52.61
B 02	0.60	0.7746	495	58.91
B 03	0.65	0.8062	498	61.41
B 04	0.56	0.7483	505	57.21
B 05	0.54	0.7348	490	55.74
B 06	0.37	0.6083	440	44.91

Port	Point	DP (in. H_2O)	Sqrt. DP	Temp (°F)	Velocity (V)

Method 2 Results	
Average DP	0.4758
Average SqrtDP	0.6853
Average Velocity Vs (ft/sec)	51.62
Q - ACFM	4,048
Qsd - DSCFM	2,190
Qs - SCFM	2,283
Qs - SCFH	136,990

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METHOD 2 VOLUMETRIC FLOW DATA

Project No:	M22E1859		
Company:	Koppers Inc.	**Run No.:**	12
Plant:	Stickney, Illinois	**Date:**	4/29/2009
Source:	TO Outlet	**Start Time:**	13:12
Source Condition:	Normal	**End Time:**	13:17
Pitot ID:	840A	**RM Testers:**	GL/GRK
Pitot Coefficient:	0.84		

Test Parameters		**Moisture Determination**	
P_{bar} - Barometric pressure, inches Hg	29.98	Method Used:	4
P_g - Stack Pressure, inches of H_2O	-0.50	Meter Calibration:	1.014
P_s - Absolute stack pressure, inches Hg	29.94	Initial Meter Volume (cf):	37.465
t_s - Average stack temperature, °F	485.1	Final Meter Volume (cf):	67.354
% CO_2	1.0	Meter Temperature, deg F:	68.8
% O_2	18.0	Meter Volume Vm(std):	30.371
% N_2	81.0	Meter Volume Vw(std):	1.295
Md - dry basis lb/lb mole	28.880	Delta H:	0.65
Ms - wet basis lb/lb mole	28.434	Train Initial Weight, g:	220.4
Stack Diameter, Feet	1.29	Train Final Weight, g:	227.9
Cross Sectional Area of Stack, Ft^2	1.31	Condensate Initial Vol, mL:	200.0
Bws - Moisture content fraction	0.041	Condensate Final Vol, mL:	220.0

Port Point	DP (in. H_2O)	Sqrt. DP	Temp (°F)	Velocity (V)
A 01	0.53	0.7280	501	55.54
A 02	0.55	0.7416	500	56.55
A 03	0.69	0.8307	505	63.51
A 04	0.57	0.7550	509	57.84
A 05	0.50	0.7071	489	53.61
A 06	0.39	0.6245	466	46.77
B 01	0.46	0.6782	498	51.66
B 02	0.55	0.7416	499	56.52
B 03	0.50	0.7071	500	53.92
B 04	0.41	0.6403	474	48.16
B 05	0.46	0.6782	450	50.35
B 06	0.39	0.6245	430	45.85

Port	Point	DP (in. H_2O)	Sqrt. DP	Temp (°F)	Velocity (V)

Method 2 Results	
Average DP	0.5000
Average SqrtDP	0.7047
Average Velocity Vs (ft/sec)	53.32
Q - ACFM	4,181
Qsd - DSCFM	2,242
Qs - SCFM	2,338
Qs - SCFH	140,270

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CALIBRATION PROCEDURES

PITOT TUBES

The pitot tubes used during this test program were fabricated according to the specification described and illustrated in USEPA Method 2, Section 10.1. The pitot tubes comply with the alignment specifications in Method 2, Section 10.1; and the pitot tube assemblies are in compliance with specifications in the same section.

After each field use, the pitot tube assemblies are inspected top, side and end views to ensure that the pitot face openings are still aligned within the specifications of USEPA Method 2, Section 10.1 and that the inter component spacings have not changed.

TEMPERATURE SENSING DEVICES

Thermocouples are checked according to USEPA Alternate Method 11 "Alternative Method 2 Thermocouple Calibration Procedure".

DRY GAS METERS

The test meters are calibrated prior to their initial use in the field according to USEPA Method 5, Section 10.2.1 and the calibration is checked after each field use using procedures in USEPA Alternate Method 9, "Alternative Method 5 Post-Test Calibration".

ANALYTICAL BALANCE

The accuracy of the analytical balance is checked with Class S, Stainless Steel Type 303 weights.

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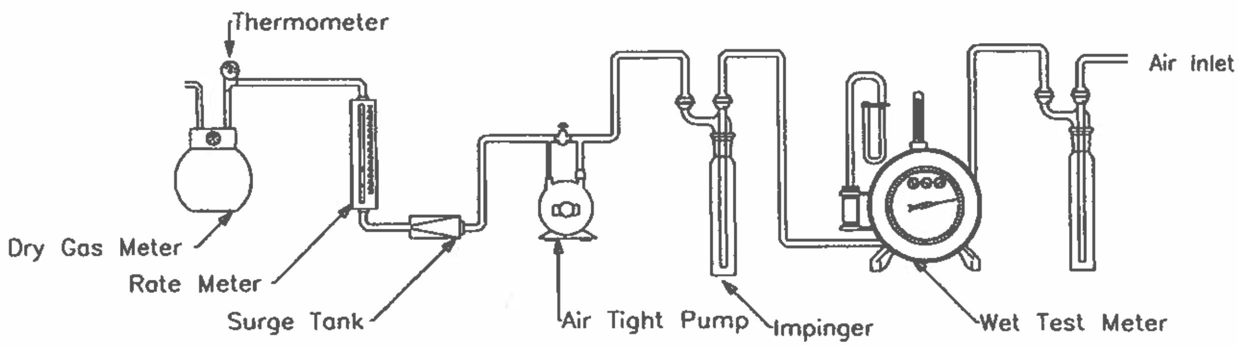
Gas Meter Calibration Train



Dwg - AF

Post Test DGM Calibration

Control Module No.	E51	Date:	01/12/09
Standard Meter No.	677191	Calibrated By:	PPOW
Standard Meter (Yr)	1.002	Barometric Pressure :	29.56

Run Number	Sample Train Vacuum (Hg") (avg test value)	Sample Train DH@$_{avg}$ (H_2O") (avg test value)	Standard Meter Gas Volume Vr	Control Module DGM Volume Vd	Standard Meter Temp. F tr	Dry Gas Meter Inlet Temp. F tdi	Dry Gas Meter Outlet Temp. F tdo	Dry Gas Meter Avg. Temp. F td	Time Min.	Time Sec.	Y	D H@
Initial			94.958	50.510	62	62	62					
Final			101.105	56.855	62	64	63					
Difference 1	1.00	0.90	6.147	6.345	62	63	63	63	10	45	0.968	1.547
Initial			101.105	56.855	62	64	63					
Final			109.670	65.726	62	67	64					
Difference 2	1.00	0.90	8.565	8.871	62	66	64	65	15	0	0.968	1.547
Initial			109.670	65.726	62	67	64					
Final			118.874	74.976	62	70	65					
Difference 3	1.00	0.90	9.204	9.250	62	69	65	67	16	0	1.001	1.518

Post Test Calibration Factor (Y_{avg}):	0.979	1.537
Pre Test Calibration Factor (Y_{avg}):	1.005	
Pre Test Calibration (Date):	07-26-08	
% diff. between Pre & Post (Y_{avg}):	2.6%	

Specifications: CFR 40, Part 60, Appendix A, Method 5, section 10.3.2. Calibration After Use.

If difference between Pre & Post is less than 5% use Pre Test (Y)

Post Test Temperature Indicator Calibration
(For K-Type Thermocouples)

Date: 01/12/09

Name: PPOW

Control Module Number: E51

Ambient (room) Temperature: 62 °F

Reference Thermocouple Calibrator: Omega Engineering, Inc. Model No. CL23A
Reference Thermocouple Calibrator Serial Number: T-256103
Date of Reference Calibration Verification: 2/28/2008

Primary Standards Directly Traceable to:
National Institute of Standards and Technology (NIST)

Reference Source Temperature, (°F)	Test Thermometer Temperature, (°F)	Temperature Difference, %
0	0	0.0
600	601	0.1
1200	1201	0.1

$$\frac{(\text{Ref. Temp., °F} + 460) - (\text{Test Therm. Temp., °F} + 460)}{\text{Ref. Temp., °F} + 460} * 100 <= 1.5\ \%$$

Post Test DGM Calibration

Control Module No.	E51	Date:	05/01/09
Standard Meter No.	677191	Calibrated By:	R. Nunez
Standard Meter (Yr)	1.001	Barometric Pressure :	29.45

Run Number	Sample Train Vacuum (Hg") (avg test value)	Sample Train $\Delta H@_{avg}$ (H_20") (avg test value)	Standard Meter Gas Volume Vr	Control Module DGM Volume Vd	Standard Meter Temp. F tr	Dry Gas Meter Inlet Temp. F tdi	Dry Gas Meter Outlet Temp. F tdo	Dry Gas Meter Avg. Temp. F td	Time Min.	Time Sec.	Y	Δ H@
Initial			16.635	491.088	62	70	67					
Final			26.331	500.849	62	71	67					
Difference 1	4.00	2.00	9.696	9.761	62	71	67	69	12	0	1.001	1.709
Initial			26.331	500.849	62	71	67					
Final			34.404	508.975	62	72	67					
Difference 2	4.00	2.00	8.073	8.126	62	72	67	69	10	0	1.002	1.710
Initial			34.404	508.975	62	72	67					
Final			40.874	515.476	62	72	68					
Difference 3	4.00	2.00	6.470	6.501	62	72	68	70	8	0	1.005	1.703

Post Test Calibration Factor (Y_{avg}):	1.003	1.707
Pre Test Calibration Factor (Y_{avg}):	1.005	
Pre Test Calibration (Date):	07/26/08	
% diff. between Pre & Post (Y_{avg}):	0.2%	

Specifications: CFR 40, Part 60, Appendix A, Method 5, section 10.3.2. Calibration After Use.

If difference between Pre & Post is less than 5% use Pre Test (Y)

Post Test Temperature Indicator Calibration

(For K-Type Thermocouples)

Date: 05/01/09

Name: R. Nunez

Control Module Number: E51

Ambient (room) Temperature: 62 °F

Reference Thermocouple Calibrator: Omega Engineering, Inc. Model No. CL23A *
Reference Thermocouple Calibrator Serial Number: T-256103
Date of Reference Calibration Verification: 2/18/2009
Date of Reference Calibration Verification: 2/18/2010

Reference Source Temperature, (°F)	Test Thermometer Temperature, (°F)	Temperature Difference, %
0	1	0.2
600	601	0.1
1200	1201	0.1

$$\frac{(\text{Ref. Temp., °F} + 460) - (\text{Test Therm. Temp., °F} + 460)}{\text{Ref. Temp., °F} + 460} * 100 <= 1.5\ \%$$

** Primary standard is directly traceable to: National Institute of Standards and Technology (NIST)*

Post Test DGM Calibration

Control Module No.	E 47	Date:	01-28-08
Standard Meter No.	2547157	Calibrated By:	AC
Standard Meter (Yr)	1.006	Barometric Pressure :	29.18

Run Number	Sample Train Vacuum (Hg") (avg test value)	Sample Train $DH@_{avg}(H_2O")$ (avg test value)	Standard Meter Gas Volume Vr	Control Module DGM Volume Vd	Standard Meter Temp. F tr	Dry Gas Meter Inlet Temp. F tdi	Dry Gas Meter Outlet Temp. F tdo	Dry Gas Meter Avg. Temp. F td	Time Min.	Time Sec.	Y	D H@
Initial			452.791	40.428	65	68	66					
Final			457.864	45.510	65	70	66					
Difference 1	0.00	0.89	5.073	5.082	65	69	66	68	9	0	1.001	1.599
Initial			457.864	45.510	65	70	66					
Final			462.957	50.645	65	72	68					
Difference 2	0.00	0.91	5.093	5.135	65	71	67	69	9	0	0.997	1.618
Initial			462.957	50.645	65	72	68					
Final			468.164	55.893	65	73	68					
Difference 3	0.00	0.90	5.207	5.248	65	73	68	70	9	14	1.000	1.607

Post Test Calibration Factor (Y_{avg}):	0.999	1.608
Pre Test Calibration Factor (Y_{avg}):	1.014	
Pre Test Calibration (Date):	04-30-06	
% diff. between Pre & Post (Y_{avg}):	1.5%	

Specifications: CFR 40, Part 60, Appendix A, Method 5, section 10.3.2. Calibration After Use.

If difference between Pre & Post is less than 5% use Pre Test (Y)

Post Test Temperature Indicator Calibration
(For K-Type Thermocouples)

Date: 01-28-08

Name: AC

Control Module Number: E 47

Ambient (room) Temperature: 65 °F

Reference Thermocouple Calibrator: Omega Engineering, Inc. Model No. CL23A
Reference Thermocouple Calibrator Serial Number: T-236796
Date of Reference Calibration Verification: 5/15/2007

Primary Standards Directly Traceable to:
National Institute of Standards and Technology (NIST)

Reference Source Temperature, (°F)	Test Thermometer Temperature, (°F)	Temperature Difference, %
0	2	0.4
600	601	0.1
1200	1200	0.0

$$\frac{(\text{Ref. Temp., }^{\circ}F + 460) - (\text{Test Therm. Temp., }^{\circ}F + 460)}{\text{Ref. Temp., }^{\circ}F + 460} \cdot 100 <= 1.5\ \%$$

Post Test DGM Calibration

Control Module No.	E47	Date:	4/30/09
Standard Meter No.	677191	Calibrated By:	R. Nunez
Standard Meter (Yr)	1.001	Barometric Pressure :	29.33

Run Number	Sample Train Vacuum (Hg") (avg test value)	Sample Train $\Delta H@_{avg}$ (H_20") (avg test value)	Standard Meter Gas Volume Vr	Control Module DGM Volume Vd	Standard Meter Temp. F tr	Dry Gas Meter Inlet Temp. F tdi	Dry Gas Meter Outlet Temp. F tdo	Dry Gas Meter Avg. Temp. F td	Time Min.	Time Sec.	Y	Δ H@
Initial			980.298	82.068	62	69	65					
Final			986.895	88.618	62	72	66					
Difference 1	3.00	2.00	6.597	6.550	62	71	66	68	8	16	1.014	1.762
Initial			986.895	88.618	62	72	66					
Final			995.311	97.028	62	74	68					
Difference 2	3.00	2.00	8.416	8.410	62	73	67	70	10	26	1.011	1.718
Initial			995.311	97.028	62	74	68					
Final			1005.556	107.296	62	76	69					
Difference 3	3.00	2.00	10.245	10.268	62	75	69	72	12	39	1.011	1.699

Post Test Calibration Factor (Y_{avg}):	1.012	1.726
Pre Test Calibration Factor (Y_{avg}):	1.014	
Pre Test Calibration (Date):	04/30/06	
% diff. between Pre & Post (Y_{avg}):	0.2%	

Specifications: CFR 40, Part 60, Appendix A, Method 5, section 10.3.2. Calibration After Use.

If difference between Pre & Post is less than 5% use Pre Test (Y)

Post Test Temperature Indicator Calibration

(For K-Type Thermocouples)

Date: 4/30/09

Name: R. Nunez

Control Module Number: E47

Ambient (room) Temperature: 62 °F

Reference Thermocouple Calibrator: Omega Engineering, Inc. Model No. CL23A *
Reference Thermocouple Calibrator Serial Number: T-256103
Date of Reference Calibration Verification: 2/18/2009
Date of Reference Calibration Verification: 2/18/2010

Reference Source Temperature, (°F)	Test Thermometer Temperature, (°F)	Temperature Difference, %
0	2	0.4
600	601	0.1
1200	1200	0.0

$$\frac{(\text{Ref. Temp., °F} + 460) - (\text{Test Therm. Temp., °F} + 460)}{\text{Ref. Temp., °F} + 460} * 100 <= 1.5\,\%$$

* *Primary standard is directly traceable to: National Institute of Standards and Technology (NIST)*

TYPE S PITOT TUBE INSPECTION DATA FORM

Pitot tube assembly level? __x__ yes ____ no

Pitot tube openings damaged? ____ yes (explain below) __x__ no

a_1 = __2__ ° (<10°), a_2 = __2__ ° (<10°) z = A sin g = __0.058__ (in.); (<0.125 in.)

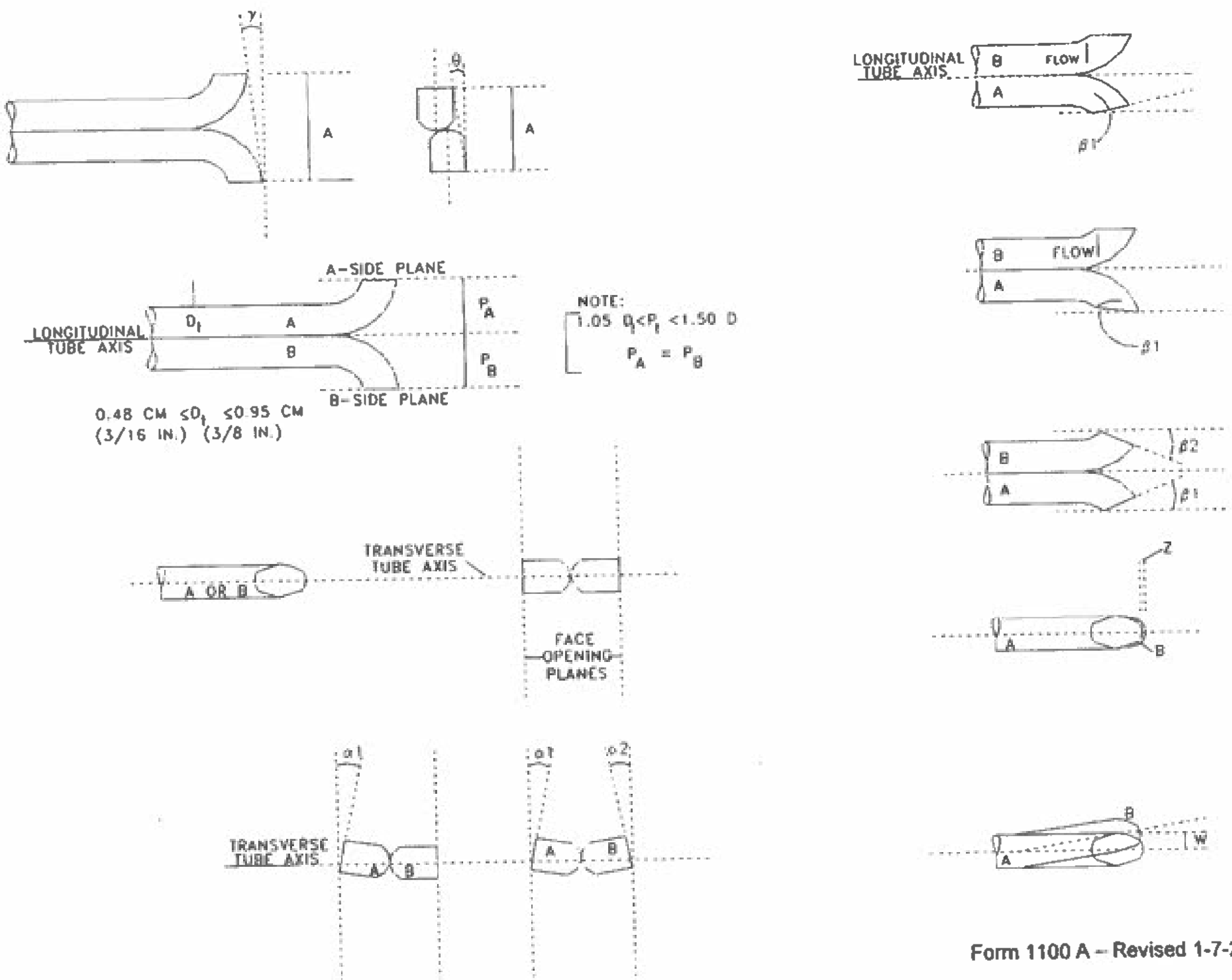
b_1 = __3__ ° (<5°), b_2 = __4__ ° (<5°) w = A sin q = __0.000__ (in.); (<0.03125 in.)

g = __3__ °, q = __0__ °, A = __1.112__ (in.) P_A = __0.556__ (in.), P_B = __0.556__ (in.), D_t = __0.375__ (in.)

Comments: 9.0ft. Pitot probe

Calibration required? ____ yes __X__ no

Pitot Tube No.: __838__ Date: __1/23/2009__ Name: __M. Kielanowicz__



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TYPE S PITOT TUBE INSPECTION DATA FORM

Pitot tube assembly level? __x__ yes _____ no

Pitot tube openings damaged? _____ yes (explain below) __x__ no

a_1 = 2 ° (<10°), a_2 = 2 ° (<10°) z = A sin g = 0.013 (in.); (<0.125 in.)

b_1 = 1 ° (<5°), b_2 = 1 ° (<5°) w = A sin q = 0.013 (in.); (<0.03125 in.)

g = 1 °, q = 1 °, A = 0.719 (in.) P_A = 0.360 (in.), P_B = 0.360 (in.), D_t = 0.250 (in.)

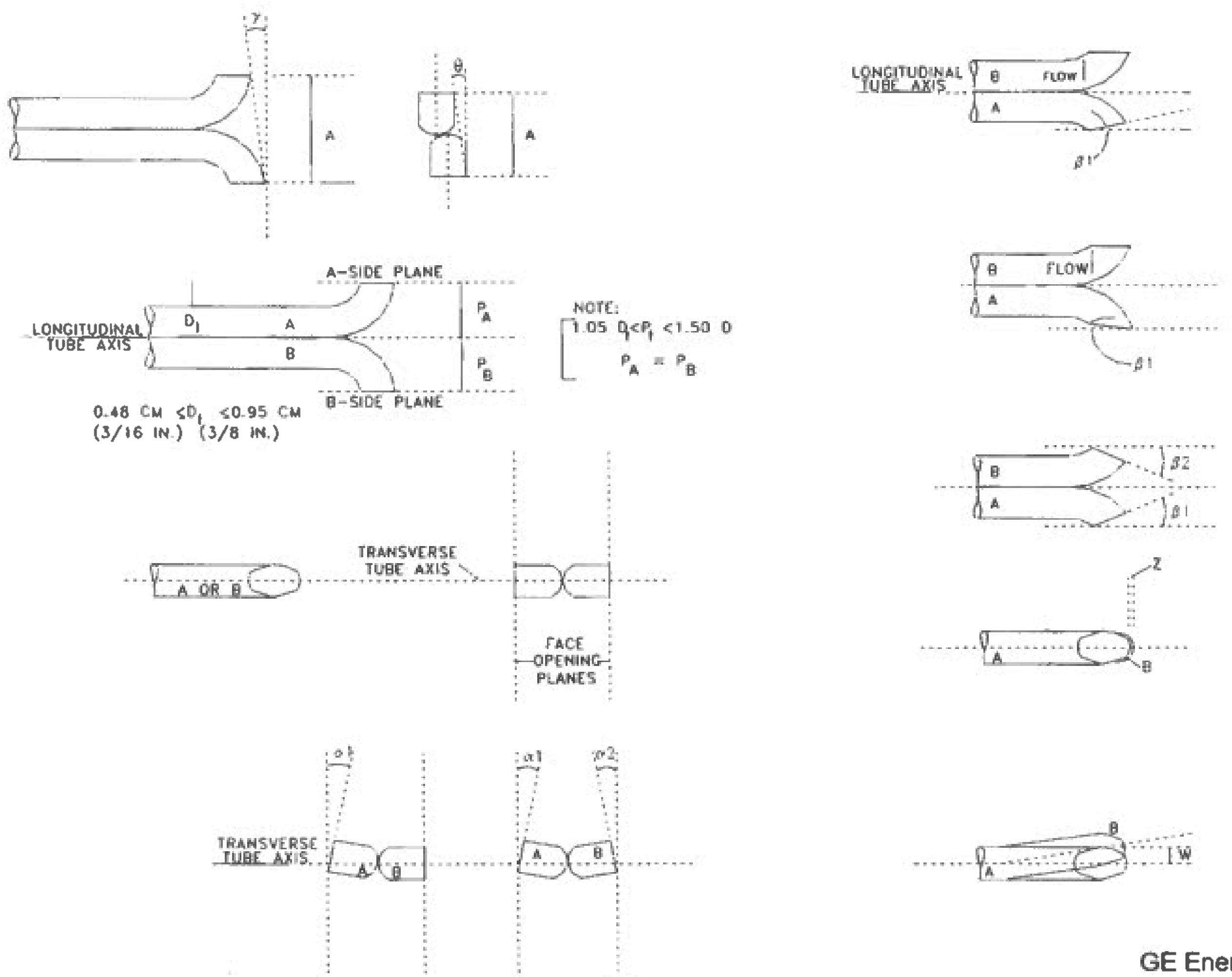
Comments: ________________________________

____

____

Calibration required? _____ yes __X__ no

Pitot Tube No.: 840 Date: 12/2/2007 Name: DCR



Instrumental Reference Method Field Data

Project Number:	M22E1859	Test Date(s):	April 29, 2009
Customer:	Koppers Inc.	Facility:	Stickney, Illinois
Unit Identification:	Thermal Oxidizer	Recorded by:	EAP

RM Analyzer Information			
Location	Manufacturer	Model #	Serial Number
Inlet 1	JUM	VE7	200412
Outlet	JUM	VE7	00061217

Reference Method Initial Linearity Check									
Gas used for Zero Calibration		Air	Gas used for VOC Calibration		Propane	Compliance or RATA?			Compliance
Location	Cal Gas Level	Cal Gas Cylinder Information: Concentration	Exp Date	ID #	Acceptable for Range?	Predicted Response	System Response	% Calibration Error	Acceptability <+-5%
Inlet 1	Zero	0	-	AAL220	Yes	N/A	0.19	N/A	N/A
	Low	499.9	12/16/10	ALM047898	Yes	501.27	496.26	-1.00	Pass
Range	Mid	848.4	12/10/09	ALM035997	Yes	850.59	853.96	0.40	Pass
1700	High	1503.0	4/11/10	ALM051375	Yes	N/A	1506.74	N/A	N/A
Slope=	1.002361943	Intercept=	0.19	Line Equation	Predicted Response = 1.002 x Cal Gas Value + 0.19				
Outlet	Zero	0	-	AAL220	Yes	N/A	0.04	N/A	N/A
	Low	15.73	2/18/11	ALM055086	Yes	15.82	15.67	-0.97	Pass
Range	Mid	29.39	1/7/11	ALM051702	Yes	29.53	29.74	0.72	Pass
60	High	50.47	11/3/11	ALM000430	Yes	N/A	50.68	N/A	N/A
Slope=	1.003368338	Intercept=	0.04	Line Equation	Predicted Response = 1.003 x Cal Gas Value + 0.04				

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Form 1092-1 - Revised 02/12/2009

Instrumental Reference Method Field Data

Project Number: M22E1859

Customer: Koppers Inc.

Unit Identification: Thermal Oxidizer

Test Dates: April 29, 2009

Facility: Stickney, Illinois

Recorded by: EAP

System Response to Zero Calibration Gas

	Inlet 1		Inlet 2		Inlet 3		Inlet 4		Outlet	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Run 1	0.19	41.12	-	-	-	-	-	-	0.04	-0.11
Run 2	41.12	37.91	-	-	-	-	-	-	-0.11	-0.22
Run 3	37.91	39.36	-	-	-	-	-	-	-0.22	-0.20

System Response to Upscale Calibration Gas

	Inlet 1		Inlet 2		Inlet 3		Inlet 4		Outlet	
Cma	499.9		-		-		-		15.73	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Run 1	496.26	511.06	-	-	-	-	-	-	15.67	15.66
Run 2	511.06	513.34	-	-	-	-	-	-	15.66	15.58
Run 3	513.34	532.45	-	-	-	-	-	-	15.58	15.75

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Project Number:	M22E1859	Test Dates:	04/29/09
Customer:	Koppers Inc.	Facility:	Stickney, Illinois
Unit Identification:	Thermal Oxidizer	Recorded by:	EAP

Inlet 1

System Drift Summary

Run #	Calibration Gas Level	Cylinder Certified Concentration	System Response		Drift from Initial Response	Drift Acceptability
			Initial	Final		
		(ppm)	(ppm)	(ppm)	%	+/- 3%
1	Low Level Gas	0.0	0.2	41.1	-2.41	Pass
	Upscale Gas	499.9	496.3	511.1	-0.87	Pass
2	Low Level Gas	0.0	41.1	37.9	-2.22	Pass
	Upscale Gas	499.9	511.1	513.3	-1.00	Pass
3	Low Level Gas	0.0	37.9	39.4	-2.30	Pass
	Upscale Gas	499.9	513.3	532.5	-2.13	Pass

Outlet

System Drift Summary

Run #	Calibration Gas Level	Cylinder Certified Concentration	System Response		Drift	Drift Acceptability
			Initial	Final		
		(ppm)	(ppm)	(ppm)	%	+/- 3%
1	Low Level Gas	0.0	0.0	-0.1	0.25	Pass
	Upscale Gas	15.7	15.7	15.7	0.02	Pass
2	Low Level Gas	0.0	-0.1	-0.2	0.43	Pass
	Upscale Gas	15.7	15.7	15.6	0.15	Pass
3	Low Level Gas	0.0	-0.2	-0.2	0.40	Pass
	Upscale Gas	15.7	15.6	15.8	-0.13	Pass

Method 25A FID Analyzer THC Results Summary

Project Number: M22E1859
Customer: Koppers Inc.
Unit Identification: Thermal Oxidizer

Test Date(s): 04/29/09
Facility: Stickney, Illinois
Recorded by: EAP

Location	Test No.	Test Date(s)	Test Time		THC (ppmv as C_3H_8)	Volumetric Flow (SCFM)	THC Emissions (lb/hr as C_3H_8)	TO Temperature °F
			Begin	End				
Inlet 1	1	4/29/09	8:25	9:25	480.63	1,121	3.691	1350
	2	4/29/09	10:20	11:20	494.39	1,098	3.719	1350
	3	4/29/09	12:15	13:15	561.25	1,036	3.984	1350
	Average				512.09	1,085	3.798	1350

Location	Test No.	Test Date(s)	Test Time		THC (ppmv as C_3H_8)	Volumetric Flow (SCFM)	THC Emissions (lb/hr as C_3H_8)	TO Temperature °F
			Begin	End				
Outlet	1	4/29/09	8:25	9:25	2.17	2,335	0.035	1350
	2	4/29/09	10:20	11:20	1.23	2,359	0.020	1350
	3	4/29/09	12:15	13:15	0.98	2,282	0.015	1350
	Average				1.46	2,325	0.023	1350

Note: Run 1 flow value is the average pitot runs 1 through 4.
Run 2 flow value is the average pitot runs 5 through 8.
Run 3 flow value is the average pitot runs 9 through 12.

$$\text{Emission Rate (lb } C_3H_8\text{/hr)} = \frac{\text{THC Concentration (ppmv as } C_3H_8)}{8.7573 \times 10^6} \text{ Flow, scfm} \times 60 \text{ mins/hr}$$

Sample Calculation Inlet Test 1:

$$\text{Emission Rate (lb } C_3H_8\text{/hr)} = \frac{480.63 \text{ (ppmv as } C_3H_8)}{8.7573 \times 10^6} \times 1{,}121 \text{ scfm} \times 60 \text{ mins/hr}$$

Emission Rate (lb C_3H_8 /hr) = 3.691

Destruction Efficiency				
Test No.	Inlet THC Emissions (lb/hr as C_3H_8)	Outlet THC Emissions (lb/hr as C_3H_8)	Efficiency (%)	TO Temperature °F
1	3.69	0.035	99.06	1350
2	3.72	0.020	99.47	1350
3	3.98	0.015	99.62	1350
Average	3.80	0.023	99.38	1350

$$\text{Destruction Efficiency (\%)} = \frac{\text{Inlet (lb/hr as } C_3H_8) - \text{Outlet (lb/hr as } C_3H_8)}{\text{Inlet (lb/hr as } C_3H_8)} \times 100\%$$

Sample Calculation Test 1:

$$\text{Destruction Efficiency (\%)} = \frac{3.69 \text{ lb/hr} - 0.035 \text{ lb/hr}}{3.69 \text{ lb/hr}} \times 100\%$$

Destruction Efficiency (%) = 99.06

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Koppers Inc.
Stickney, Illinois
Thermal Oxidizer
04/29/09

Linearity/Pre 1

Time	Inlet VOC	Stack VOC
7:16	38.20	0.04
7:17	28.69	0.11
7:18	21.60	22.17
7:19	18.62	49.89
7:20	15.11	50.62
7:21	10.64	50.66
7:22	6.86	50.68
7:23	5.33	50.59
7:24	3.49	39.22
7:25	16.20	29.83
7:26	-0.47	29.74
7:27	-1.50	29.47
7:28	-2.68	9.43
7:29	-0.56	15.69
7:30	-0.56	15.67
7:31	-1.41	15.33
7:32	-2.55	1.23
7:33	-3.49	1.23
7:34	-1.44	1.20
7:35	0.19	1.55
7:36	1163.39	1.74
7:37	1504.20	1.09
7:38	1506.44	0.99
7:39	1506.82	1.00
7:40	1506.74	2.22
7:41	884.60	3.32
7:42	854.62	1.50
7:43	853.96	1.48
7:44	716.89	2.27
7:45	497.80	1.23
7:46	496.26	1.04

Koppers Inc.
Stickney, Illinois
Thermal Oxidizer
04/29/09

Post 1/Pre 2

Time	Inlet VOC	Stack VOC
9:27	435.46	1.21
9:28	366.56	-0.06
9:29	329.99	-0.06
9:30	305.45	-0.10
9:31	286.30	-0.11
9:32	270.38	1.98
9:33	257.16	15.34
9:34	245.97	15.46
9:35	234.82	15.53
9:36	224.84	15.57
9:37	215.52	15.61
9:38	201.86	15.62
9:39	118.00	15.65
9:40	59.32	15.66
10:00	62.50	1.09
10:01	59.63	1.13
10:02	57.10	1.18
10:03	54.79	1.16
10:04	52.34	1.06
10:05	49.73	1.08
10:06	48.10	1.26
10:07	132.81	1.09
10:08	511.03	1.02
10:09	511.84	1.03
10:10	511.06	1.01
10:11	394.71	1.01
10:12	43.83	0.92
10:13	41.12	0.82

Koppers Inc.
Stickney, Illinois
Thermal Oxidizer
04/29/09

Post 2/Pre 3

Time	Inlet VOC	Stack VOC
11:24	243.48	-0.20
11:25	212.23	-0.22
11:26	190.91	-0.19
11:27	175.08	12.78
11:28	160.86	15.49
11:29	149.85	15.54
11:30	140.57	15.58
11:31	132.39	15.58
11:50	55.93	0.64
11:51	52.78	0.81
11:52	48.97	0.77
11:53	46.95	0.73
11:54	475.76	0.72
11:55	512.87	0.71
11:56	513.32	0.79
11:57	513.34	0.80
11:58	512.85	0.72
11:59	102.01	0.68
12:00	39.82	0.68
12:01	37.91	0.72

Koppers Inc.
Stickney, Illinois
Thermal Oxidizer
04/29/09

Post 3

Time	Inlet VOC	Stack VOC
13:19	194.65	-0.19
13:20	172.68	-0.20
13:21	155.44	1.72
13:22	142.48	15.23
13:23	127.25	15.55
13:24	114.88	15.66
13:25	118.70	15.72
13:26	107.47	15.75
13:27	104.16	15.80
13:28	100.62	3.74
13:29	94.02	0.38
13:30	91.00	0.74
13:31	86.72	1.14
13:32	81.67	1.19
13:33	76.70	1.47
13:34	71.18	0.97
13:35	65.44	1.42
13:36	61.92	1.29
13:37	58.26	2.30
13:38	55.14	3.79
13:39	291.62	1.13
13:40	534.03	1.05
13:41	532.41	1.04
13:42	532.45	1.01
13:43	535.24	1.10
13:44	496.28	1.08
13:45	58.71	0.98
13:46	47.91	0.88
13:47	45.33	0.94
13:48	43.01	1.02
13:49	41.27	1.06
13:50	39.36	1.05

PITOT TRAVERSE DATA

Project: Koppers

Location: ~~RTO Inlet~~ TO Inlet (on all) 5/20/09 KEM

Date: 4-29-09 Test No: 1 Run 1 Time: 834 - 839

Point No.	ΔP	√ΔP	t_s	α	Point No.	ΔP	√ΔP	t_s	α
1-1	.23		209		2-1	.22		208	
2	.30		209		2	.23		208	
3	.20		208		3	.23		207	
4	.25		206		4	.18		202	
5	.21		195		5	.14		170	
6	.14		154		6	.08		126	

Preliminary Velocity Calculation (This data has not been peer reviewed and may not be accurate)

P_{bar} 29.98 "Hg Static -.55 "H_2O P_g ____ "Hg P_s ____ "Hg Pitot ID 838 Cp ~~.839~~ 0.840 Temp. ID ES1

0.44 × ____ %CO_2 = ____ √ΔP ____ t_s ____ °F T ____ °R Flue Area .83 ft^2

0.32 × ____ %O_2 = + ____ Duct Dimensions 1.03

0.28 × ____ %N_2 = + ____ B_{ws} ____ 1 - B_{ws} ____ Disturbance: Upstream ____

(____ Md × ____ 1-Bws) + (18 × ____ Bws) = ____ (Ms) Downstream ____

$$v_s = 85.49 \times \_\_\_ Cp \times \sqrt{\frac{(\_\_\_)Ts\,°R}{Ms \times \_\_\_ Ps}} \times \_\_\_ \sqrt{\Delta P} = \_\_\_ \text{ ft/sec (Vs)}$$

Q_{acfm} = ____ Vs × ____ Flue Area × 60 = ____ acfm Port Length 6 Inches

$$Q_{scfm} = 17.647 \times ACFM \times \frac{Ps}{Ts\,°R} = \_\_\_ \text{ SCFM}$$

$$Q_{dscfm} = 17.647 \times ACFM \times \frac{Ps}{Ts\,°R} \times (1\text{-}Bws) = \_\_\_ \text{ DSCFM}$$

Pre-test leak check ✓ "H_2O

Post-test leak check ✓ "H_2O

Data Taken By: GL / JMM

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PITOT TRAVERSE DATA

Project: Koppers
Location: RTO Inlet
Date: 4-29-09 Test No: 1 Run 2 Time: 854 - 859

Point No.	ΔP	√ΔP	ts	α	Point No.	ΔP	√ΔP	ts	α
1-1	.21		209		2-1	.23		209	
2	.24		209		2	.29		209	
3	.22		209		3	.27		209	
4	.18		202		4	.24		205	
5	.17		202		5	.22		196	
6	.14		183		6	.16		190	

Preliminary Velocity Calculation (This data has not been peer reviewed and may not be accurate)

P_{bar} 29.96 "Hg Static -.55 "H_2O P_g ____ "Hg P_s ____ "Hg Pitot ID 838 Cp ~~.839~~ 0.840 Temp. ID E51

0.44 × ____ %CO_2 = ____ √ΔP ____ t_s ____ °F T ____ °R Flue Area .83 ft²

0.32 × ____ %O_2 = + ____ Duct Dimensions 1.03

0.28 × ____ %N_2 = + ____ B_{ws} ____ 1 - B_{ws} ____ Disturbance: Upstream ____

(____ Md × ____ 1-Bws) + (18 × ____ Bws) = ____ (Ms) Downstream ____

$$\dot{v}_s = 85.49 \times \_\_\_ Cp \times \sqrt{\frac{(\_\_\_)Ts\,°R}{\_\_\_ Ms \times \_\_\_ Ps}} \times \_\_\_ \sqrt{\Delta P} = \_\_\_ \text{ ft/sec (Vs)}$$

Q_{acfm} = ____ Vs × ____ Flue Area × 60 = ____ acfm Port Length 6 Inches

$$Q_{scfm} = 17.647 \times ACFM \times \frac{Ps}{Ts\,°R} = \_\_\_ \text{ SCFM}$$

$$Q_{dscfm} = 17.647 \times ACFM \times \frac{Ps}{Ts\,°R} \times (1\text{-}Bws) = \_\_\_ \text{ DSCFM}$$

Pre-test leak check ✓ "H_2O

Post-test leak check ✓ "H_2O

Data Taken By: GL/JMN

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PITOT TRAVERSE DATA

Project: Koppers

Location: RTO Inlet

Date: 4-29-09 Test No: 1 Run 3 Time: 908 – 913

Point No.	ΔP	√ΔP	ts	α	Point No.	ΔP	√ΔP	ts	α
1-1	.25		209		2-1	.19		209	
2	.29		208		2	.22		209	
3	.26		207		3	.18		209	
4	.23		203		4	.18		202	
5	.21		200		5	.11		158	
6	.17		170		6	.08		140	

Preliminary Velocity Calculation (This data has not been peer reviewed and may not be accurate)

P_{bar} 29.98 "Hg Static -.55 "H_2O P_g ____ "Hg P_s ____ "Hg Pitot ID 838 C_p ~~.839~~ 0.840 Temp. ID E51

0.44 × ____ %CO_2 = ____ √ΔP ____ t_s ____ °F T ____ °R Flue Area .83 ft²

0.32 × ____ %O_2 = + ____ Duct Dimensions 1.03

0.28 × ____ %N_2 = + ____ B_{ws} ____ 1 - B_{ws} ____ Disturbance: Upstream ____

(____ Md × ____ 1-Bws) + (18 × ____ Bws) = ____ (Ms) Downstream ____

$$v_s = 85.49 \times \_\_\_ Cp \times \sqrt{\frac{(\_\_\_)Ts\,°R}{\_\_\_ Ms \times \_\_\_ Ps}} \times \_\_\_ \sqrt{\Delta P} = \_\_\_ ft/sec (Vs)$$

Q_{acfm} = ____ Vs × ____ Flue Area × 60 = ____ acfm Port Length 6 Inches

$$Q_{scfm} = 17.647 \times ACFM \times \frac{Ps}{Ts\,°R} = \_\_\_ SCFM$$

$$Q_{dscfm} = 17.647 \times ACFM \times \frac{Ps}{Ts\,°R} \times (1-Bws) = \_\_\_ DSCFM$$

Pre-test leak check ✓ "H_2O

Post-test leak check ✓ "H_2O

Data Taken By: GL / JMM

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Form 1012 – Revised 1-4-2008

PITOT TRAVERSE DATA

Project: Koppers

Location: RTO Inlet

Date: 4-29-09 Test No: 1 Run 4 Time: 924-929

Point No.	ΔP	√ΔP	ts	α	Point No.	ΔP	√ΔP	ts	α
1-1	,23		208		2-1	,24		209	
2	,23		208		2	,24		209	
3	,14		208		3	,24		209	
4	.16		207		4	,20		206	
5	,14		206		5	,19		204	
6	,07		200		6	,15		190	

Preliminary Velocity Calculation (This data has not been peer reviewed and may not be accurate)

P_{bar} 29.98 "Hg Static -.55 "H_2O P_g ____ "Hg P_s ____ "Hg Pitot ID 838 C_p ~~.839~~ 0.840 Temp. ID ES1

0.44 × ____ %CO_2 = ____ √ΔP ____ t_s ____ °F T ____ °R Flue Area .83 ft²

0.32 × ____ %O_2 = + ____ Duct Dimensions 1.03

0.28 × ____ %N_2 = + ____ B_{ws} ____ 1 - B_{ws} ____ Disturbance: Upstream ____

(____ Md × ____ 1-Bws) + (18 × ____ Bws) = ____ (Ms) Downstream ____

v_s = 85.49 × ____ Cp × √[(____)Ts °R / (____ Ms × ____ Ps)] × ____ √ΔP = ____ ft/sec(Vs)

Q_{acfm} = ____ Vs × ____ Flue Area × 60 = ____ acfm Port Length 6 Inches

Q_{scfm} = 17.647 × ACFM × Ps / Ts °R = ____ SCFM

Q_{dscfm} = 17.647 × ACFM × Ps / Ts °R × (1-Bws) = ____ DSCFM

Pre-test leak check ✓ "H_2O

Post-test leak check ✓ "H_2O

Data Taken By: GL / JMM

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PITOT TRAVERSE DATA

Project: Koppers

Location: RTO Inlet

Date: 4-29-09 Test No: 2 Run 1 Time: 1020 – 1025

Point No.	ΔP	√ΔP	t_s	α	Point No.	ΔP	√ΔP	t_s	α
1-1	.22		209		2-1	.25		209	
2	.26		209		2	.26		209	
3	.25		208		3	.21		209	
4	.26		204		4	.19		200	
5	.21		170		5	.11		168	
6	.20		140		6	.08		147	

Preliminary Velocity Calculation (This data has not been peer reviewed and may not be accurate)

P_{bar} 29.98 "Hg Static -.55 "H_2O P_g ____ "Hg P_s ____ "Hg Pitot ID 838 Cp ~~.839~~ 0.840 Temp. ID E51

0.44 × ____ %CO_2 = ____ √ΔP ____ t_s ____ °F T ____ °R Flue Area .83 ft²

0.32 × ____ %O_2 = + ____ Duct Dimensions 1.03

0.28 × ____ %N_2 = + ____ B_{ws} ____ 1 - B_{ws} ____ Disturbance: Upstream ____

(____ Md × ____ 1-Bws) + (18 × ____ Bws) = ____ (Ms) Downstream ____

$$v_s = 85.49 \times \_\_\_ Cp \times \sqrt{\frac{(\_\_\_)Ts\,°R}{\_\_\_Ms \times \_\_\_Ps}} \times \_\_\_\sqrt{\Delta P} = \_\_\_ \text{ft/sec (Vs)}$$

Q_{acfm} = ____ Vs × ____ Flue Area × 60 = ____ acfm Port Length 6 inches

$Q_{scfm} = 17.647 \times ACFM \times \frac{Ps}{Ts\,°R}$ = ____ SCFM

$Q_{dscfm} = 17.647 \times ACFM \times \frac{Ps}{Ts\,°R} \times (1-Bws)$ = ____ DSCFM

Pre-test leak check ✓ "H_2O

Post-test leak check ✓ "H_2O

Data Taken By: GL / JMM

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PITOT TRAVERSE DATA

Project: Koppers

Location: RTO Inlet

Date: 4-29-09 Test No: 2 Run 2 Time: 1038 – 1043

Point No.	ΔP	√ΔP	t_s	α	Point No.	ΔP	√ΔP	t_s	α
1-1	.28		209		2-1	.25		208	
2	.27		209		2	.28		208	
3	.11		209		3	.25		208	
4	.21		207		4	.14		204	
5	.18		200		5	.16		190	
6	.13		163		6	.14		130	

Preliminary Velocity Calculation (This data has not been peer reviewed and may not be accurate)

P_{bar} 29.78 "Hg Static -.55 "H_2O P_g ____ "Hg P_s ____ "Hg Pitot ID 838 C_p ~~.837~~ 0.840 Temp. ID E51

0.44 × ____ %CO_2 = ____ √ΔP ____ t_s ____ °F T ____ °R Flue Area .83 ft²

0.32 × ____ %O_2 = + ____ Duct Dimensions 1.03

0.28 × ____ %N_2 = + ____ B_{ws} ____ 1 - B_{ws} ____ Disturbance: Upstream ____

(____ Md × ____ 1-Bws) + (18 × ____ Bws) = ____ (Ms) Downstream ____

$$v_s = 85.49 \times \_\_\_ C_p \times \sqrt{\frac{(\_\_\_)T_s\,°R}{\_\_\_ M_s \times \_\_\_ P_s}} \times \_\_\_ \sqrt{\Delta P} = \_\_\_ \text{ ft/sec}(V_s)$$

Q_{acfm} = ____ Vs × ____ Flue Area × 60 = ____ acfm Port Length 6 Inches

$$Q_{scfm} = 17.647 \times ACFM \times \frac{P_s}{T_s\,°R} = \_\_\_ \text{ SCFM}$$

$$Q_{dscfm} = 17.647 \times ACFM \times \frac{P_s}{T_s\,°R} \times (1\text{-}B_{ws}) = \_\_\_ \text{ DSCFM}$$

Pre-test leak check ✓ "H_2O

Post-test leak check ✓ "H_2O

Data Taken By: GL / JMM

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PITOT TRAVERSE DATA

Project: Koppers

Location: RTO Inlet

Date: 4-29-09 Test No: 2 Run 3 Time: 1057-1102

Point No.	ΔP	$\sqrt{\Delta P}$	t_s	α	Point No.	ΔP	$\sqrt{\Delta P}$	t_s	α
1-1	.25		209		2-1	.24		209	
2	.24		210		2	.25		209	
3	.24		210		3	.20		209	
4	.19		208		4	.16		180	
5	.19		200		5	.15		180	
6	.14		149		6	.06		140	

Preliminary Velocity Calculation (This data has not been peer reviewed and may not be accurate)

P_{bar} 29.98 "Hg Static -.55 "H_2O P_g ____ "Hg P_s ____ "Hg Pitot ID 838 C_p ~~.839~~ 0.840 Temp. ID ES1

0.44 × ____ %CO_2 = ____ $\sqrt{\Delta P}$ ____ t_s ____ °F T ____ °R Flue Area .83 ft²

0.32 × ____ %O_2 = + ____ Duct Dimensions 1.03

0.28 × ____ %N_2 = + ____ B_{ws} ____ 1 - B_{ws} ____ Disturbance: Upstream ____

(____ Md × ____ 1-Bws) + (18 × ____ Bws) = ____ (Ms) Downstream ____

$$v_s = 85.49 \times \_\_\_ Cp \times \sqrt{\frac{(\_\_\_)Ts\ °R}{\_\_\_ Ms \times \_\_\_ Ps}} \times \_\_\_ \sqrt{\Delta P} = \_\_\_ ft/sec (Vs)$$

Q_{acfm} = ____ Vs × ____ Flue Area × 60 = ____ acfm Port Length 6 Inches

$$Q_{scfm} = 17.647 \times ACFM \times \frac{Ps}{Ts\ °R} = \_\_\_\_ SCFM$$

$$Q_{dscfm} = 17.647 \times ACFM \times \frac{Ps}{Ts\ °R} \times (1-Bws) = \_\_\_\_ DSCFM$$

Pre-test leak check ✓ "H_2O

Post-test leak check ✓ "H_2O Data Taken By: GC / JMM

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PITOT TRAVERSE DATA

Project: Koppers

Location: RTO Inlet

Date: 4-29-09 Test No: 2 Run 4 Time: 1121-1126

Point No.	ΔP	√ΔP	t_s	α	Point No.	ΔP	√ΔP	t_s	α
1-1	.22		205		2-1	.21		205	
2	.23		209		2	.24		205	
3	.22		206		3	.21		209	
4	.21		206		4	.13		202	
5	.10		200		5	.09		180	
6	.06		179		6	.08		160	

Preliminary Velocity Calculation (This data has not been peer reviewed and may not be accurate)

P_{bar} 29.98 "Hg Static -.55 "H_2O P_g ____ "Hg P_s ____ "Hg Pitot ID 838 C_p ~~.637~~ 0.840 Temp. ID E51

0.44 × ____ %CO_2 = ____ √ΔP ____ t_s ____ °F T ____ °R Flue Area .83 ft²

0.32 × ____ %O_2 = + ____ Duct Dimensions 1.03

0.28 × ____ %N_2 = + ____ B_{ws} ____ 1 - B_{ws} ____ Disturbance: Upstream ____

(____ Md × ____ 1-Bws) + (18 × ____ Bws) = ____ (Ms) Downstream ____

$$v_s = 85.49 \times \_\_\_ Cp \times \sqrt{\frac{(\_\_\_)Ts\,°R}{\_\_\_Ms \times \_\_\_Ps}} \times \_\_\_\sqrt{\Delta P} = \_\_\_ \text{ft/sec}(Vs)$$

Q_{acfm} = ____ Vs × ____ Flue Area × 60 = ____ acfm Port Length 6 Inches

Q_{scfm} = 17.647 × ACFM × $\frac{Ps}{Ts\,°R}$ = ____ SCFM

Q_{dscfm} = 17.647 × ACFM × $\frac{Ps}{Ts\,°R}$ × (1-Bws) = ____ DSCFM

Pre-test leak check ✓ "H_2O

Post-test leak check ✓ "H_2O

Data Taken By: GL/JMM

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PITOT TRAVERSE DATA

Project: Koppers

Location: RTO Inlet

Date: 4-29-09 Test No: 3 Run 1 Time: 1221-1226

Point No.	ΔP	√ΔP	t_s	α	Point No.	ΔP	√ΔP	t_s	α
1-1	.18		212		2-1	.21		212	
2	.26		213		2	.22		212	
3	.25		212		3	.19		210	
4	.17		203		4	.16		200	
5	.12		174		5	.08		168	
6	.07		157		6	.06		136	

Preliminary Velocity Calculation (This data has not been peer reviewed and may not be accurate)

P_{bar} 29.98 "Hg Static -.50 "H_2O P_g ____ "Hg P_s ____ "Hg Pitot ID 838 C_p .837 Temp. ID E51

0.44 × ____ %CO_2 = ____ √ΔP ____ t_s ____ °F T ____ °R 0.840 Flue Area .83 ft²

0.32 × ____ %O_2 = + ____ Duct Dimensions 1.03

0.28 × ____ %N_2 = + ____ B_{ws} ____ 1 - B_{ws} ____ Disturbance: Upstream ____

(____ Md × ____ 1-Bws) + (18 × ____ Bws) = ____ (Ms) Downstream ____

$$v_s = 85.49 \times \_\_\_ Cp \times \sqrt{\frac{(\_\_\_)Ts\,°R}{\_\_\_Ms \times \_\_\_Ps}} \times \_\_\_\sqrt{\Delta P} = \_\_\_ \text{ ft/sec (Vs)}$$

Q_{acfm} = ____ Vs × ____ Flue Area × 60 = ____ acfm Port Length 6 Inches

$$Q_{scfm} = 17.647 \times ACFM \times \frac{Ps}{Ts\,°R} = \_\_\_\_ \text{ SCFM}$$

$$Q_{dscfm} = 17.647 \times ACFM \times \frac{Ps}{Ts\,°R} \times (1\text{-}Bws) = \_\_\_\_ \text{ DSCFM}$$

Pre-test leak check ✓ "H_2O

Post-test leak check ✓ "H_2O Data Taken By: GC/JMM

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PITOT TRAVERSE DATA

Project: Koppers

Location: RTO Inlet

Date: 4-29-09 Test No: 3 Run 2 Time: 1241 – 1246

Point No.	ΔP	$\sqrt{\Delta P}$	t_s	α	Point No.	ΔP	$\sqrt{\Delta P}$	t_s	α
1-1	.21		214		2-1	.22		214	
2	.23		214		2	.24		214	
3	.20		212		3	.23		210	
4	.19		200		4	.20		200	
5	.11		161		5	.13		163	
6	.08		140		6	.12		147	

Preliminary Velocity Calculation (This data has not been peer reviewed and may not be accurate)

P_{bar} 29.98 "Hg Static -.55 "H_2O P_g____ "Hg P_s____ "Hg Pitot ID 838 Cp ~~.837~~ 0.840 Temp. ID E51

0.44 × ____ %CO_2 = ____ $\sqrt{\Delta P}$ ____ t_s____ °F T____ °R Flue Area .83 ft²

0.32 × ____ %O_2 = + ____ Duct Dimensions 1.03

0.28 × ____ %N_2 = + ____ B_{ws}____ 1 - B_{ws}____ Disturbance: Upstream ____

(____ Md × ____ 1-Bws) + (18 × ____ Bws) = ____ (Ms) Downstream ____

$$v_s = 85.49 \times \_\_\_ Cp \times \sqrt{\frac{(\_\_\_)Ts\,°R}{\_\_\_ Ms \times \_\_\_ Ps}} \times \_\_\_ \sqrt{\Delta P} = \_\_\_ \text{ ft/sec (Vs)}$$

Q_{acfm} = ____ Vs × ____ Flue Area × 60 = ____ acfm Port Length 6 Inches

$$Q_{scfm} = 17.647 \times ACFM \times \frac{Ps}{Ts\,°R} = \_\_\_ \text{ SCFM}$$

$$Q_{dscfm} = 17.647 \times ACFM \times \frac{Ps}{Ts\,°R} \times (1\text{-}Bws) = \_\_\_ \text{ DSCFM}$$

Pre-test leak check ✓ "H_2O

Post-test leak check ✓ "H_2O

Data Taken By: GL / JMM

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PITOT TRAVERSE DATA

Project: Koppers

Location: RTO Inlet

Date: 4-29-09 Test No: 3 Run 3 Time: 1254-1259

Point No.	ΔP	$\sqrt{\Delta P}$	t_s	α	Point No.	ΔP	$\sqrt{\Delta P}$	t_s	α
1-1	.21		212		2-1	.22		212	
2	.23		211		2	.22		212	
3	.21		211		3	.20		209	
4	.15		206		4	.16		202	
5	.14		200		5	.12		179	
6	.13		171		6	.08		160	

Preliminary Velocity Calculation (This data has not been peer reviewed and may not be accurate)

P_{bar} 29.98 "Hg Static -.55 "H_2O P_g ____ "Hg P_s ____ "Hg Pitot ID 838 ~~Cp .839~~ Temp. ID ES1

0.44 × ____ %CO_2 = ____ $\sqrt{\Delta P}$ ____ t_s ____ °F T ____ °R 0.840 Flue Area .83 ft²

0.32 × ____ %O_2 = + ____ Duct Dimensions 1.03

0.28 × ____ %N_2 = + ____ B_{ws} ____ 1 - B_{ws} ____ Disturbance: Upstream ____

(____ Md × ____ 1-Bws) + (18 × ____ Bws) = ____ (Ms) Downstream ____

$$v_s = 85.49 \times \_\_\_ Cp \times \sqrt{\frac{(\_\_\_)Ts\,°R}{\_\_\_ Ms \times \_\_\_ Ps}} \times \_\_\_ \sqrt{\Delta P} = \_\_\_ \text{ft/sec (Vs)}$$

Q_{acfm} = ____ Vs × ____ Flue Area × 60 = ____ acfm Port Length 6 Inches

$$Q_{scfm} = 17.647 \times ACFM \times \frac{Ps}{Ts\,°R} = \_\_\_ \text{SCFM}$$

$$Q_{dscfm} = 17.647 \times ACFM \times \frac{Ps}{Ts\,°R} \times (1-Bws) = \_\_\_ \text{DSCFM}$$

Pre-test leak check ✓ "H_2O

Post-test leak check ✓ "H_2O

Data Taken By: GL/JMM

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PITOT TRAVERSE DATA

Project: Koppers

Location: RTO Inlet

Date: 4-29-09 Test No: 3 Run 4 Time: 1306 - 1311

Point No.	ΔP	√ΔP	t_s	α	Point No.	ΔP	√ΔP	t_s	α
1-1	.21		213		2-1	.21		213	
2	.22		213		2	.22		213	
3	.22		213		3	.20		213	
4	.18		189		4	.18		200	
5	.14		176		5	.11		194	
6	.10		151		6	.09		180	

Preliminary Velocity Calculation (This data has not been peer reviewed and may not be accurate)

P_{bar} 29.98 "Hg Static -.55 "H_2O P_g ____ "Hg P_s ____ "Hg Pitot ID 838 Cp 0.840 Temp. ID E51

0.44 × ____ %CO_2 = ____ √ΔP ____ t_s ____ °F T ____ °R Flue Area .83 ft²

0.32 × ____ %O_2 = + ____ Duct Dimensions 1.03

0.28 × ____ %N_2 = + ____ B_{ws} ____ 1 - B_{ws} ____ Disturbance: Upstream ____

(____ Md × ____ 1-Bws) + (18 × ____ Bws) = ____ (Ms) Downstream ____

$$v_s = 85.49 \times \_\_\_ Cp \times \sqrt{\frac{(\_\_\_)Ts\,°R}{\_\_\_Ms \times \_\_\_Ps}} \times \_\_\_\sqrt{\Delta P} = \_\_\_ \text{ ft/sec (Vs)}$$

Q_{acfm} = ____ Vs × ____ Flue Area × 60 = ____ acfm Port Length 6 Inches

$$Q_{scfm} = 17.647 \times ACFM \times \frac{Ps}{Ts\,°R} = \_\_\_ \text{ SCFM}$$

$$Q_{dscfm} = 17.647 \times ACFM \times \frac{Ps}{Ts\,°R} \times (1\text{-}Bws) = \_\_\_ \text{ DSCFM}$$

Pre-test leak check ✓ "H_2O

Post-test leak check ✓ "H_2O

Data Taken By: GL / JMM

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MOISTURE FIELD DATA SHEET

Project: Koppers Date: 4-29-09
Sampling Location: RTO Inlet
Source Condition: 1350° oxidizer Temp Monitor: Model ____
Dry Gas Meter No. #51 Y = 1.005 Serial No. ____
Top Loading Balance Calibration Check. Challenge Weight Used: ____ Resultant Weight ____ Pass? ____
Challenge Weight Used: ____ Resultant Weight ____ Pass? ____

Test (Run) No. 1 Barometric Pressure (P_{bar}) ____ in. Hg
Gas Temperature ____ °F Static Pressure ____ in. Hg
Orsat Analysis ____ %CO_2 ____ %O_2

Clock Time 24 hour	Meter Volume (V_m) ft³	Meter Gage Pressure (ΔH) in. H_2O	Meter Temp. (t_m) °F	Impgr. Outlet Temp °F
825	361.290	.65	54	35
830	363.40	.65	55	40
835	365.80	.65	55	45
840	368.70	.65	56	50
845	370.90	.65	57	52
850	373.60	.65	57	54
855	375.80	.65	58	56
900	378.10	.65	58	56
905	380.4	.65	58	56
910	382.5	.65	58	56
915	384.90	.65	58	56
920	386.70	.65	56	56
925	389.361	.65	58	56
Avg.			56.9 (T_m) °R	

Condensate: 220 mls (V_f); - 200 mls (V_i); ____ mls; × 0.04707 = ____ ft³ [$V_{wc(std)}$] +

Silica Gel or Train: 216.2 grams (W_f); - 211.9 grams (W_i); ____ grams; × 0.04715 = ____ ft³ [$V_{wsg(std)}$]

= ____ ft³ [$V_{w(std)}$]

$V_{m(std)}$ = ____ ft³

Water Vapor, proportion by volume

B_{ws} = ____

Leak Check: 0.000 / 10; 0.000 / 10

Moisture correction factor: 1 - B_{ws} = ____

Comments:

Test (Run) No. ____ Barometric Pressure (P_{bar}) ____ in. Hg
Gas Temperature ____ °F Static Pressure ____ in. Hg
Orsat Analysis ____ %CO_2 ____ %O_2

Clock Time 24 hour	Meter Volume (V_m) ft³	Meter Gage Pressure (ΔH) in. H_2O	Meter Temp. (t_m) °F	Impgr. Outlet Temp °F
1020	389.435	.65	63	59
1025	392.00	.65	63	59
1030	394.80	.65	63	59
1035	397.30	.65	63	59
1040	399.6	.65	64	59
1045	401.40	.65	64	59
1050	403.50	.65	64	59
1055	405.80	.65	64	60
1100	408.70	.65	65	60
1105	410.9	.65	65	60
1110	411.60	.65	65	60
1115	414.30	.65	65	60
1120	417.248	.65	65	60
Avg.			64.1 (T_m) °R	

Condensate: 220 mls (V_f); - 200 mls (V_i); ____ mls; × 0.04707 = ____ ft³ [$V_{wc(std)}$] +

Silica Gel or Train: 216.4 grams (W_f); - 210.7 grams (W_i); ____ grams; × 0.04715 = ____ ft³ [$V_{wsg(std)}$]

= ____ ft³ [$V_{w(std)}$]

$V_{m(std)}$ = ____ ft³

Water Vapor, proportion by volume

B_{ws} = ____

Leak Check: 0.000 / 10; 0.000 / 10

Moisture correction factor: 1 - B_{ws} = ____

Comments:

$$V_{m(std)} = 17.64\, V_m Y \frac{P_{bar} + \frac{DH}{13.6}}{T_m}$$

$$B_{ws} = \frac{V_{w(std)}}{V_{w(std)} + V_{m(std)}}$$

Operator 6C

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Form 1047 -Revised 1-7-2007

MOISTURE FIELD DATA SHEET

Project: Koppers Date: 4-29-09
Sampling Location: RTO Inlet
Source Condition: 1350° Oxidizer Temp Monitor: Model
Dry Gas Meter No. 15 S1 Y = 1.005 Serial No.
Top Loading Balance Calibration Check. Challenge Weight Used: ____ Resultant Weight ____ Pass? ____
Challenge Weight Used: ____ Resultant Weight ____ Pass? ____

Test (Run) No. 3 Barometric Pressure (P_{bar}) 29.98 in. Hg
Gas Temperature ____ °F Static Pressure ____ in. Hg
Orsat Analysis ____ %CO_2 ____ %O_2

Clock Time 24 hour	Meter Volume (V_m) ft³	Meter Gage Pressure (ΔH) in. H_2O	Meter Temp. (t_m) °F	Impgr. Outlet Temp °F
1215	417.338	.65	65	60
1220	419.50	.65	65	60
1225	422.00	.65	66	60
1230	424.90	.65	66	60
1235	427.10	.65	66	60
1240	430.10	.65	66	58
1245	432.90	.65	66	56
1250	435.90	.65	69	56
1255	438.80	.65	69	56
1300	440.20	.65	68	56
1305	443.3	.65	68	54
1310	445.10	.65	68	54
1315	446.835	.65	68	54
Avg.			66.8 (T_m) °R	

Condensate

220 mls (V_f)
- 200 mls (V_i)
____ mls
× 0.04707 = ____
____ ft³ ($V_{wc(std)}$) + ____ ft³ ($V_{wsg(std)}$)
= ____ ft³ ($V_{w(std)}$)

Silica Gel or Train

218.2 grams (W_f)
- 210.9 grams (W_i)
____ grams
× 0.04715 = ____

$V_{m(std)}$ = ____ ft³

Water Vapor, proportion by volume

Leak Check: 0.00 @ 10; 0.00 @ 10

B_{ws} = ____

Moisture correction factor:
1 - B_{ws} = ____

Comments:

Test (Run) No. ____ Barometric Pressure (P_{bar}) ____ in. Hg
Gas Temperature ____ °F Static Pressure ____ in. Hg
Orsat Analysis ____ %CO_2 ____ %O_2

Clock Time 24 hour	Meter Volume (V_m) ft³	Meter Gage Pressure (ΔH) in. H_2O	Meter Temp. (t_m) °F	Impgr. Outlet Temp °F
Avg.			(T_m) °R	

Condensate

____ mls (V_f)
- ____ mls (V_i)
____ mls
× 0.04707 = ____
____ ft³ ($V_{wc(std)}$) + ____ ft³ ($V_{wsg(std)}$)
= ____ ft³ ($V_{w(std)}$)

Silica Gel or Train

____ grams (W_f)
- ____ grams (W_i)
____ grams
× 0.04715 = ____

$V_{m(std)}$ = ____ ft³

Water Vapor, proportion by volume

Leak Check:

B_{ws} = ____

Moisture correction factor:
1 - B_{ws} = ____

Comments:

$$V_{m(std)} = 17.64\, V_m Y \frac{P_{bar} + \frac{DH}{13.6}}{T_m}$$

$$B_{ws} = \frac{V_{w(std)}}{V_{w(std)} + V_{m(std)}}$$

Operator GL

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PITOT TRAVERSE DATA

Project: Koppers

Location: ~~RTO Outlet~~ TO Outlet (on all) 5/20/09 KEM

Date: 4-29-09 Test No: 1 Run 1 Time: 828 – 833

Point No.	ΔP	√ΔP	ts	α	Point No.	ΔP	√ΔP	ts	α
1-1	.50		485		2-1	.51		490	
2	.54		485		2	.57		485	
3	.54		496		3	.60		495	
4	.39		500		4	.54		490	
5	.47		440		5	.42		457	
6	.46		380		6	.35		440	

Preliminary Velocity Calculation (This data has not been peer reviewed and may not be accurate)

P_{bar} 29.98 "Hg Static -.50 "H2O P_g ____ "Hg P_s ____ "Hg Pitot ID 849 C_p .84 Temp. ID E47

0.44 × ____ %CO_2 = ____ √ΔP ____ t_s ____ °F T ____ °R Flue Area 1.31 ft²

0.32 × ____ %O_2 = + ____ Duct Dimensions 1.29'

0.28 × ____ %N_2 = + ____ B_{ws} ____ 1 - B_{ws} ____ Disturbance: Upstream ____

(____ Md × ____ 1-Bws) + (18 × ____ Bws) = ____ (Ms) Downstream ____

$$v_s = 85.49 \times \_\_\_ Cp \times \sqrt{\frac{(\_\_\_)Ts\,°R}{\_\_\_Ms \times \_\_\_Ps}} \times \_\_\_\sqrt{\Delta P} = \_\_\_ \text{ft/sec}(Vs)$$

Q_{acfm} = ____ Vs × ____ Flue Area × 60 = ____ acfm Port Length 5.5 Inches

$$Q_{scfm} = 17.647 \times ACFM \times \frac{Ps}{Ts\,°R} = \_\_\_ \text{SCFM}$$

$$Q_{dscfm} = 17.647 \times ACFM \times \frac{Ps}{Ts\,°R} \times (1\text{-Bws}) = \_\_\_ \text{DSCFM}$$

Pre-test leak check ✓ "H2O

Post-test leak check ✓ "H2O

Data Taken By: GL / GRK

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Form 1012 – Revised 1-4-2008

PITOT TRAVERSE DATA

Project: Koppers

Location: RTO Outlet

Date: 4-29-09 Test No: 1 Run 2 Time: 846 - 852

Point No.	ΔP	$\sqrt{\Delta P}$	t_s	α	Point No.	ΔP	$\sqrt{\Delta P}$	t_s	α
1-1	.64		503		2-1	.48		474	
2	.61		500		2	.57		486	
3	.57		502		3	.56		495	
4	.55		504		4	.56		490	
5	.41		468		5	.47		468	
6	.38		456		6	.36		415	

Preliminary Velocity Calculation (This data has not been peer reviewed and may not be accurate)

P_{bar} 29.98 "Hg Static ~.50 "H_2O P_g____ "Hg P_s____ "Hg Pitot ID 849 C_p .84 Temp. ID E47

0.44 × ____ %CO_2 = ____ $\sqrt{\Delta P}$ ____ t_s____°F T____°R Flue Area 1.31 ft²

0.32 × ____ %O_2 = +____ Duct Dimensions 1.291

0.28 × ____ %N_2 = +____ B_{ws}____ 1 - B_{ws}____ Disturbance: Upstream ____

(____ Md × ____ 1-Bws) + (18 × ____ Bws) = ____ (Ms) Downstream ____

$$v_s = 85.49 \times \_\_\_ Cp \times \sqrt{\frac{(\_\_\_)Ts\,°R}{\_\_\_ Ms \times \_\_\_ Ps}} \times \_\_\_ \sqrt{\Delta P} = \_\_\_ \text{ft/sec}(Vs)$$

Q_{acfm} = ____ Vs × ____ Flue Area × 60 = ____ acfm Port Length 6.5 Inches

$Q_{scfm} = 17.647 \times ACFM \times \frac{Ps}{Ts\,°R}$ = ____ SCFM

$Q_{dscfm} = 17.647 \times ACFM \times \frac{Ps}{Ts\,°R} \times (1-Bws)$ = ____ DSCFM

Pre-test leak check ✓ "H_2O

Post-test leak check ✓ "H_2O

Data Taken By: CL / GKK

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PITOT TRAVERSE DATA

Project: Koppers

Location: RTO Outlet

Date: 4-29-09 Test No: 1 Run 3 Time: 902 - 907

Point No.	ΔP	√ΔP	t_s	α	Point No.	ΔP	√ΔP	t_s	α
1-1	.44		489		2-1	.50		490	
2	.49		494		2	.51		494	
3	.55		498		3	.55		499	
4	.35		490		4	.56		490	
5	.44		432		5	.51		426	
6	.50		384		6	.39		463	

Preliminary Velocity Calculation (This data has not been peer reviewed and may not be accurate)

P_{bar} 29.96 "Hg Static -.5 "H2O P_g ____ "Hg P_s ____ "Hg Pitot ID 849 C_p .84 Temp. ID E47

0.44 × ____ %CO2 = ____ √ΔP ____ t_s ____ °F T ____ °R Flue Area 1.31 ft²

0.32 × ____ %O2 = + ____ Duct Dimensions 1.29'

0.28 × ____ %N2 = + ____ B_{ws} ____ 1 - B_{ws} ____ Disturbance: Upstream ____

(____ Md × ____ 1-Bws) + (18 × ____ Bws) = ____ (Ms) Downstream ____

v_s = 85.49 × ____ Cp × √[(____)Ts °R / (____ Ms × ____ Ps)] × ____ √ΔP = ____ ft/sec(Vs)

Q_{acfm} = ____ Vs × ____ Flue Area × 60 = ____ acfm Port Length 5.5 Inches

Q_{scfm} = 17.647 × ACFM × Ps / Ts °R = ____ SCFM

Q_{dscfm} = 17.647 × ACFM × Ps / Ts °R × (1-Bws) = ____ DSCFM

Pre-test leak check ✓ "H2O

Post-test leak check ✓ "H2O

Data Taken By: GL / GKK

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Form 1012 – Revised 1-4-2009

PITOT TRAVERSE DATA

Project: Koppers

Location: RTO Outlet

Date: 4-29-09 Test No: 1 Run 4 Time: 917 - 923

Point No.	ΔP	√ΔP	t_s	α	Point No.	ΔP	√ΔP	t_s	α
1-1	.51		500		2-1	.51		498	
2	.56		497		2	.54		495	
3	.57		500		3	.49		496	
4	.57		505		4	.45		487	
5	.49		487		5	.37		420	
6	.44		465		6	.33		391	

Preliminary Velocity Calculation (This data has not been peer reviewed and may not be accurate)

P_{bar} 29.98 "Hg Static -.50 "H_2O P_g ____ "Hg P_s ____ "Hg Pitot ID 849 C_p .84 Temp. ID E47

0.44 × ____ %CO_2 = ____ √ΔP ____ t_s ____ °F T ____ °R Flue Area 1.31 ft²

0.32 × ____ %O_2 = + ____ Duct Dimensions 1.291

0.28 × ____ %N_2 = + ____ B_{ws} ____ 1 - B_{ws} ____ Disturbance: Upstream ____

(____ Md × ____ 1-Bws) + (18 × ____ Bws) = ____ (Ms) Downstream ____

$$v_s = 85.49 \times \_\_\_\_ Cp \times \sqrt{\frac{(\_\_\_\_)Ts\,°R}{\_\_\_\_ Ms \times \_\_\_\_ Ps}} \times \_\_\_\_ \sqrt{\Delta P} = \_\_\_\_ \text{ ft/sec (Vs)}$$

Q_{acfm} = ____ Vs × ____ Flue Area × 60 = ____ acfm Port Length 5.5 Inches

$$Q_{scfm} = 17.647 \times ACFM \times \frac{Ps}{Ts\,°R} = \_\_\_\_ \text{ SCFM}$$

$$Q_{dscfm} = 17.647 \times ACFM \times \frac{Ps}{Ts\,°R} \times (1\text{-}Bws) = \_\_\_\_ \text{ DSCFM}$$

Pre-test leak check ✓ "H_2O

Post-test leak check ✓ "H_2O

Data Taken By: GL / GRK

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PITOT TRAVERSE DATA

Project: Koppers

Location: RTO Outlet

Date: 4-29-09 Test No: 2 Run1 Time: 1026 – 1033

Point No.	ΔP	√ΔP	t_s	α	Point No.	ΔP	√ΔP	t_s	α
1-1	.44		493		2-1	.49		494	
2	.57		494		2	.60		498	
3	.54		496		3	.58		498	
4	.37		500		4	.54		490	
5	.45		487		5	.38		489	
6	.47		425		6	.34		440	

Preliminary Velocity Calculation (This data has not been peer reviewed and may not be accurate)

P_{bar} 29.98 "Hg Static -.56 "H_2O P_g ____ "Hg P_s ____ "Hg Pitot ID 849 C_p .84 Temp. ID E47

0.44 × ____ %CO_2 = ____ √ΔP ____ t_s ____ °F T ____ °R Flue Area 1.31 ft²

0.32 × ____ %O_2 = + ____ Duct Dimensions 1.291

0.28 × ____ %N_2 = + ____ B_{ws} ____ 1 - B_{ws} ____ Disturbance: Upstream ____

(____ Md × ____ 1-Bws) + (18 × ____ Bws) = ____ (Ms) Downstream ____

$$v_s = 85.49 \times \_\_\_ Cp \times \sqrt{\frac{(\_\_\_)Ts\,°R}{\_\_\_ Ms \times \_\_\_ Ps}} \times \_\_\_ \sqrt{\Delta P} = \_\_\_ \text{ft/sec (Vs)}$$

Q_{acfm} = ____ Vs × ____ Flue Area × 60 = ____ acfm Port Length 5.5 Inches

$$Q_{scfm} = 17.647 \times ACFM \times \frac{Ps}{Ts\,°R} = \_\_\_ \text{ SCFM}$$

$$Q_{dscfm} = 17.647 \times ACFM \times \frac{Ps}{Ts\,°R} \times (1\text{-}Bws) = \_\_\_ \text{ DSCFM}$$

Pre-test leak check ✓ "H_2O

Post-test leak check ✓ "H_2O

Data Taken By: GL / GKK

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PITOT TRAVERSE DATA

Project: Koppers

Location: RTO Outlet

Date: 4-29-09 Test No: 2 Run 2 Time: 1044-1049

Point No.	ΔP	√ΔP	t_s	α	Point No.	ΔP	√ΔP	t_s	α
1-1	.43		492		2-1	.48		493	
2	.61		498		2	.57		499	
3	.62		495		3	.54		500	
4	.43		505		4	.48		502	
5	.53		480		5	.42		455	
6	.41		476		6	.45		430	

Preliminary Velocity Calculation (This data has not been peer reviewed and may not be accurate)

P_{bar} 29.98 "Hg Static -.50 "H_2O P_g ____ "Hg P_s ____ "Hg Pitot ID 849 C_p .84 Temp. ID E47

0.44 × ____ %CO_2 = ____ √ΔP ____ t_s ____ °F T ____ °R Flue Area 1.31 ft²

0.32 × ____ %O_2 = + ____ Duct Dimensions 1.29'

0.28 × ____ %N_2 = + ____ B_{ws} ____ 1 - B_{ws} ____ Disturbance: Upstream ____

(____ Md × ____ 1-Bws) + (18 × ____ Bws) = ____ (Ms) Downstream ____

$$v_s = 85.49 \times \_\_\_\_ Cp \times \sqrt{\frac{(\_\_\_\_)Ts\,°R}{\_\_\_\_ Ms \times \_\_\_\_ Ps}} \times \_\_\_\_ \sqrt{\Delta P} = \_\_\_\_ ft/sec (Vs)$$

Q_{acfm} = ____ Vs × ____ Flue Area × 60 = ____ acfm Port Length 6.5 inches

$$Q_{scfm} = 17.647 \times ACFM \times \frac{Ps}{Ts\,°R} = \_\_\_\_ SCFM$$

$$Q_{dscfm} = 17.647 \times ACFM \times \frac{Ps}{Ts\,°R} \times (1\text{-}Bws) = \_\_\_\_ DSCFM$$

Pre-test leak check ✓ "H_2O

Post-test leak check ✓ "H_2O

Data Taken By: GC/GKK

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PITOT TRAVERSE DATA

Project: Koppers
Location: RTO Outlet
Date: 4-29-09 Test No: 2 Run 3 Time: 1103 - 1108

Point No.	ΔP	√ΔP	ts	α	Point No.	ΔP	√ΔP	ts	α
1-1	.53		494		2-1	.53		494	
2	.54		494		2	.66		490	
3	.52		503		3	.62		495	
4	.51		500		4	.62		498	
5	.33		415		5	.58		490	
6	.53		389		6	.47		480	

Preliminary Velocity Calculation (This data has not been peer reviewed and may not be accurate)

P_{bar} 29.98 "Hg Static -.50 "H_2O P_g ____ "Hg P_s ____ "Hg Pitot ID 849 C_p .84 Temp. ID E47

0.44 × ____ %CO_2 = ____ √ΔP ____ t_s ____ °F T ____ °R Flue Area 1.31 ft²

0.32 × ____ %O_2 = + ____ Duct Dimensions 1.291

0.28 × ____ %N_2 = + ____ B_{ws} ____ 1 - B_{ws} ____ Disturbance: Upstream ____

(____ Md × ____ 1-Bws) + (18 × ____ Bws) = ____ (Ms) Downstream ____

$$v_s = 85.49 \times \_\_\_ Cp \times \sqrt{\frac{(\_\_\_)Ts\,°R}{\_\_\_ Ms \times \_\_\_ Ps}} \times \_\_\_ \sqrt{\Delta P} = \_\_\_ \text{ft/sec}(Vs)$$

Q_{acfm} = ____ Vs × ____ Flue Area × 60 = ____ acfm Port Length 5.5 Inches

$Q_{scfm} = 17.647 \times ACFM \times \frac{Ps}{Ts\,°R}$ = ____ SCFM

$Q_{dscfm} = 17.647 \times ACFM \times \frac{Ps}{Ts\,°R} \times (1\text{-}Bws)$ = ____ DSCFM

Pre-test leak check ✓ "H_2O

Post-test leak check ✓ "H_2O

Data Taken By: GL/GRK

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PITOT TRAVERSE DATA

Project: Koppers

Location: RTO Outlet

Date: 4-29-09 Test No: 2 Run 4 Time: 1114 - 1120

Point No.	ΔP	√ΔP	t_s	α	Point No.	ΔP	√ΔP	t_s	α
1-1	,49		480		2-1	,42		480	
2	,63		480		2	,58		486	
3	,65		473		3	,53		500	
4	,61		470		4	,33		486	
5	,53		504		5	,49		452	
6	,43		470		6	,49		409	

Preliminary Velocity Calculation (This data has not been peer reviewed and may not be accurate)

P_{bar} 29.98 "Hg Static -.50 "H_2O P_g ____ "Hg P_s ____ "Hg Pitot ID 849 C_p .84 Temp. ID E47

0.44 × ____ %CO_2 = ____ √ΔP ____ t_s ____ °F T ____ °R Flue Area 1.31 ft²

0.32 × ____ %O_2 = + ____ Duct Dimensions 1.291

0.28 × ____ %N_2 = + ____ B_{ws} ____ 1 - B_{ws} ____ Disturbance: Upstream ____

(____ Md × ____ 1-Bws) + (18 × ____ Bws) = ____ (Ms) Downstream ____

$$v_s = 85.49 \times \_\_\_\_ Cp \times \sqrt{\frac{(\_\_\_\_)Ts\ ^\circ R}{\_\_\_\_ Ms \times \_\_\_\_ Ps}} \times \_\_\_\_ \sqrt{\Delta P} = \_\_\_\_ \text{ ft/sec}(Vs)$$

Q_{acfm} = ____ Vs × ____ Flue Area × 60 = ____ acfm Port Length 5.5 Inches

$$Q_{scfm} = 17.647 \times ACFM \times \frac{Ps}{Ts\ ^\circ R} = \_\_\_\_ SCFM$$

$$Q_{dscfm} = 17.647 \times ACFM \times \frac{Ps}{Ts\ ^\circ R} \times (1-Bws) = \_\_\_\_ DSCFM$$

Pre-test leak check ✓ "H_2O

Post-test leak check ✓ "H_2O

Data Taken By: GL/GKK

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PITOT TRAVERSE DATA

Project: Koppers

Location: RTO Outlet

Date: 4-29-09 Test No: 3 Run1 Time: 1227-1232

Point No.	ΔP	√ΔP	t_s	α	Point No.	ΔP	√ΔP	t_s	α
1-1	,46		493		2-1	,43		493	
2	,51		492		2	,51		493	
3	,52		493		3	.50		493	
4	.39		485		4	,44		480	
5	.39		454		5	,34		445	
6	,38		~~4~~380		6	.30		420	

Preliminary Velocity Calculation (This data has not been peer reviewed and may not be accurate)

P_{bar} 29.94 "Hg Static -.50 "H_2O P_g ____ "Hg P_s ____ "Hg Pitot ID 849 C_p .84 Temp. ID E47

0.44 × ____ %CO_2 = ____ √ΔP ____ t_s ____ °F T ____ °R Flue Area 1.31 ft²

0.32 × ____ %O_2 = + ____ Duct Dimensions 1.291

0.28 × ____ %N_2 = + ____ B_{ws} ____ 1 - B_{ws} ____ Disturbance: Upstream ____

(____ Md × ____ 1-Bws) + (18 × ____ Bws) = ____ (Ms) Downstream ____

$v_s = 85.49 \times$ ____ $Cp \times \sqrt{\frac{(\ \ )Ts\ °R}{Ms \times Ps}} \times$ ____ $\sqrt{\Delta P}$ = ____ ft/sec (Vs)

Q_{acfm} = ____ Vs × ____ Flue Area × 60 = ____ acfm Port Length 5.5 Inches

$Q_{scfm} = 17.647 \times ACFM \times \frac{Ps}{Ts\ °R}$ = ____ SCFM

$Q_{dscfm} = 17.647 \times ACFM \times \frac{Ps}{Ts\ °R} \times (1\text{-}Bws)$ = ____ DSCFM

Pre-test leak check ✓ "H_2O

Post-test leak check ✓ "H_2O

100

Data Taken By: GL/GKK

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PITOT TRAVERSE DATA

Project: Koppers

Location: RTO Outlet

Date: 4-29-09 Test No: 3 Run 2 Time: 1247-1252

Point No.	ΔP	$\sqrt{\Delta P}$	t_s	α	Point No.	ΔP	$\sqrt{\Delta P}$	t_s	α
1-1	.50		496		2-1	.51		497	
2	.49		502		2	.52		500	
3	.64		503		3	.54		500	
4	.52		496		4	.42		490	
5	.46		492		5	.51		480	
6	.35		466		6	.43		430	

Preliminary Velocity Calculation (This data has not been peer reviewed and may not be accurate)

P_{bar} 29.98 "Hg Static -.50 "H_2O P_g ____ "Hg P_s ____ "Hg Pitot ID 849 C_p .84 Temp. ID E47

0.44 × ____ %CO_2 = ____ $\sqrt{\Delta P}$ ____ t_s ____ °F T ____ °R Flue Area 1.31 ft²

0.32 × ____ %O_2 = + ____ Duct Dimensions 1.29'

0.28 × ____ %N_2 = + ____ B_{ws} ____ 1 - B_{ws} ____ Disturbance: Upstream ____

(____ Md × ____ 1-Bws) + (18 × ____ Bws) = ____ (Ms) Downstream ____

$$v_s = 85.49 \times \_\_\_ Cp \times \sqrt{\frac{(\_\_\_)Ts\ °R}{\_\_\_Ms \times \_\_\_Ps}} \times \_\_\_\sqrt{\Delta P} = \_\_\_ \text{ft/sec}(Vs)$$

Q_{acfm} = ____ Vs × ____ Flue Area × 60 = ____ acfm Port Length 5.5 Inches

$$Q_{scfm} = 17.647 \times ACFM \times \frac{Ps}{Ts\ °R} = \_\_\_ SCFM$$

$$Q_{dscfm} = 17.647 \times ACFM \times \frac{Ps}{Ts\ °R} \times (1-Bws) = \_\_\_ DSCFM$$

Pre-test leak check ✓ "H_2O

Post-test leak check ✓ "H_2O

Data Taken By: GL / GRK

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Form 1012 - Revised 1-6-2008

PITOT TRAVERSE DATA

Project: Koppers

Location: RTO Outlet

Date: 4-29-09 Test No: #3 Run 3 Time: 1300 - 1305

Point No.	ΔP	$\sqrt{\Delta P}$	t_s	α	Point No.	ΔP	$\sqrt{\Delta P}$	t_s	α
1-1	.48		490		2-1	.48		492	
2	.51		488		2	.60		495	
3	.53		500		3	.65		498	
4	.34		481		4	.56		505	
5	.31		443		5	.54		490	
6	.34		400		6	.37		440	

Preliminary Velocity Calculation (This data has not been peer reviewed and may not be accurate)

P_{bar} 29.98 "Hg Static -.50 "H_2O P_g ____ "Hg P_s ____ "Hg Pitot ID 849 C_p .84 Temp. ID E47

0.44 × ____ %CO_2 = ____ $\sqrt{\Delta P}$ ____ t_s ____ °F T ____ °R Flue Area 1.31 ft²

0.32 × ____ %O_2 = + ____ Duct Dimensions 1.29'

0.28 × ____ %N_2 = + ____ B_{ws} ____ 1 - B_{ws} ____ Disturbance: Upstream ____

(____ Md × ____ 1-Bws) + (18 × ____ Bws) = ____ (Ms) Downstream ____

$$v_s = 85.49 \times \_\_\_ Cp \times \sqrt{\frac{(\_\_\_)Ts\,°R}{\_\_\_Ms \times \_\_\_Ps}} \times \_\_\_ \sqrt{\Delta P} = \_\_\_ ft/sec(Vs)$$

Q_{acfm} = ____ Vs × ____ Flue Area × 60 = ____ acfm Port Length 5.5 Inches

$$Q_{scfm} = 17.647 \times ACFM \times \frac{Ps}{Ts\,°R} = \_\_\_\_ SCFM$$

$$Q_{dscfm} = 17.647 \times ACFM \times \frac{Ps}{Ts\,°R} \times (1\text{-}Bws) = \_\_\_\_ DSCFM$$

Pre-test leak check ✓ "H_2O

Post-test leak check ✓ "H_2O

Data Taken By: GL / GKK

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PITOT TRAVERSE DATA

Project: Koppers
Location: RTO Outlet
Date: 4-29-09 Test No: 3 Run 4 Time: 1312-1317

Point No.	ΔP	√ΔP	t_s	α	Point No.	ΔP	√ΔP	t_s	α
1-1	.53		501		2-1	.46		498	
2	.55		500		2	.55		499	
3	.64		505		3	.50		500	
4	.57		509		4	.41		474	
5	.50		489		5	.46		450	
6	.39		466		6	.39		430	

Preliminary Velocity Calculation (This data has not been peer reviewed and may not be accurate)

P_{bar} 29.98 "Hg Static -.50 "H_2O P_g ____ "Hg P_s ____ "Hg Pitot ID 849 C_p .84 Temp. ID E47

0.44 × ____ %CO_2 = ____ √ΔP ____ t_s ____ °F T ____ °R Flue Area 1.31 ft²

0.32 × ____ %O_2 = + ____ Duct Dimensions 1.291

0.28 × ____ %N_2 = + ____ B_{ws} ____ 1 - B_{ws} ____ Disturbance: Upstream ____

(____ Md × ____ 1-Bws) + (18 × ____ Bws) = ____ (Ms) Downstream ____

$$v_s = 85.49 \times \_\_\_ Cp \times \sqrt{\frac{(\_\_\_)Ts\,°R}{\_\_\_Ms \times \_\_\_Ps}} \times \_\_\_ \sqrt{\Delta P} = \_\_\_ ft/sec(Vs)$$

Q_{acfm} = ____ Vs × ____ Flue Area × 60 = ____ acfm Port Length 6.5 Inches

$Q_{scfm} = 17.647 \times ACFM \times \frac{Ps}{Ts\,°R}$ = ____ SCFM

$Q_{dscfm} = 17.647 \times ACFM \times \frac{Ps}{Ts\,°R} \times (1\text{-}Bws)$ = ____ DSCFM

Pre-test leak check ✓ "H_2O

Post-test leak check ✓ "H_2O

Data Taken By: GC / GRK

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MOISTURE FIELD DATA SHEET

Project: Koppers Date: 4-29-09
Sampling Location: RTO Outlet
Source Condition: 1350° oxidizer temp Monitor: Model
Dry Gas Meter No. E47 Y = 1.014 Serial No.
Top Loading Balance Calibration Check. Challenge Weight Used: ______ Resultant Weight ______ Pass? ______
Challenge Weight Used: ______ Resultant Weight ______ Pass? ______

Test (Run) No. 1 Barometric Pressure (P_{bar}) ______ in. Hg
Gas Temperature ______ °F Static Pressure ______ in. Hg

Orsat Analysis: ______ %CO_2 ______ %O_2

Clock Time 24 hour	Meter Volume (V_m) ft³	Meter Gage Pressure (ΔH) in. H_2O	Meter Temp. (t_m) °F	Impgr. Outlet Temp °F
825	978.650	.65	57	58
830	981.40	.65	57	60
835	883.60	.65	58	58
840	985.90	.65	58	58
845	988.2	.65	60	57
850	990.8	.65	60	57
855	993.0	.65	60	56
900	995.0	.65	61	56
905	998.1	.65	61	55
910	1000.4	.65	61	55
915	1003.00	.65	62	55
920	1005.30	.65	62	55
925	1007.724	.65	62	55
Avg.			59.9 (T_m)	°R

Condensate

220 mls (V_f)
- 200 mls (V_i)
______ mls
× 0.04707 = ______
______ ft³ ($V_{wc(std)}$) + ______ ft³ ($V_{wsg(std)}$)
= ______ ft³ ($V_{w(std)}$)

Silica Gel or Train

220.4 grams (W_f)
- 211.6 grams (W_i)
______ grams
× 0.04715 = ______

$V_{m(std)}$ = ______ ft³

Water Vapor, proportion by volume

Leak Check:
0.00 @ 15
0.00 @ 15

B_{ws} = ______

Moisture correction factor:
1 - B_{ws} = ______

Comments:

Test (Run) No. 2 Barometric Pressure (P_{bar}) ______ in. Hg
Gas Temperature ______ °F Static Pressure ______ in. Hg

Orsat Analysis: ______ %CO_2 ______ %O_2

Clock Time 24 hour	Meter Volume (V_m) ft³	Meter Gage Pressure (ΔH) in. H_2O	Meter Temp. (t_m) °F	Impgr. Outlet Temp °F
1020	008.052	.65	67	64
1025	10.10	.65	67	64
1030	12.30	.65	67	64
1035	15.25	.65	67	64
1040	17.30	.65	68	59
1045	19.80	.65	68	58
1050	22.10	.65	68	58
1055	24.80	.65	69	55
1100	27.2	.65	69	54
1105	29.8	.65	69	54
1110	32.20	.65	69	54
1115	34.80	.65	67	54
1120	37.221	.65	69	54
Avg.			68.2 (T_m)	°R

Condensate

215 mls (V_f)
- 200 mls (V_i)
______ mls
× 0.04707 = ______
______ ft³ ($V_{wc(std)}$) + ______ ft³ ($V_{wsg(std)}$)
= ______ ft³ ($V_{w(std)}$)

Silica Gel or Train

219.0 grams (W_f)
- 210.8 grams (W_i)
______ grams
× 0.04715 = ______

$V_{m(std)}$ = ______ ft³

Water Vapor, proportion by volume

Leak Check:
0.00 @ 16
0.00 @ 16

B_{ws} = ______

Moisture correction factor:
1 - B_{ws} = ______

Comments:

$$V_{m(std)} = 17.64\, V_m Y \frac{P_{bar} + \frac{DH}{13.6}}{T_m}$$

$$B_{ws} = \frac{V_{w(std)}}{V_{w(std)} + V_{m(std)}}$$

Operator GL

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Form 1047 -Revised 1-7-2007

MOISTURE FIELD DATA SHEET

Project: Koppers Date: 4-29-09
Sampling Location: RTO outlet
Source Condition: 1350° Oxidizer Temp Monitor: Model
Dry Gas Meter No. F 47 Y = 1.014 Serial No.
Top Loading Balance Calibration Check. Challenge Weight Used: ___ Resultant Weight ___ Pass? ___
Challenge Weight Used: ___ Resultant Weight ___ Pass? ___

Test (Run) No. 3 Barometric Pressure (P_{bar}) 29.98 in. Hg
Gas Temperature ___ °F Static Pressure ___ in. Hg
Orsat Analysis ___ %CO_2 ___ %O_2

Clock Time 24 hour	Meter Volume (V_m) ft³	Meter Gage Pressure (ΔH) in. H_2O	Meter Temp. (t_m) °F	mpgr. Outlet Temp °F
1215	37.465	.65	68	67
1220	37.60	.65	68	67
1225	42.8	.65	68	67
1230	45.00	.65	68	66
1235	47.50	.65	68	65
1240	49.80	.65	69	64
1245	52.00	.65	69	60
1250	54.20	.65	69	60
1255	57.20	.65	69	60
1300	59.80	.65	69	60
1305	62.40	.65	70	58
1310	64.90	.65	70	58
1315	67.354	.65	70	58
Avg.			68.8 (T_m)	°R

Condensate
220 mls (V_f)
- 200 mls (V_i)
___ mls
× 0.04707 = ___
___ ft³ [$V_{wc(std)}$] +

Silica Gel or Train
227.9 grams (W_f)
- 220.4 grams (W_i)
___ grams
× 0.04715 = ___
___ ft³ [$V_{wsg(std)}$]
= ___ ft³ [$V_{w(std)}$]

$V_{m(std)}$ = ___ ft³
Water Vapor, proportion by volume
Leak Check: 0.000 16 0.000 16
B_{ws} = ___
Moisture correction factor:
1 - B_{ws} = ___
Comments:

Test (Run) No. ___ Barometric Pressure (P_{bar}) ___ in. Hg
Gas Temperature ___ °F Static Pressure ___ in. Hg
Orsat Analysis ___ %CO_2 ___ %O_2

Clock Time 24 hour	Meter Volume (V_m) ft³	Meter Gage Pressure (ΔH) in. H_2O	Meter Temp. (t_m) °F	Impgr. Outlet Temp °F
Avg.			(T_m)	°R

Condensate
___ mls (V_f)
- ___ mls (V_i)
___ mls
× 0.04707 = ___
___ ft³ [$V_{wc(std)}$] +

Silica Gel or Train
___ grams (W_f)
- ___ grams (W_i)
___ grams
× 0.04715 = ___
___ ft³ [$V_{wsg(std)}$]
= ___ ft³ [$V_{w(std)}$]

$V_{m(std)}$ = ___ ft³
Water Vapor, proportion by volume
Leak Check:
B_{ws} = ___
Moisture correction factor:
1 - B_{ws} = ___
Comments:

$$V_{m(std)} = 17.64\, V_m Y \frac{P_{bar} + \frac{DH}{13.6}}{T_m}$$

$$B_{ws} = \frac{V_{w(std)}}{V_{w(std)} + V_{m(std)}}$$

Operator GL

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Form 1047 -Revised 1-7-2007

AIR LIQUIDE Scott Specialty Gases
Air Liquide America Specialty Gases LLC

Shipped From: 1290 COMBERMERE STREET
TROY MI 48083
Phone: 248-589-2950 Fax: 248-589-2134

C E R T I F I C A T E O F A N A L Y S I S

WAREHOUSE/STOCK
WAREHOUSE/STOCK/
CHICAGO WAREHOUSE
868 SIVERT
WOOD DALE IL 60191

PROJECT #: 05-66254-001
PO#: GENERAL STOCK
ITEM #: 0501024 AL
DATE: 04Jun2008

CYLINDER #: AAL220
FILL PRESSURE: 02000 PSIG

PURE MATERIAL: AIR CAS# 132259-10-0

GRADE: ZERO AIR

PURITY: -

IMPURITY	MAXIMUM CONCENTRATIONS
THC	1 PPM
O2	20 TO 21%

ANALYST: ____________________

RATA CLASS

Dual-Analyzed Calibration Standard

Scott Specialty Gases
AIR LIQUIDE AMERICA SPECIALTY GASES LLC
1290 COMBERMERE STREET, TROY, MI 48083
Phone: 248-589-2950 Fax: 248-589-2134

CERTIFICATE OF ACCURACY: EPA Protocol Gas

Assay Laboratory

SCOTT SPECIALTY GASES
1290 COMBERMERE STREET
TROY, MI 48083

P.O. No.: GE ENERGY STOCK
Project No.: 05-61275-002

Customer

GE ENERGY - ELMHURST

888 INDUSTRIAL DRIVE
ELMHURST IL 60126-1012

ANALYTICAL INFORMATION

This certification was performed according to EPA Traceability Protocol For Assay & Certification of Gaseous Calibration Standards; Procedure G-1; September, 1997.

Cylinder Number: ALM047898 **Certification Date:** 17Dec2007 **Exp. Date:** 16Dec2010
Cylinder Pressure*:** 1850 PSIG

COMPONENT	CERTIFIED CONCENTRATION (Moles)		ANALYTICAL ACCURACY**	TRACEABILITY
PROPANE	499.9	PPM	+/- 1%	Direct NIST and NMi
AIR		BALANCE		

*** Do not use when cylinder pressure is below 150 psig.
** Analytical accuracy is based on the requirements of EPA Protocol Procedure G1, September 1997.

REFERENCE STANDARD

TYPE/SRM NO.	EXPIRATION DATE	CYLINDER NUMBER	CONCENTRATION	COMPONENT
NTRM 2648	01May2011	ALM050570	4986. PPM	PROPANE

INSTRUMENTATION

INSTRUMENT/MODEL/SERIAL#	DATE LAST CALIBRATED	ANALYTICAL PRINCIPLE
VARIAN/3400/7506	17Dec2007	TCD/FID

ANALYZER READINGS

(Z=Zero Gas R=Reference Gas T=Test Gas r=Correlation Coefficient)

First Triad Analysis — **Second Triad Analysis** — **Calibration Curve**

PROPANE

Date: 17Dec2007	Response Unit:AREA	
Z1=0.00000	R1=412226.0	T1=41285.00
R2=412385.0	Z2=0.00000	T2=41382.00
Z3=0.00000	T3=41406.00	R3=413138.0
Avg. Concentration:	499.9	PPM

Concentration=A+Bx+Cx2+Dx3+Ex4	
r=0.999999465	
Constants:	A=0.277081647
B=0.012114421	C=0
D=0	E=0

APPROVED BY: ROBERT LESNIAK

RATA CLASS

Scott Specialty Gases

Dual-Analyzed Calibration Standard

1290 COMBERMERE STREET,TROY,MI 48083 Phone: 248-589-2950 Fax: 248-589-2134

CERTIFICATE OF ACCURACY: EPA Protocol Gas

Assay Laboratory

SCOTT SPECIALTY GASES
1290 COMBERMERE STREET
TROY,MI 48083

P.O. No.: GE ENERGY STOCK
Project No.: 05-49891-001

Customer

GE ENERGY - ELMHURST

888 INDUSTRIAL DRIVE
ELMHURST IL 60126-1012

ANALYTICAL INFORMATION

This certification was performed according to EPA Traceability Protocol For Assay & Certification of Gaseous Calibration Standards; Procedure G-1; September, 1997.

Cylinder Number: ALM035997 **Certification Date:** 11Dec2006 **Exp. Date:** 10Dec2009

Cylinder Pressure*:** 1950 PSIG

COMPONENT	CERTIFIED CONCENTRATION (Moles)		ANALYTICAL ACCURACY**	TRACEABILITY
PROPANE	848.4	PPM	+/- 1%	Direct NIST and NMi
AIR		BALANCE		

*** Do not use when cylinder pressure is below 150 psig.

** Analytical accuracy is based on the requirements of EPA Protocol Procedure G1, September 1997.

REFERENCE STANDARD

TYPE/SRM NO.	EXPIRATION DATE	CYLINDER NUMBER	CONCENTRATION	COMPONENT
NTRM 1200	02Feb2010	K019476	1186. PPM	PROPANE

INSTRUMENTATION

INSTRUMENT/MODEL/SERIAL#	DATE LAST CALIBRATED	ANALYTICAL PRINCIPLE
VARIAN/3600/0455	01Dec2006	FLAME IONIZATION

ANALYZER READINGS

(Z=Zero Gas R=Reference Gas T=Test Gas r=Correlation Coefficient)

First Triad Analysis — **Second Triad Analysis** — **Calibration Curve**

PROPANE

First Triad Analysis:

Date: 13Dec2006	Response Unit:AREA	
Z1=0.00000	R1=123900.0	T1=88300.00
R2=124462.0	Z2=0.00000	T2=88810.00
Z3=0.00000	T3=8826.000	R3=124191.0
Avg. Concentration:	848.4	PPM

Calibration Curve:

Concentration=A+Bx+Cx2+Dx3+Ex4	
r=0.999986	
Constants:	A=3.544536
B=0.009470	C=0
D=0	E=0

Special Notes: SEND CERT WITH CYLINDER

APPROVED BY: ____________________
HILARY THATCHER

RATA CLASS

Scott Specialty Gases

Dual-Analyzed Calibration Standard

1290 COMBERMERE STREET,TROY,MI 48083 Phone: 248-589-2950 Fax: 248-589-2134

CERTIFICATE OF ACCURACY: EPA Protocol Gas

Assay Laboratory

SCOTT SPECIALTY GASES
1290 COMBERMERE STREET
TROY,MI 48083

P.O. No.: GE ENERGY STOCK
Project No.: 05-53846-001

Customer

GE ENERGY - ELMHURST

888 INDUSTRIAL DRIVE
ELMHURST IL 60126-1012

ANALYTICAL INFORMATION

This certification was performed according to EPA Traceability Protocol For Assay & Certification of Gaseous Calibration Standards; Procedure G-1; September, 1997.

Cylinder Number: ALM051375 **Certification Date:** 12Apr2007 **Exp. Date:** 11Apr2010
Cylinder Pressure*:** 1900 PSIG

COMPONENT	CERTIFIED CONCENTRATION (Moles)		ANALYTICAL ACCURACY**	TRACEABILITY
PROPANE	1,503	PPM	+/- 1%	Direct NIST and NMi
AIR		BALANCE		

*** Do not use when cylinder pressure is below 150 psig.
** Analytical accuracy is based on the requirements of EPA Protocol Procedure G1, September 1997.

REFERENCE STANDARD

TYPE/SRM NO.	EXPIRATION DATE	CYLINDER NUMBER	CONCENTRATION	COMPONENT
NTRM 2647	01May2011	ALM036405	2499. PPM	PROPANE

INSTRUMENTATION

INSTRUMENT/MODEL/SERIAL#	DATE LAST CALIBRATED	ANALYTICAL PRINCIPLE
VARIAN/3600/0455	03Apr2007	FLAME IONIZATION

ANALYZER READINGS

(Z=Zero Gas R=Reference Gas T=Test Gas r=Correlation Coefficient)

First Triad Analysis | **Second Triad Analysis** | **Calibration Curve**

PROPANE

First Triad Analysis:

Date: 12Apr2007	Response Unit:AREA	
Z1=0.00000	R1=186908.0	T1=112225.0
R2=186738.0	Z2=0.00000	T2=112317.0
Z3=0.00000	T3=112412.0	R3=186618.0
Avg. Concentration:	1503.	PPM

Calibration Curve:

Concentration=A+Bx+Cx2+Dx3+Ex4	
r=0.999999	
Constants:	A=1.383892
B=0.013426	C=0
D=0	E=0

Special Notes: SEND CERT WITH CYLINDER

APPROVED BY: ____________________

AIR LIQUIDE
Scott Specialty Gases
Air Liquide America Specialty Gases LLC

RATA CLASS

Dual-Analyzed Calibration Standard

1290 COMBERMERE STREET, TROY, MI 48083 Phone: 248-589-2950 Fax: 248-589-2134

CERTIFICATE OF ACCURACY: EPA Protocol Gas

Assay Laboratory

SCOTT SPECIALTY GASES
1290 COMBERMERE STREET
TROY, MI 48083

P.O. No.: GE ENERGY STOCK
Project No.: 05-62769-001

Customer

GE ENERGY - ELMHURST

888 INDUSTRIAL DRIVE
ELMHURST IL 60126-1012

ANALYTICAL INFORMATION

This certification was performed according to EPA Traceability Protocol For Assay & Certification of Gaseous Calibration Standards; Procedure G-1; September, 1997.

Cylinder Number: ALM055086 Certification Date: 19Feb2008 Exp. Date: 18Feb2011
Cylinder Pressure***: 2000 PSIG

COMPONENT	CERTIFIED CONCENTRATION (Moles)		ANALYTICAL ACCURACY**	TRACEABILITY
PROPANE	15.73	PPM	+/- 1%	Direct NIST and NMi
AIR		BALANCE		

*** Do not use when cylinder pressure is below 150 psig.
** Analytical accuracy is based on the requirements of EPA Protocol Procedure G1, September 1997.

REFERENCE STANDARD

TYPE/SRM NO.	EXPIRATION DATE	CYLINDER NUMBER	CONCENTRATION	COMPONENT
NTRM 1667	04Jul2008	ALM019225	49.80 PPM	PROPANE

INSTRUMENTATION

INSTRUMENT/MODEL/SERIAL#	DATE LAST CALIBRATED	ANALYTICAL PRINCIPLE
BECKMAN/400 A/2000830	19Feb2008	FLAME IONIZATION

ANALYZER READINGS

(Z=Zero Gas R=Reference Gas T=Test Gas r=Correlation Coefficient)

First Triad Analysis — Second Triad Analysis — Calibration Curve

PROPANE

First Triad Analysis:

Date: 19Feb2008	Response Unit:MV	
Z1=0.00000	R1=114.2000	T1=35.80000
R2=114.1000	Z2=0.00000	T2=35.80000
Z3=0.00000	T3=35.80000	R3=114.2000
Avg. Concentration:	15.73	PPM

Calibration Curve:

Concentration=A+Bx+Cx2+Dx3+Ex4
r=0.9999
Constants: A=0.102783
B=0.437011 C=0
D=0 E=0

APPROVED BY: HILARY THATCHER

AIR LIQUIDE

Scott Specialty Gases
Air Liquide America Specialty Gases LLC

RATA CLASS

Dual-Analyzed Calibration Standard

1290 COMBERMERE STREET, TROY, MI 48083 Phone: 248-589-2950 Fax: 248-589-2134

CERTIFICATE OF ACCURACY: EPA Protocol Gas

Assay Laboratory		Customer
	P.O. No.: GE ENERGY STOCK	GE ENERGY - ELMHURST
SCOTT SPECIALTY GASES	Project No.: 05-61770-001	
1290 COMBERMERE STREET		888 INDUSTRIAL DRIVE
TROY, MI 48083		ELMHURST IL 60126-1012

ANALYTICAL INFORMATION

This certification was performed according to EPA Traceability Protocol For Assay & Certification of Gaseous Calibration Standards; Procedure G-1; September, 1997.

Cylinder Number: ALM051702 **Certification Date:** 08Jan2008 **Exp. Date:** 07Jan2011

Cylinder Pressure*:** 1900 PSIG

COMPONENT	CERTIFIED CONCENTRATION (Moles)		ANALYTICAL ACCURACY**	TRACEABILITY
PROPANE	29.39	PPM	+/- 1%	Direct NIST and NMi
AIR		BALANCE		

*** Do not use when cylinder pressure is below 150 psig.

** Analytical accuracy is based on the requirements of EPA Protocol Procedure G1, September 1997.

REFERENCE STANDARD

TYPE/SRM NO.	EXPIRATION DATE	CYLINDER NUMBER	CONCENTRATION	COMPONENT
NTRM 1668	04Jul2008	ALM022966	98.80 PPM	PROPANE

INSTRUMENTATION

INSTRUMENT/MODEL/SERIAL#	DATE LAST CALIBRATED	ANALYTICAL PRINCIPLE
VARIAN/3400/7506	07Jan2008	TCD/FID

ANALYZER READINGS

(Z=Zero Gas R=Reference Gas T=Test Gas r=Correlation Coefficient)

PROPANE

First Triad Analysis

Date: 08Jan2008	Response Unit:AREA	
Z1=0.00000	R1=2614839.	T1=775417.0
R2=2613551.	Z2=0.00000	T2=775574.0
Z3=0.00000	T3=774972.0	R3=2607816.
Avg. Concentration:	29.39	PPM

Second Triad Analysis

Calibration Curve

Concentration=A+Bx+Cx2+Dx3+Ex4

r=0.99999821 1

Constants:	A=0.053642941
B=3.77656E-06	C=0
D=0	E=0

APPROVED BY: ROBERT LESNIAK

AIR LIQUIDE Air Liquide America Specialty Gases LLC SCOTT™

RATA CLASS

Dual-Analyzed Calibration Standard

1290 COMBERMERE STREET, TROY, MI 48083 Phone: 248-589-2950 Fax: 248-589-2134

CERTIFICATE OF ACCURACY: EPA Protocol Gas

Assay Laboratory

P.O. No.: GE ENERGY STOCK

AIR LIQUIDE AMERICA SPECIALTY GASES LLC Project No.: 05-70000-001
1290 COMBERMERE STREET
TROY, MI 48083

Customer

GE ENERGY - ELMHURST

888 INDUSTRIAL DRIVE
ELMHURST IL 60126-1012

ANALYTICAL INFORMATION

This certification was performed according to EPA Traceability Protocol For Assay & Certification of Gaseous Calibration Standards; Procedure G-1; September, 1997.

Cylinder Number: ALM000430 Certification Date: 03Nov2008 Exp. Date: 03Nov2011
Cylinder Pressure***: 1950 PSIG

COMPONENT	CERTIFIED CONCENTRATION (Moles)		ANALYTICAL ACCURACY**	TRACEABILITY
PROPANE	50.47	PPM	+/- 1%	Direct NIST and NMi
AIR		BALANCE		

*** Do not use when cylinder pressure is below 150 psig.
** Analytical accuracy is based on the requirements of EPA Protocol Procedure G1, September 1997.

REFERENCE STANDARD

TYPE/SRM NO.	EXPIRATION DATE	CYLINDER NUMBER	CONCENTRATION	COMPONENT
NTRM 1668	02Oct2012	ALM022966	98.80 PPM	PROPANE

INSTRUMENTATION

INSTRUMENT/MODEL/SERIAL#	DATE LAST CALIBRATED	ANALYTICAL PRINCIPLE
HORIBA/FIA-220/G05000JAS	03Nov2008	FLAME IONIZATION

ANALYZER READINGS

(Z=Zero Gas R=Reference Gas T=Test Gas r=Correlation Coefficient)

First Triad Analysis — Second Triad Analysis — Calibration Curve

PROPANE

Date: 03Nov2008	Response Unit:MV	
Z1=0.00000	R1=99.90000	T1=50.60000
R2=99.50000	Z2=0.00000	T2=50.70000
Z3=0.00000	T3=50.60000	R3=99.40000
Avg. Concentration:	50.47	PPM

Concentration=A+Bx+Cx2+Dx3+Ex4	
r=0.99998098	
Constants:	A=0.173714057
B=0.990388621	C=0
D=0	E=0

Special Notes: SEND CERT WITH CERT

APPROVED BY: ROBERT LESNIAK

Page 1 of 1

Attachment W

#2 Tube Heater 2012 Stack Test

Response to Violation Notice A-2023-00162

Koppers Inc.

AIRTECH
Environmental
Services Inc.

Report on the
Air Emissions Test Program

Conducted for Koppers Inc.
at their Facility Located in Stickney, Illinois

Report No. 4035
November 12, 2012

Table of Contents

Project Overview

General

Airtech Environmental Services Inc. (Airtech) was contracted by Koppers Inc. (Koppers) to conduct an air emissions test program at the Koppers facility located in Stickney, Illinois. The objective of the program was to perform diagnostic control efficiency testing on the inlet and outlet of the #2 tube (process) heater. The specific objectives of the test program are summarized in the following table:

Parameter(s)	Inlet	Outlet
Volumetric flow rate	X	X
Moisture	X	X
Benzene, toluene, xylene, styrene, indane, indene, and naphthalene	X	X
Methane, ethane, ethylene, hydrogen, and nitrogen	X	X
Oxygen, carbon dioxide	X	X
Sulfur Dioxide, carbon monoxide		X
Total hydrocarbons	X	X
Carbonyl sulfide, hydrogen sulfide, and carbon disulfide	X	X

Testing was performed to meet the requirements of Koppers.

Testing was performed on September 12, 2012. Coordinating the field portion of the test program were:

Stephanie M. Flynn – Koppers Inc.
Eric Abens – Airtech Environmental Services Inc.

Methodology

Sulfur Dioxide and Carbon Monoxide Methodology

EPA Methods 6C and 10 were used to measure the sulfur dioxide (SO_2) and Carbon Monoxide (CO) concentrations at the outlet test location. The reference method analyzers were equipped with a dilution system designed to lower the dew-point of the sample gas to prevent condensation in the sampling system. Reference method dilution rates were nominally 100:1.

VOC Methodology

The concentrations of benzene, toluene, xylene, styrene, indane, indene, ethyl benzene and naphthalene concentrations at each test location were determined using EPA Method 18. With this approach, a sample of the gas stream was withdrawn from the test locations at a constant rate through a series of adsorbent tubes packed with activated charcoal.

The concentration of methane, ethane, ethylene, hydrogen, and nitrogen were determined at the test location using the flexible bag approach as outlined in EPA Method 18. In EPA Method 18, a sample of the exhaust gas was withdrawn from the source at a constant rate through a stainless steel probe and Teflon sample line.

Analysis of the methane, ethane, ethylene, hydrogen, and nitrogen samples was performed by the Gas Technology Institute located in Des Plaines, Illinois.

EPA Method TO-15 was used to measure the carbonyl sulfide (COS), hydrogen sulfide (H_2S), and carbon disulfide (CS_2) concentrations at the inlet and outlet test locations. A sample was withdrawn from the test location at a constant rate directly into a specially prepared Tedlar bag. Analysis was conducted using gas chromatography coupled with mass spectroscopy (GC-MS). The Tedlar bag samples were analyzed for VOCs by the Gas Technology Institute located in Des Plaines, Illinois.

Total Hydrocarbon Methodology

EPA Method 25A was used for the determination of total hydrocarbons (THC) at each test location. In Method 25A, a sample of the gas stream was withdrawn from the test location at a constant rate through a stainless steel probe and Teflon sample line. At the inlet test location, the reference method analyzers were equipped with a dilution system designed to lower the dew-point of the sample gas to prevent condensation in the sampling system. Reference method dilution rates were nominally 100:1. At the outlet test location, the probe and sample line were maintained at a temperature of at least 250°F to prevent the condensation of moisture or organics.

The sample gas then passed directly into a heated flame ionization analyzer (FIA). Testing was conducted simultaneously at the inlet and outlet.

To convert the various pollutant concentrations to mass emission rates, the volumetric flow rate was determined during each run using EPA Methods 1, 2, 3A, and 4. The carbon dioxide (CO_2) concentration was determined using two different sampling approaches, the flexible bag approach at the inlet and continuous sampling equipped with a dilution probe at the outlet. The oxygen (O_2) concentration was determined using the flexible bag approach at the inlet and the outlet test locations.

Parameters

The following parameters were determined at each test location except where indicated:

- gas temperature
- gas velocity
- carbon dioxide concentration
- oxygen concentration
- moisture concentration
- sulfur dioxide concentration (outlet only)
- carbon monoxide concentration (outlet only)
- benzene concentration
- toluene concentration
- xylene concentration
- styrene concentration
- indane concentration
- indene concentration
- naphthalene concentration
- ethyl benzene concentration
- methane concentration
- ethane concentration
- ethylene concentration
- hydrogen concentration
- nitrogen concentration
- total hydrocarbons concentration
- carbonyl sulfide concentration
- hydrogen sulfide concentration
- carbon disulfide concentration

Results

A complete summary of test results is presented in Tables 1 and 2 on Pages 6 through 9.

Due to complications with the sample train, Run 1 was stopped and an additional run was performed to replace it.

Prepared by: Reviewed by:

Cathy Busse Eric Abens

Summary of Results

Table 1 – Summary of Inlet Emission Results

Test Parameters	Run 2	Run 3	Run 4	Average
Date	9/12/2012	9/12/2012	9/12/2012	
Start Time	16:42	18:06	19:51	
Stop Time	17:26	18:50	20:35	
Gas Conditions				
Temperature (°F)	153	142	132	**142**
Volumetric Flow Rate (acfm)	71.0	62.0	41.0	**58.0**
Volumetric Flow Rate (scfm)	60.0	54.0	37.0	**50.0**
Volumetric Flow Rate (dscfm)	43.0	43.0	31.0	**39.0**
Carbon Dioxide (% dry)	2.4	2.4	2.4	**2.4**
Oxygen (% dry)	11.9	12.0	12.6	**12.2**
Moisture (%)	27.8	20.7	16.0	**21.5**
Pollutant Results				
Benzene Concentration (ppm)	6,500	10,083	34,882	**17,155**
Benzene Emission Rate (lb/hr)	4.76	6.62	15.5	**8.98**
Toluene Concentration (ppm)	3,952	3,851	7,975	**5,259**
Toluene Emission Rate (lb/hr)	3.41	2.98	4.19	**3.53**
Xylene Concentration (ppm)	994	1,225	1,238	**1,152**
Xylene Emission Rate (lb/hr)	0.989	1.09	0.750	**0.944**
Styrene Concentration (ppm)	163.8	213	185	**187**
Styrene Emission Rate (lb/hr)	0.160	0.187	0.110	**0.152**
Indane Concentration (ppm)	5.71	36.8	81.2	**41.3**
Indane Emission Rate (lb/hr)	0.00635	0.0368	0.0551	**0.0327**
Indene Concentration (ppm)	14.7	59.8	64.4	**46.3**
Indene Emission Rate (lb/hr)	0.0163	0.0594	0.0434	**0.0397**
Ethyl Benzene Concentration (ppm)	271	366	475	**370**
Ethyl Benzene Emission Rate (lb/hr)	0.269	0.326	0.288	**0.294**
Napthalene Concentration (ppm)	4.45	0.985	6.59	**4.01**
Napthalene Emission Rate (lb/hr)	0.00534	0.00106	0.00482	**0.00374**
Methane Concentration (ppm)	54,400	70,000	65,300	**63,233**
Methane Emission Rate (lb/hr)	8.18	9.44	5.98	**7.87**

Table 1 – Summary of Inlet Emission Results (continued)

Test Parameters	Run 2	Run 3	Run 4	Average
Date	9/12/2012	9/12/2012	9/12/2012	
Start Time	16:42	18:06	19:51	
Stop Time	17:26	18:50	20:35	
Pollutant Results				
Ethane Concentration (ppm)	13,100	17,900	16,200	**15,733**
Ethane Emission Rate (lb/hr)	3.69	4.53	2.78	**3.67**
Ethylene Concentration (ppm)	3,000	3,500	3,200	**3,233**
Ethylene Emission Rate (lb/hr)	0.789	0.826	0.512	**0.709**
Hydrogen Concentration (ppm)	36,000	51,000	43,000	**43,333**
Hydrogen Emission Rate (lb/hr)	0.337	0.429	0.245	**0.337**
Nitrogen Concentration (ppm)	542,000	517,000	528,000	**529,000**
Nitrogen Emission Rate (lb/hr)	71.1	60.9	42.2	**58.1**
Carbonyl Sulfide Concentration (ppm)	607	377	665	**550**
Carbonyl Sulfide Emission Rate (lb/hr)	0.342	0.191	0.228	**0.253**
Hydrogen Sulfide Concentration (ppm)	120,000	65,300	132,000	**105,767**
Hydrogen Sulfide Emission Rate (lb/hr)	38.3	18.7	25.7	**27.6**
Carbon Disulfide Concentration (ppm)	1,760	1,536	2,340	**1,879**
Carbon Disulfide Emission Rate (lb/hr)	1.26	0.984	1.02	**1.09**
THC Concentration (ppmwv)	239,265	159,360	149,288	**182,638**
THC Emission Rate (lb/hr)	98.9	59.1	37.6	**65.2**

Table 2 – Summary of Outlet Emission Results

Outlet Test Parameters	**Run 2**	**Run 3**	**Run 4**	**Average**
Date	9/12/2012	9/12/2012	9/12/2012	
Start Time	16:42	18:06	19:51	
Stop Time	17:26	18:50	20:35	
Gas Conditions				
Temperature (°F)	968	969	990	**975**
Volumetric Flow Rate (acfm)	11,300	10,300	11,000	**10,800**
Volumetric Flow Rate (scfm)	4,100	3,800	4,000	**3,900**
Volumetric Flow Rate (dscfm)	3,400	3,100	3,300	**3,200**
Carbon Dioxide (% dry)	7.4	7.8	7.1	**7.5**
Oxygen (% dry)	5.7	5.6	9.6	**7.0**
Moisture (%)	18.6	17.6	17.7	**18.0**
Pollutant Results				
Sulfur Dioxide Concentration (ppmdv)	1,737	1,697	1,801	**1,745**
Sulfur Dioxide Emission rate (lb/hr)	71.3	63.4	70.9	**68.6**
Carbon Monoxide Concentration (ppmdv)	5,865	1,986	2,295	**3,382**
Carbon Monoxide Emission Rate (lb/hr)	105	32.5	39.6	**59.2**
Benzene Concentration (ppm)	7.40	9.1	12.5	**9.67**
Benzene Emission Rate (lb/hr)	0.371	0.415	0.601	**0.462**
Toluene Concentration (ppm)	2.84	2.61	2.75	**2.73**
Toluene Emission Rate (lb/hr)	0.168	0.140	0.156	**0.155**
Xylene Concentration (ppm)	0.171	0.148	0.124	**0.148**
Xylene Emission Rate (lb/hr)	0.0117	0.00919	0.00810	**0.00965**
Styrene Concentration (ppm)	<0.0279	<0.0283	<0.0270	**<0.0278**
Styrene Emission Rate (lb/hr)	<0.00187	<0.00172	<0.00173	**<0.00177**
Indane Concentration (ppm)	<0.0318	<0.0321	<0.0307	**<0.0315**
Indane Emission Rate (lb/hr)	<0.00242	<0.00223	<0.00225	**<0.00230**
Indene Concentration (ppm)	<0.0301	<0.0305	<0.0292	**<0.0299**
Indene Emission Rate (lb/hr)	<0.00228	<0.00211	<0.00212	**<0.00217**
Ethyl Benzene Concentration (ppm)	0.0752	0.0615	0.0541	**0.0636**
Ethyl Benzene Emission Rate (lb/hr)	0.00512	0.00381	0.00354	**0.00416**
Napthalene Concentration (ppm)	<0.0265	<0.0268	<0.0256	**<0.0263**
Napthalene Emission Rate (lb/hr)	<0.00218	<0.00201	<0.00202	**<0.00207**

Table 2 – Summary of Outlet Emission Results (continued)

Outlet Test Parameters	**Run 2**	**Run 3**	**Run 4**	**Average**
Date	9/12/2012	9/12/2012	9/12/2012	
Start Time	16:42	18:06	19:51	
Stop Time	17:26	18:50	20:35	
Pollutant Results				
Methane Concentration (ppm)	<300	2,000	300	**867**
Methane Emission Rate (lb/hr)	<3.09	18.7	2.96	**8.26**
Ethane Concentration (ppm)	<300	<300	<300	**<300**
Ethane Emission Rate (lb/hr)	<5.79	<5.27	<5.55	**<5.54**
Ethylene Concentration (ppm)	<300	<300	<300	**<300**
Ethylene Emission Rate (lb/hr)	<5.40	<4.92	<5.18	**<5.16**
Hydrogen Concentration (ppm)	<1,000	2,000	<1,000	**1,333**
Hydrogen Emission Rate (lb/hr)	<0.641	1.17	<0.616	**0.808**
Nitrogen Concentration (ppm)	813,000	826,000	834,000	**824,333**
Nitrogen Emission Rate (lb/hr)	7,300	6,756	7,188	**7,081**
Carbonyl Sulfide Concentration (ppm)	41.8	1.39	0.09	**14.4**
Carbonyl Sulfide Emission Rate (lb/hr)	1.61	0.0488	0.00333	**0.554**
Hydrogen Sulfide Concentration (ppm)	1.76	0.470	1.98	**1.40**
Hydrogen Sulfide Emission Rate (lb/hr)	0.0385	0.00936	0.0415	**0.0298**
Carbon Disulfide Concentration (ppm)	0.510	<0.030	<0.030	**0.1900**
Carbon Disulfide Emission Rate (lb/hr)	0.0249	<0.00133	<0.00141	**0.00922**
THC Concentration (ppmwv)	49.0	140	95.4	**94.9**
THC Emission Rate (lb/hr)	1.38	3.62	2.59	**2.53**
THC Destruction Efficiency (%)	98.6	93.9	93.1	**95.2**

Test Procedures

Method Listing

The following EPA test methods were referenced for the test program. These methods can be found in 40 CFR Part 60 Appendix A.

Method 1	Sample and velocity traverse for stationary sources
Method 1A	Sample and velocity traverses for stationary sources with small stacks or ducts
Method 2	Determination of stack gas velocity and volumetric flow rate (type S pitot tube)
Method 3A	Determination of oxygen and carbon dioxide concentrations in emissions from stationary sources
Method 4	Determination of moisture content in stack gases
Method 6C	Determination of sulfur dioxide emissions from stationary sources (instrumental analyzer procedure)
Method 10	Determination of carbon monoxide emissions from stationary sources
Method 18	Determination of gaseous organic compound emissions by gas chromatography
Method 25A	Determination of total gaseous organic concentration using a flame ionization analyzer

The following method was found in the Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air

Method TO-15	Determination of volatile organic compounds in air collected in specially-prepared canisters and analyzed by gas chromatography mass spectrometry

Method Descriptions

Method 1/1A

Method 1/1A was used to determine the suitability of each test location and to determine the sample points used for the volumetric flow rate determinations. Each test location conformed to the minimum requirements of being located at least 2.0 diameters downstream and at least 0.5 diameters upstream from the nearest flow disturbance.

The inlet test location was a round, horizontal stack with a diameter of 6.0 inches. Eight points were sampled for each of the two test ports. The test location was approximately 2.0 diameters downstream and approximately 7.2 diameters upstream from the nearest flow disturbances. A cross section of the sampling location, showing the sample points, can be found in Figure 1 of the Appendix.

The outlet test location was a round, vertical stack with a diameter of 24.0 inches. Eight points were sampled for each of the two test ports. The test location was approximately 2.5 diameters downstream and approximately 9.0 diameters upstream from the nearest flow disturbances. A cross section of the sampling location, showing the sample points, can be found in Figure 2 of the Appendix.

Method 2

Method 2 was used to determine the gas velocity through each test location using a Type-S pitot tube and an incline plane oil manometer. The values measured in Method 2, along with the measurements made in Methods 3A and 4, were used to calculate the volumetric flow rate through the test locations. A diagram of the Method 2 apparatus is shown in Figure 3 of the Appendix.

The manometer was leveled and "zeroed" prior to each test run. The sample train was leak checked before and after each run by pressurizing the positive side, or "high" side, of the pitot tube, creating a deflection on the manometer of at least three inches H_2O. The leak check was considered valid if the manometer remained stable for 15 seconds. This procedure was repeated on the negative side by generating a vacuum of at least three inches H_2O. The velocity head pressure and gas temperature were then determined at each point specified in Method 1. The static pressure of the stack was measured using a water filled U-tube manometer. In addition, the barometric pressure was measured and recorded.

Method 3A-Flexible Bag Approach

The O_2 content of the gas stream at the inlet and the outlet test locations and the CO_2 content at the inlet test location were determined in conjunction with each Method 2 test run using EPA Method 3A. The O_2 and the CO_2 content was used to calculate the dry molecular weight of the gas stream. The molecular weight was then used, along with the moisture content determined by EPA Method 4, for the calculation of the volumetric flow rate. For these calculations, the balance of the gas stream was assumed to be nitrogen since the other gas stream components are insignificant for the purposes of calculating molecular weight. A gas sample was collected into a Tedlar bag from the back of each sample train for the duration of each test run. Analysis was performed using a Servomex 1440 paramagnetic O_2 analyzer.

The analyzer was calibrated immediately prior to analysis of the bag samples using the procedures outlined in Method 3A using EPA Protocol calibration gases.

Methods 3A, 6C and 10

The CO_2, SO_2 and CO concentrations at the outlet test location were determined using EPA Methods 3A, 6C and 10. A sample of the gas stream was continuously withdrawn from the test location and analyzed using a continuous gas analysis system. A schematic of the sampling system is shown in Figure 4 of the Appendix.

The sample gas was withdrawn from the test location at a constant rate through an in-situ 0.3 micron stainless steel cintered frit and an EPM style dilution probe. The diluted gas was then vented to the oxygen, carbon dioxide, sulfur dioxide, nitrogen oxides and carbon monoxide analyzers. Results from these analyzers were determined on a "wet" basis.

The analyzers that were used for this project are listed in the table below.

Parameter	Manufacturer	Model Number	Operating Principle	Units Reported	Range
Carbon Dioxide	Servomex	1440	Infrared	(%)	(0-9.930)
Sulfur Dioxide	Thermo Environmental	43C	Pulsed Fluorescence	(ppmdv)	(0-920.9)
Carbon Monoxide	Thermo Environmental	48C	Infrared, Gas Filter Correlation	(ppmdv)	(0-900.9)

Each analyzer was calibrated with zero nitrogen and at least two known concentrations of the appropriate gas constituent in a balance of nitrogen. Each calibration gas was certified according to EPA Protocol 1 procedures.

Prior to sampling, a calibration error test was performed for each analyzer using EPA Protocol 1 gases. The zero and high-range calibration gases for each constituent were introduced through the dilution system. Each analyzer was then adjusted to the appropriate values. The mid-range gas was then introduced to each analyzer and the measured values were recorded. The measured values for each calibration gas were then compared to the calibration gas values and the differences were less than the method requirement of two percent of the span value.

A sample system bias check was then performed by introducing the zero and mid-range calibration gases into the sampling system prior to the filter. The gas was drawn through the entire sampling system. The measured responses were then compared to the calibration error test values to determine the bias in response due to the sampling system. The sampling system bias was less than the method requirement of five percent of the span value. In addition, the system response time was determined by measuring the time required for each analyzer to reach 95 percent of its' high-range calibration gas value.

After each test run the instrument drift for each analyzer was determined by introducing the zero and mid-range calibration gases into the sampling system prior to the filter. The gas was drawn through the entire sampling system. The measured responses were then compared to the values from the previous test run to determine the analyzer drift. For all test runs, the analyzer drift was less than the method requirement of three percent of the span value.

Method 4

The moisture content at each test location was determined using Method 4. A known volume of sample gas was withdrawn from the source and the moisture was condensed and measured. The dry standard volume of the sample gas was then compared to the volume of moisture collected to determine the moisture content of the sample gas. A diagram of the Method 4 apparatus is shown in Figure 5.

To condense the water vapor at each test location, the gas sample passed through a series of four impingers. The first two impingers were each filled with 100 ml of water. The third impinger was empty and the fourth contained a known weight of silica gel to absorb any remaining water vapor.

The sample train was leak checked prior to the test run by capping the probe tip and pulling a vacuum greater than the highest vacuum expected during the test run. A leak check was considered valid if the leak rate was below the lesser of 0.02 cubic feet per minute or 4 percent of the average sample rate.

The volume of dry gas exiting the gas condenser system was measured with a dry gas meter. After leaving the dry gas meter, the sample stream passed through an orifice used to meter the flow rate through the sample train. The pressure drop across the orifice was measured with an incline plane, oil manometer. The gas meter reading, gas meter inlet and outlet temperatures, gas meter static pressure and pump vacuum were recorded for each sample point.

After the test run, the sample train was leak checked at the highest vacuum encountered during the test run. The tests were considered valid since the leak rate was less than 0.02 cfm. The amount of water collected in the condenser system was measured gravimetrically. The net weight gain of water was converted to a volume of wet gas and then compared to the amount of dry gas sampled to determine the moisture content.

Method 18-Adsorbent Tube

The benzene, toluene, xylene, styrene, indane, indene, ethyl benzene and naphthalene concentrations at each test location were determined using EPA Method 18. In this approach, a sample of the gas stream was withdrawn from each source at a constant rate, and passed through a set of charcoal adsorbent tubes connected in series. The samples were then transferred to the laboratory for analysis. Benzene, toluene, xylene, styrene, indane, indene, ethyl benzene and naphthalene was desorbed from the tubes and analyzed by gas chromatography. The apparatus used for EPA Method 18 is shown in Figure 6 in the Appendix.

The sample train was leak checked prior to the test run by capping the probe tip and pulling a vacuum greater than the highest vacuum expected during the test run. A leak check was considered valid if the leak rate was less than 0.02 liters per minute or 4 percent of the average sample rate. Sample gas was withdrawn from the source at a constant rate. The volume of dry gas exiting the gas condenser system was measured with a dry gas meter. The gas meter reading, gas meter inlet and outlet temperatures, gas meter static pressure and pump vacuum was recorded every five minutes during each test run. Each test run was 45 minutes in duration. After the test run the sample train was leak checked at the highest vacuum encountered during the test run. The charcoal tubes were then sealed, labeled and chilled for transfer to the Airtech Laboratory located in Denver, Colorado.

Method 18-Tedlar Bag

Method 18 was used to determine the concentration of methane, ethane, ethylene, hydrogen, and nitrogen at the inlet and outlet test locations. An integrated gas sample was collected from the source and its major components separated using a gas chromatograph (GC). The apparatus used for EPA Method 18 is shown in Figure 7 in the Appendix.

The Tedlar bag sample from Method 3 was used for the Method 18 analysis. Analysis of the samples was performed by the Gas Technology Institute located in Des Plaines, Illinois.

Method 25A

The total hydrocarbon concentration at each location was determined using Method 25A. A sample of the gas stream was continuously withdrawn from the test location and analyzed using a continuous gas analysis system. A diagram of the Method 25A apparatus is shown in Figure 8 of the Appendix.

The sample gas was withdrawn from each location at a constant rate through a stainless steel probe and a Teflon sample line. At the inlet test location, the reference method analyzers were equipped with a dilution system designed to lower the dew-point of the sample gas to prevent condensation in the sampling system. Reference method dilution rates were nominally 100:1. At the outlet test location, the probe and sample line were maintained at a temperature of at least 250°F to prevent the condensation of moisture or organics.

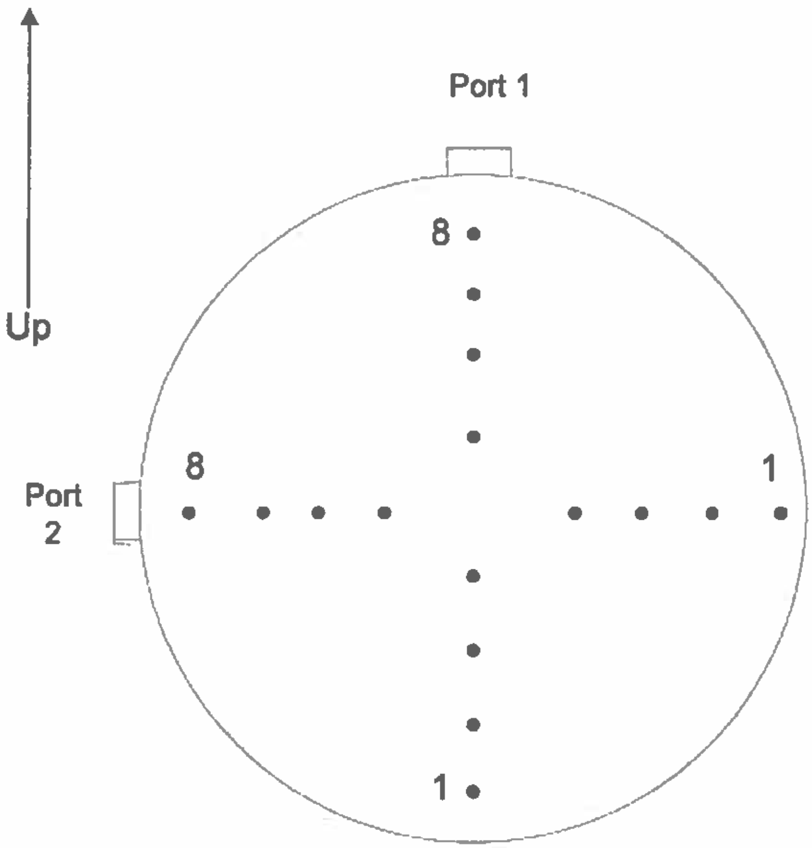
The sample gas was vented to a J.U.M. Engineering Model 3-500 gas analyzer. This analyzer used a flame ionization detector for the determination of total hydrocarbons. Results from this analyzer were determined on a "wet" basis. Hydrogen was used to fuel the instrument. The flame ionization analyzer (FIA) was calibrated with zero nitrogen and three known concentrations of propane in a balance of nitrogen. Each calibration gas was certified according to EPA Protocol 1 procedures.

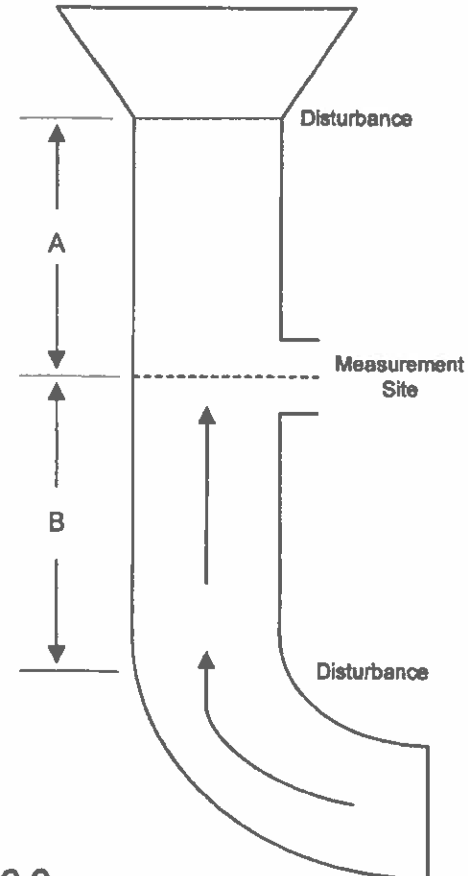
Prior to sampling, a calibration error test was performed for the FIA. The zero and high-range calibration gases were introduced into the sampling system prior to the filter. The gas was drawn through the entire sampling system and the FIA was adjusted to the appropriate values. The mid and low-range gases were then introduced to the FIA and the measured values were recorded. The measured values for each calibration gas were then compared to the calibration gas values and the differences were less than the method requirement of five percent of the actual value.

After each test run the instrument drift for each FIA was determined by introducing the zero and mid-range calibration gases into the sampling system. The gas was drawn through the entire sampling system. The measured responses were then compared to the values from the previous test run to determine the analyzer drift. For all test runs, the analyzer drift was less than the method requirement of three percent of the span value.

Appendix

Figures





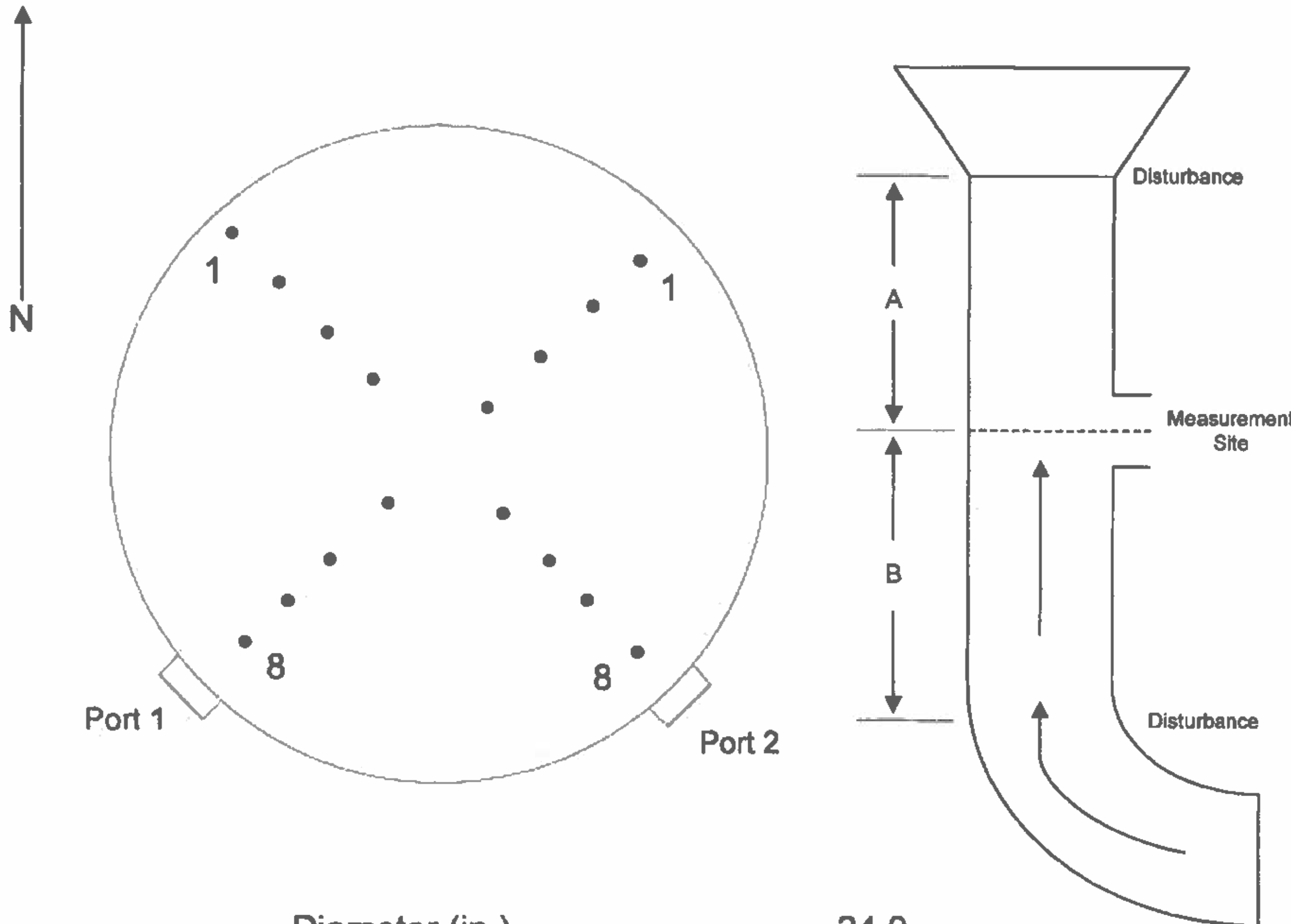
Diameter (in.)	6.0
Port Length (in.)	9.5
Distance A (Duct Diameters)	7.2
Distance B (Duct Diameters)	2.0

Point	Distance From Wall (in.)
1	0.5
2	0.6
3	1.2
4	1.9
5	4.1
6	4.8
7	5.4
8	5.5

Cross Section of the Inlet Test Location
Koppers Inc.

Figure 1

AIRTECH Environmental Services Inc.



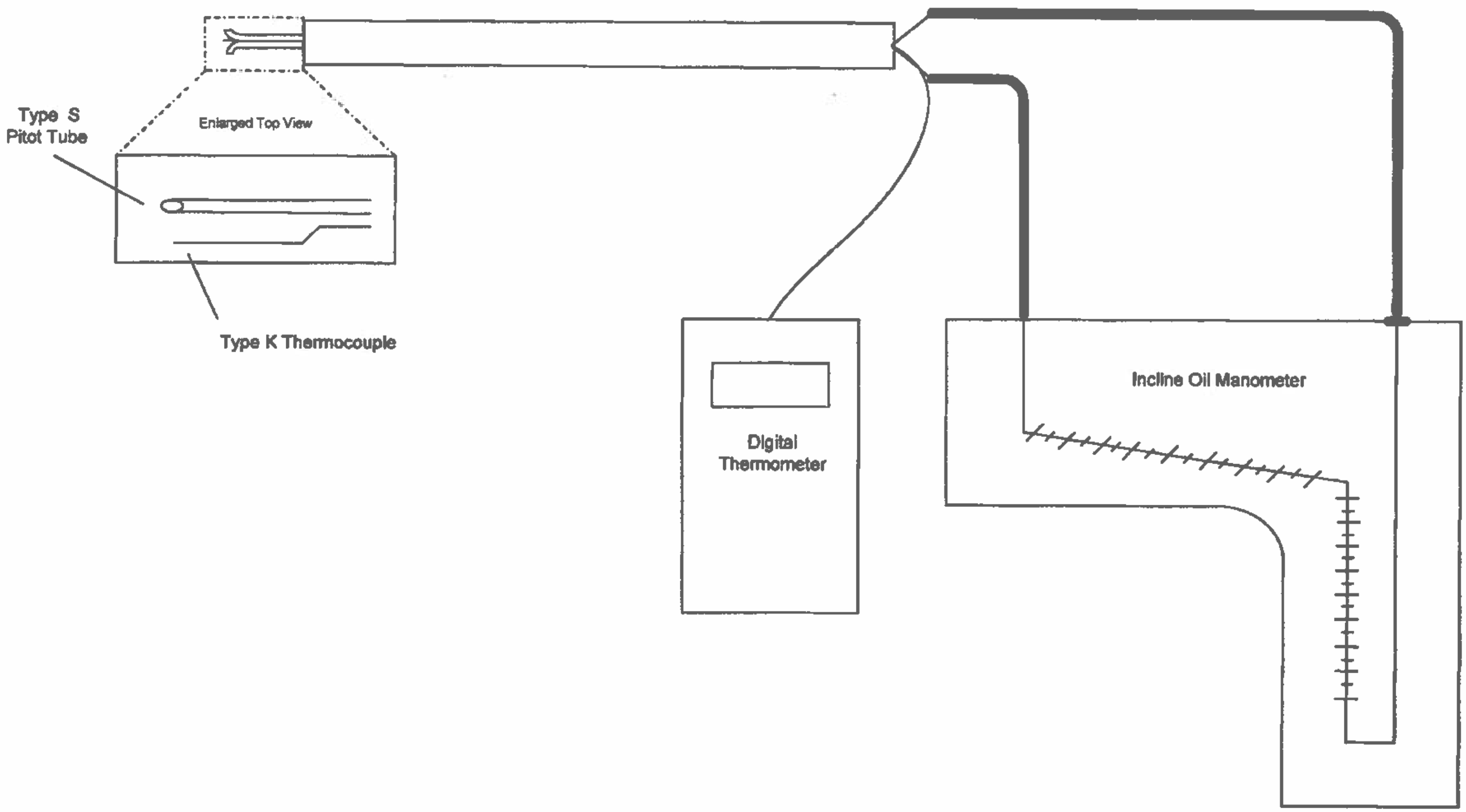
Diameter (in.)	24.0
Port Length (in.)	9.0
Distance A (Duct Diameters)	9.0
Distance B (Duct Diameters)	2.5

Point	Distance From Wall (in.)
1	1.0
2	2.5
3	4.7
4	7.8
5	16.2
6	19.3
7	21.5
8	23.0

Cross Section of the Outlet Test Location
Koppers Inc.

Figure 2

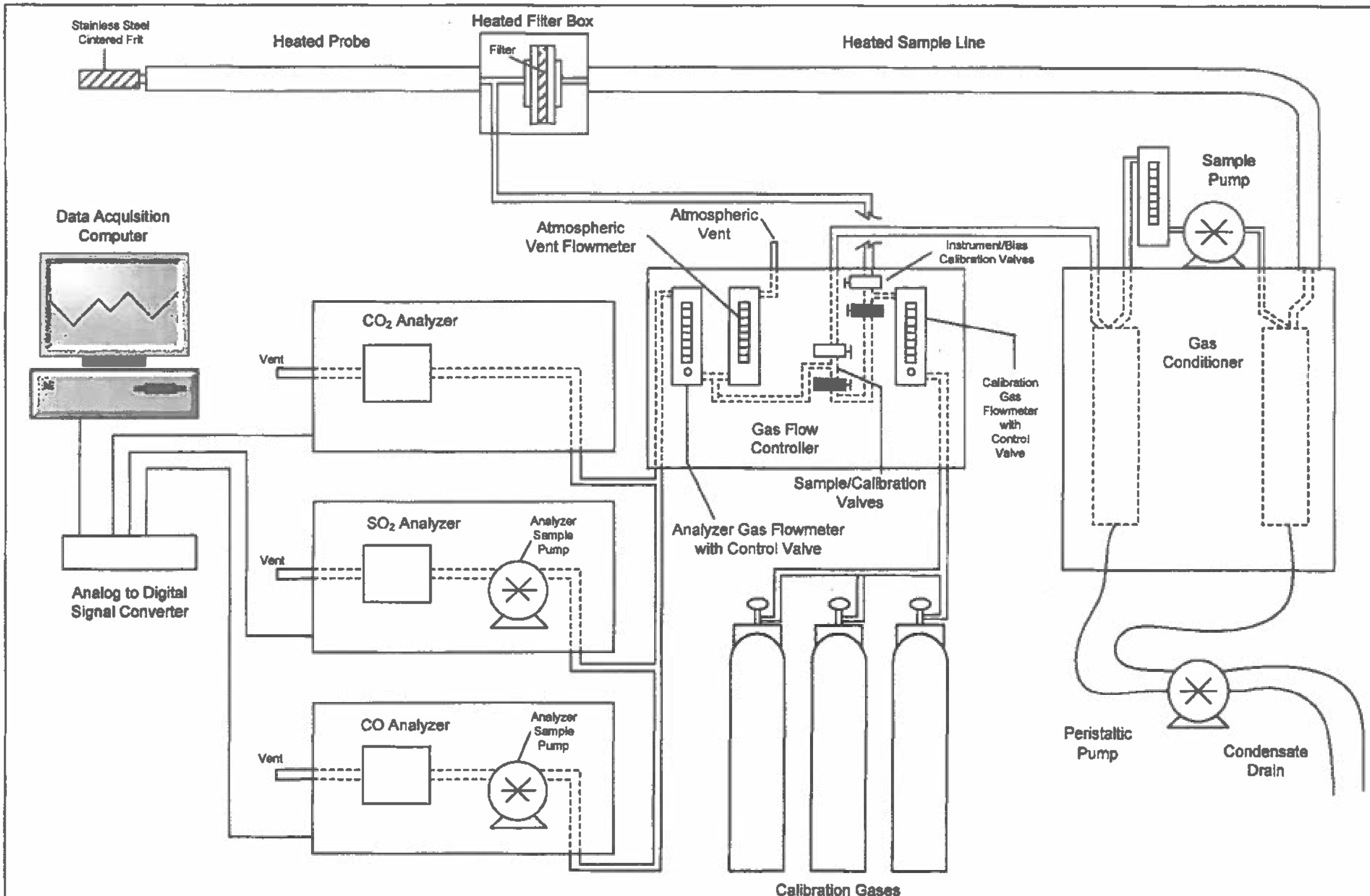
AIRTECH Environmental Services Inc.



EPA Method 2:
Type S Pitot Tube Assembly with Manometer

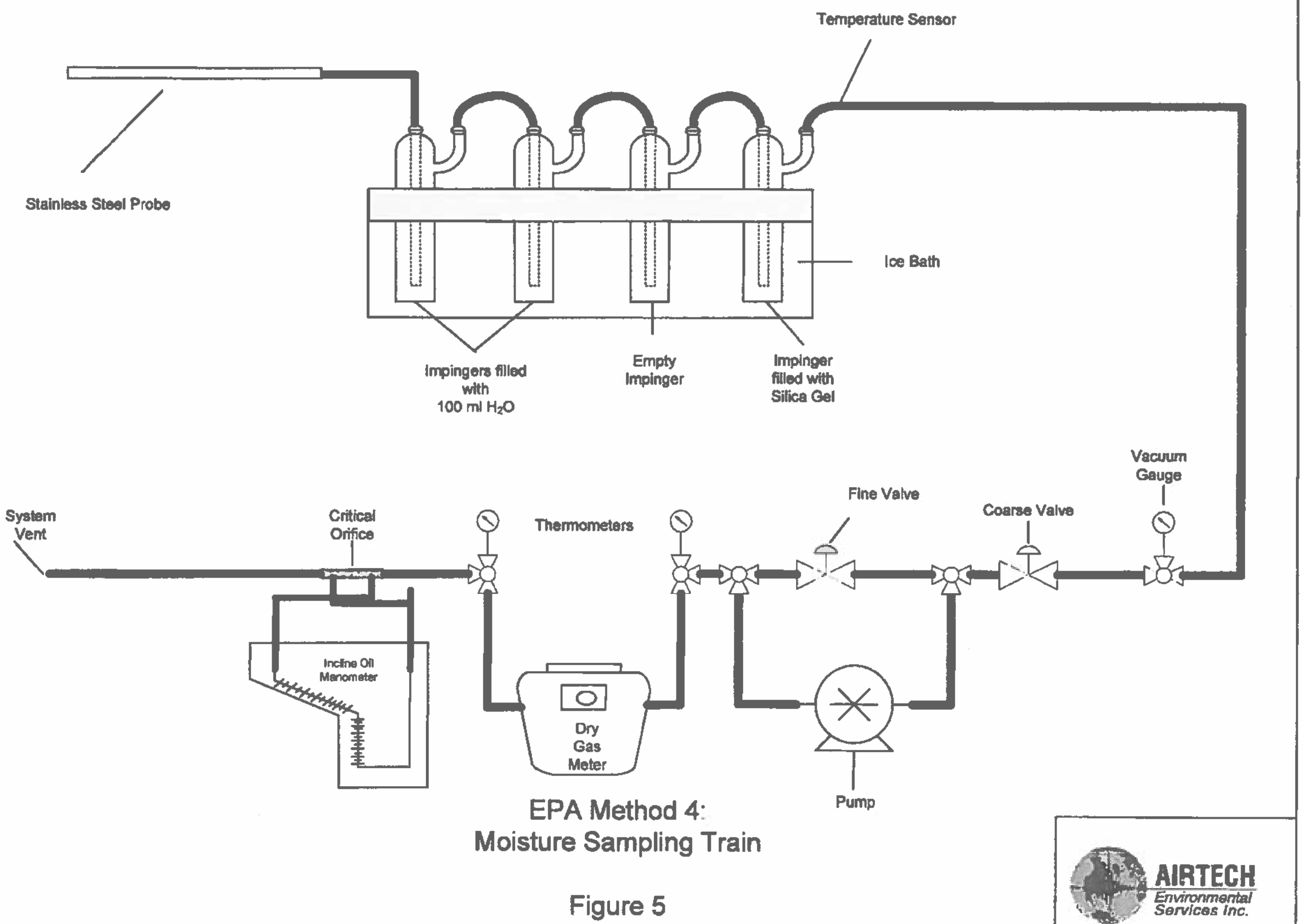
Figure 3

AIRTECH Environmental Services Inc.



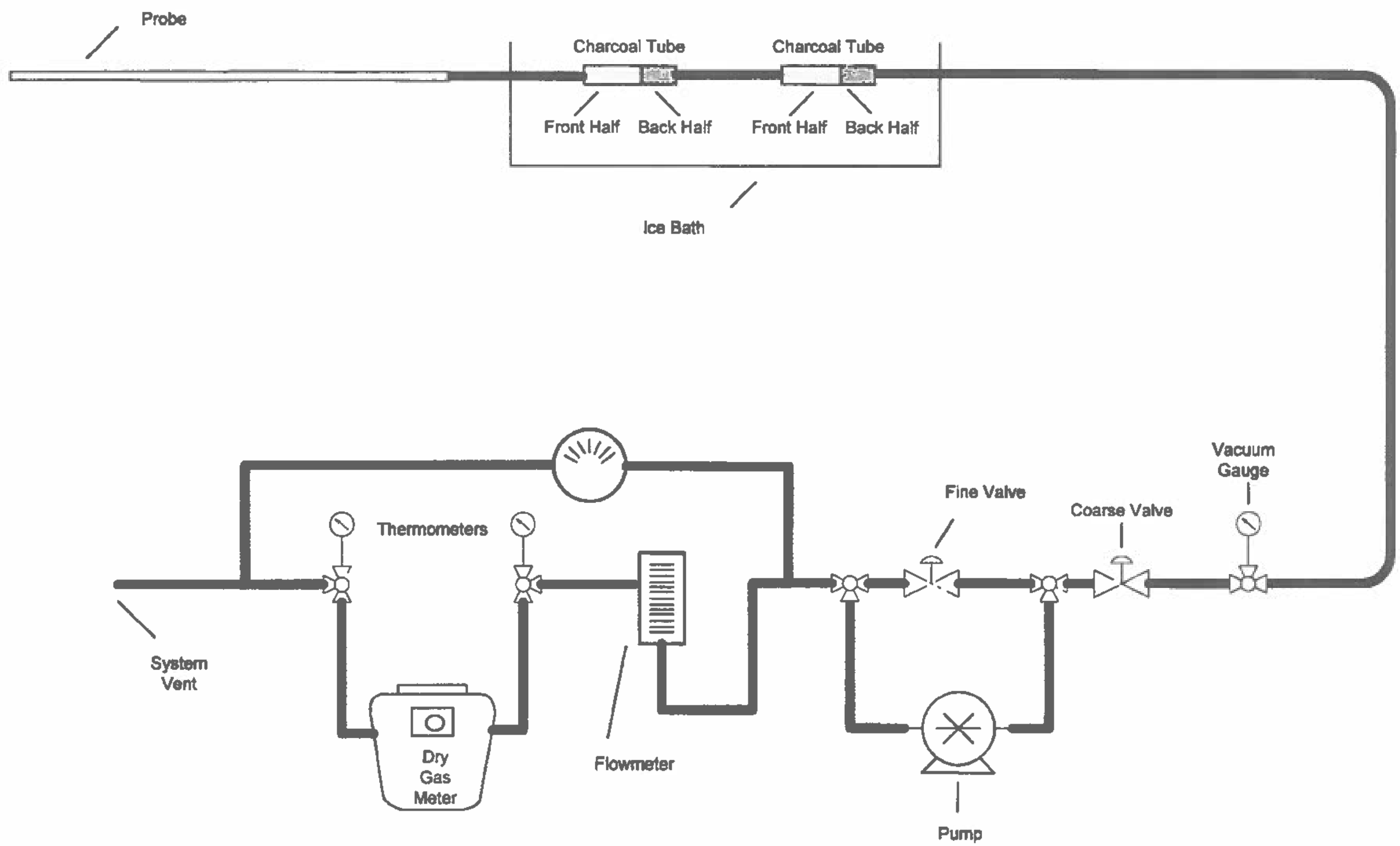
EPA Methods 3A, 7E and 10:
CO_2, SO_2 and CO Gas Sampling System

Figure 4



EPA Method 4:
Moisture Sampling Train

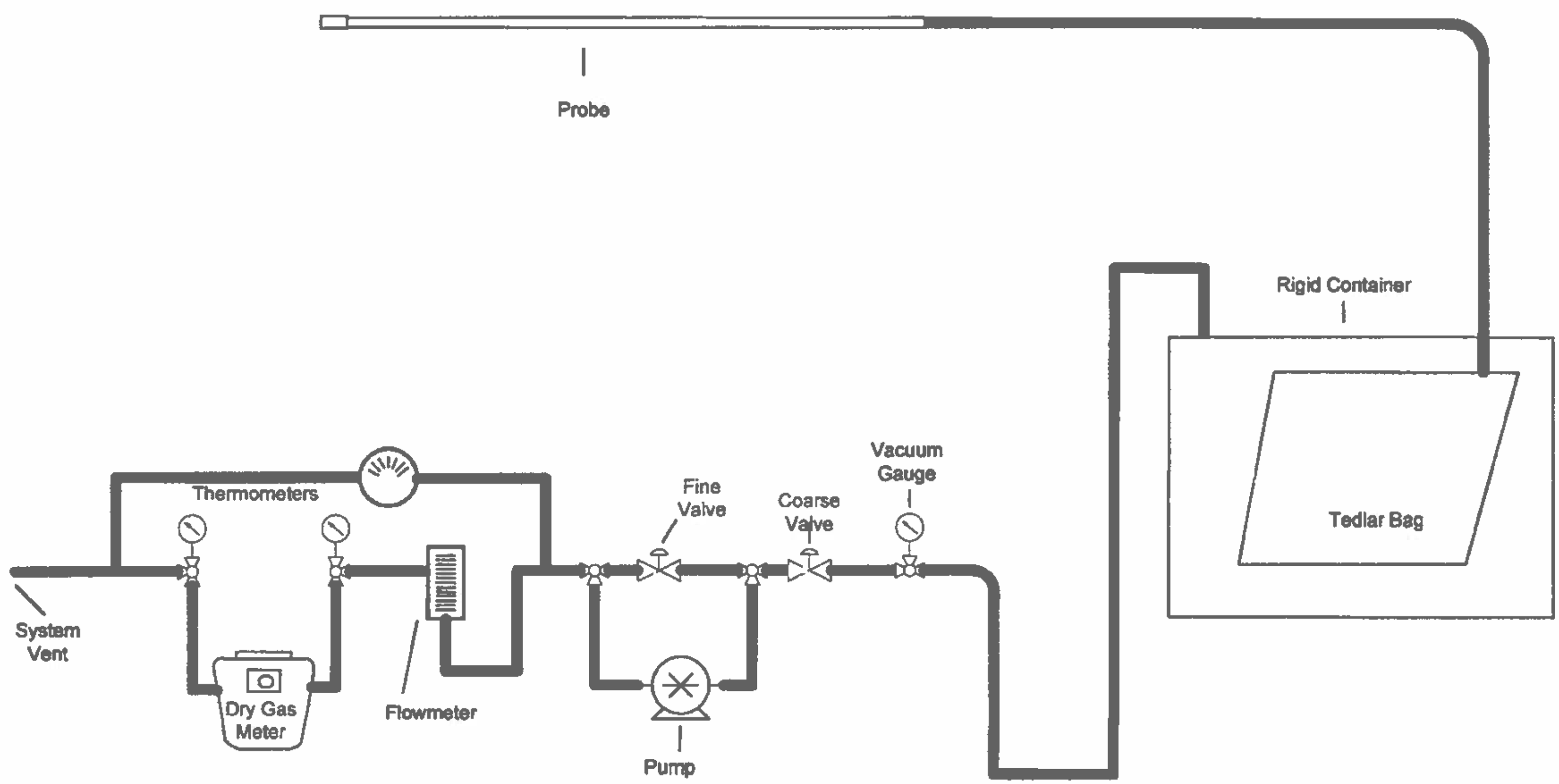
Figure 5



EPA Method 18:
Toluene Charcoal Tube Sampling System

Figure 6

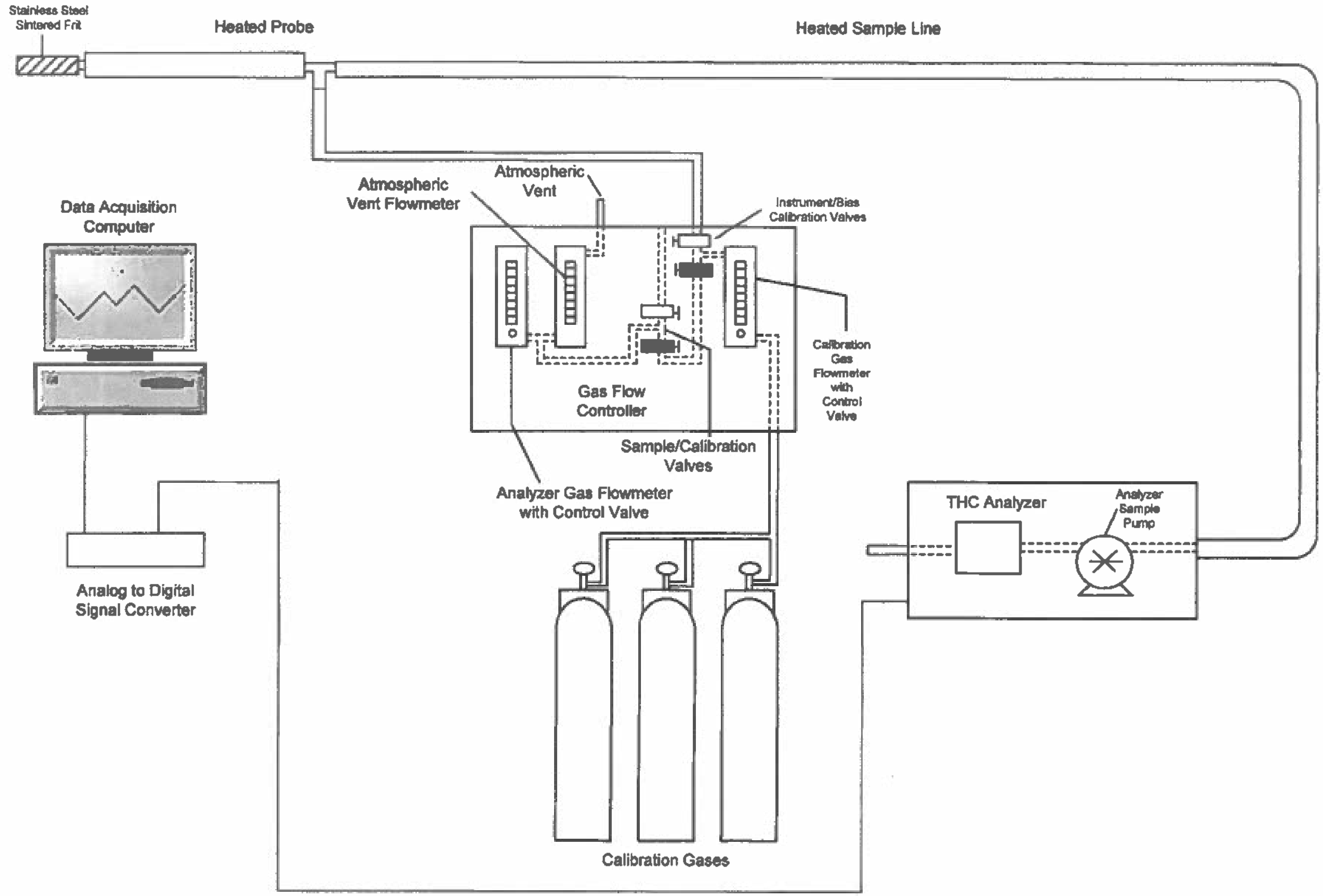
AIRTECH Environmental Services Inc.



EPA Method 18:
VOC Sampling Train

Figure 7

AIRTECH Environmental Services Inc.



EPA Method 25A:
Total Hydrocarbon Gas Sampling System

Figure 8

AIRTECH Environmental Services Inc.

Sample Calculations

Sample Calculations for Run 2, Outlet Test Location

Area of Sample Location

$$A_s = \pi \times \left(\frac{d_s}{2\times12}\right)^2$$

$$A_s = \pi \times \left(\frac{24.0}{2\times12}\right)^2$$

$$A_s = 3.14 ft^2$$

where:

A_s	= area of stack (ft^2)
D_s	= diameter of stack (in)
12	= conversion factor (in/ft)
2	= conversion factor (diameter to radius)

Stack Pressure Absolute

$$P_a = P_b + \frac{P_s}{13.6}$$

$$P_a = 29.60 + \frac{-0.2}{13.6}$$

$$P_a = 29.59 in.Hg$$

where:

P_a	= stack pressure absolute (in. Hg)
P_b	= barometric pressure (in. Hg)
P_s	= static pressure (in. H_2O)
13.6	= conversion factor (in. H_2O/in. Hg)

Volume of Dry Gas Collected Corrected to Standard Conditions

$$V_{m(std)} = \frac{17.64(V_m)(Y_d)\left(P_b + \frac{\Delta H}{13.6}\right)}{(T_m + 460)}$$

$$V_{m(std)} = \frac{17.64(27.20)(0.9944)\left(29.60 + \frac{1.00}{13.6}\right)}{(95.5 + 460)}$$

$$V_{m(std)} = 25.49 scf$$

where:

$V_{m(std)}$	= volume of gas collected at standard conditions (scf)
V_m	= volume of gas sampled at meter conditions (ft^3)
Y_d	= gas meter correction factor (dimensionless)
P_b	= barometric pressure (in. Hg)
ΔH	= average sample pressure (in. H_2O)
T_m	= average gas meter temperature (^oF)
13.6	= conversion factor (in. H_2O/in. Hg)
17.64	= ratio of standard temperature over standard pressure (^oR/in. Hg)
460	= conversion (^oF to ^oR)

Volume of Water Vapor Collected Corrected to Standard Conditions

$$V_{w(std)} = 0.04707 \times V_{wc} + 0.04715 \times V_{wsg}$$

$$V_{w(std)} = 0.04707 \times 113.0 + 0.04715 \times 11.0$$

$$V_{w(std)} = 5.84 scf$$

where:

$V_{w(std)}$	= volume of water vapor at standard conditions (scf)
V_{wc}	= weight of liquid collected (g)
V_{wsg}	= weight gain of silica gel (g)
0.04707	= volume occupied by one milliliter water at standard conditions (ft^3/g)
0.04715	= volume occupied by one gram water at standard conditions (ft^3/g)

Percent Moisture

$$B_{ws} = 100 \times \left[\frac{V_{w(std)}}{(V_{m(std)} + V_{w(std)})} \right]$$

$$B_{ws} = 100 \times \left[\frac{5.84}{(25.49 + 5.84)} \right]$$

$$B_{ws} = 18.6\%$$

where:

B_{ws}	= moisture content of the gas stream (%)
$V_{m(std)}$	= volume of gas collected at standard conditions (scf)
$V_{w(std)}$	= volume of water vapor at standard conditions (scf)
100	= conversion factor

Molecular Weight of Dry Gas Stream[1]

$$M_d = \left(44 \times \frac{\%CO_2}{100}\right) + \left(32 \times \frac{\%O_2}{100}\right) + \left(28 \times \frac{(\%N_2)}{100}\right)$$

$$M_d = \left(44 \times \frac{7.40}{100}\right) + \left(32 \times \frac{5.7}{100}\right) + \left(28 \times \frac{89.6}{100}\right)$$

$$M_d = 29.41 lbs / lb - mole$$

where:

M_d	= molecular weight of the dry gas stream (lb/lb-mole)
$\%CO_2$	= carbon dioxide content of the dry gas stream (%)
44	= molecular weight of carbon dioxide (lb/lb-mole)
$\%O_2$	= oxygen content of the dry gas stream (%)
32	= molecular weight of oxygen (lb/lb-mole)
%CO	= carbon monoxide content of the dry gas stream (%)
$\%N_2$	= nitrogen content of the dry gas stream (%)
28	= molecular weight of nitrogen (lb/lb-mole)
100	= conversion factor

---

[1] The remainder of the gas stream after subtracting carbon dioxide and oxygen is assumed to be nitrogen.

Molecular Weight of Wet Gas Stream

$$M_s = \left(M_d \times \left(1 - \frac{B_{ws}}{100}\right)\right) + \left(18 \times \frac{B_{ws}}{100}\right)$$

$$M_s = \left(29.41 \times \left(1 - \frac{18.6}{100}\right)\right) + \left(18 \times \frac{18.6}{100}\right)$$

$$M_s = 27.28\ lbs/lb-mole$$

where:

M_s	= molecular weight of the wet gas stream (lb/lb-mole)
M_d	= molecular weight of the dry gas stream (lb/lb-mole)
B_{ws}	= moisture content of the gas stream (%)
18	= molecular weight of water (lb/lb-mole)
100	= conversion factor

Velocity of Gas Stream

$$V_s = 85.49(C_p)(\sqrt{\Delta P})\sqrt{\frac{(T_s + 460)}{(M_s)(P_a)}}$$

$$V_s = 85.49(0.84)(0.626)\sqrt{\frac{(968 + 460)}{(27.28)(29.44)}}$$

$$V_s = 59.8\ ft/\sec$$

where:

V_s	= average velocity of the gas stream (ft/sec)
C_p	= pitot tube coefficient (dimensionless)
$\sqrt{\Delta P}$	= average square root of velocity pressures (in. H_2O)$^{1/2}$
T_s	= average stack temperature (°F)
M_s	= molecular weight of the wet gas stream (lb/lb-mole)
P_a	= stack pressure absolute (in. Hg)
85.49	= pitot tube constant (ft/sec)([(lb/lb-mole)(in. Hg)]/[(°R)(in. H_2O)])$^{1/2}$
460	= conversion (°F to °R)

Volumetric Flow of Gas Stream - Actual Conditions

$Q_a = 60(V_s)(A_s)$

$Q_a = 60(59.8)(3.14)$

$Q_a = 11{,}268\,acfm$

where:

Q_a	= volumetric flow rate of the gas stream at actual conditions (acfm)
V_s	= average velocity of the gas stream (ft/sec)
A_s	= area of duct or stack (ft^2)
60	= conversion factor (sec/min)

Volumetric Flow of Gas Stream - Standard Conditions

$$Q_{std} = \frac{17.64(Q_a)(P_a)}{(T_s + 460)}$$

$$Q_{std} = \frac{17.64(11{,}268)(29.59)}{(968 + 460)}$$

$$Q_{std} = 4{,}119\,scfm$$

where:

Q_{std}	= volumetric flow rate of the gas stream at standard conditions (scfm)
Q_a	= volumetric flow rate of the gas stream at actual conditions (acfm)
T_s	= average stack temperature (°F)
P_a	= stack pressure absolute (in. Hg)
17.64	= ratio of standard temperature over standard pressure (°R/in. Hg)
460	= conversion (°F to °R)

Volumetric Flow of Gas Stream - Standard Conditions - Dry Basis

$$Q_{dstd} = Q_{std}\left(1 - \frac{B_{ws}}{100}\right)$$

$$Q_{dstd} = 4{,}119\left(1 - \frac{18.6}{100}\right)$$

$$Q_{dstd} = 3{,}352\,dscfm$$

where:

Q_{dstd}	= volumetric flow rate of the dry gas stream at standard conditions (dscfm)
Q_{std}	= volumetric flow rate of the gas stream at standard conditions (scfm)
B_{ws}	= moisture content of the gas stream (%)
100	= conversion factor

Sample Calculations, Method 18 Adsorbent Tube, Run 2[2]

Xylene Concentration (ppm)

$$C_{Xppm} = \frac{(m)(28.3)(385.3)(10^6)}{(V_{m(std)})(10^6)(453.59)(MW)}$$

$$C_{Xppm} = \frac{(34.5)(28.3)(385.3)(10^6)}{(45.6)(10^6)(453.59)(106.16)}$$

$$C_{Xppm} = 0.171 ppm$$

where:

C_{xppm}	= xylene concentration (ppm)
m	= mass of xylene collected (µg)
28.3	= conversion factor (ft^3/L)
385.3	= conversion factor (ft^3/lb-mole)
10^6	= conversion factor (ppm)
$V_{m(std)}$	= volume of gas collected at standard conditions (L)
10^6	= conversion factor (ug/g)
453.6	= conversion factor (g/lb)
MW	= molecular weight of xylene (lb/lb-mole)

Xylene Emission Rate, lb/hr

$$E_x = \frac{(C_{x(ppm)})(60)(MW)(Q_{std})}{(385.3)(10^6)}$$

$$E_x = \frac{(0.171)(60)(106.16)(4{,}119)}{(385.3)(10^6)}$$

$$E_x = 0.0117 lb/hr$$

where:

E_x	= xylene emission rate (lb/hr)
C_x	= xylene concentration (ppm)
MW	= molecular weight of xylene (lb/lbmole)
Q_{std}	= volumetric flow rate of the gas stream at standard conditions (scfm)
60	= conversion factor (min/hr)
385.3	= volume occupied by one lb/mole of gas at standard conditions (dscf/lbmole)
10^6	= conversion factor (ppm)

---

[2] The concentrations and emission rates of benzene, toluene, styrene, indane, indene, ethyl benzene and naphthalene were all calculated in a similar manner.

Sample Calculations, Method 18 Tedlar Bag Approach, Run 2

Methane Emission Rate[3]

$$E_A = \frac{(C)(Q_{(std)})(60)(MW)}{(385.6)(10^6)}$$

$$E_A = \frac{(<300)(4{,}119)(60)(16.04)}{(385.3)(10^6)}$$

$$E_A = < 3.09 lb/hr$$

where:

E_A	= methane emission rate (lb/hr)
C	= methane concentration (ppmv)
$Q_{(std)}$	= stack gas flow rate (scfm)
60	= conversion factor (min/hr)
MW	= molecular weight of methane (lb/lb-mole)
385.3	= volume occupied by one lb of gas at standard conditions (ft^3/lb)
1,000,000	= conversion factor (ppm/mole fraction)

[3] The emission rates of ethane, ethylene, hydrogen, and nitrogen were all calculated in a similar manner.

Total Hydrocarbon Concentration, Corrected for Analyzer Drift, as propane[4]

$$C_w = \left(C - \left(\frac{c_{0i} + c_{0f}}{2}\right)\right)\left(\frac{c_a}{\left(\frac{c_{si} + c_{sf}}{2}\right) - \left(\frac{c_{0i} + c_{0f}}{2}\right)}\right)$$

$$C_w = \left(50.3 - \left(\frac{1.7 + 0.7}{2}\right)\right)\left(\frac{80.10}{\left(\frac{80.3 + 80.9}{2}\right) - \left(\frac{1.7 + 0.7}{2}\right)}\right)$$

$$C_w = 49.0\, ppmwv$$

where:

C_w	= total hydrocarbon concentration, corrected for analyzer drift (ppmwv)
C	= total hydrocarbon concentration (ppmwv)
C_{0i}	= initial zero calibration value (ppmwv)
C_{0f}	= final zero calibration value (ppmwv)
C_{si}	= initial span calibration value (ppmwv)
C_{sf}	= final span calibration value (ppmwv)
C_a	= actual span gas value (ppmwv)

Total Hydrocarbon Emission Rate, as propane[5]

$$E_{THC} = \frac{(C_w)(MW)(Q_{std})(60)}{385.3 \times 10^6}$$

$$E_{THC} = \frac{(49.0)(44.10)(4{,}119)(60)}{385.3 \times 10^6}$$

$$E_{THC} = 1.38\, lb/hr$$

where:

E_{THC}	= total hydrocarbon emission rate, as propane (lb/hr)
C_w	= total hydrocarbon concentration, wet basis, as propane (ppmwv)
MW	= molecular weight of propane (lb/lbmole)
Q_{std}	= volumetric flow rate of the gas stream at standard conditions (scfm)
60	= conversion factor (min/hr)
385.3	= volume occupied by one pound of gas at standard conditions (dscf/lbmole)
10^6	= conversion factor (fraction to ppm)

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[4] The CO2, SO2 and CO concentrations were calculated in a similar manner.

[5] The SO2 and CO emission rate was calculated in a similar manner using the appropriate molecular weight.

Destruction Efficiency

$$DE = 100 \times \frac{(E_{inlet} - E_{outlet})}{E_{inlet}}$$

$$DE = 100 \times \frac{(98.9 - 1.38)}{98.9}$$

$$DE = 98.6\%$$

where:

DE	= destruction efficiency (%)
E_{inlet}	= total hydrocarbon emission rate, as propane, at the inlet (lb/hr)
E_{outlet}	= total hydrocarbon emission rate, as propane, at the outlet (lb/hr)
100	= conversion factor (fraction to %)

Parameters

Koppers | Method 1-4 Parameters Inlet | Project No. 4035

Parameters	Run 2	Run 3	Run 4
Date	9/12/12	9/12/12	9/12/12
Start Time	16:42	18:05	19:50
Stop Time	17:27	18:50	20:35
Dimensions of Sample Location, D_s (in)	6.0	6.0	6.0
Velocity Pressure, $\Delta P^{1/2}$ avg (in. $H_2O^{1/2}$)	0.0933	0.0841	0.0572
Barometric Pressure, P_b (Inches Hg)	29.65	29.65	29.65
Static Pressure, P_s (Inches H_2O)	-0.1	-0.1	-0.1
Pitot Coefficient, C_p	0.84	0.84	0.84
Sample Location Temperature, T_s (°F)	153	142	132
Volume Metered, V_m (ft^3)	24.89	24.99	25.35
Meter Temperature, T_m (°F)	91.1	91.8	89.7
Average Sample Pressure, ΔH_{avg} (in. H_2O)	1.00	1.00	1.00
Gas Meter Correction Factor, Y_d	1.0046	1.0046	1.0046
Carbon Dioxide (% dry)	2.4	2.4	2.4
Oxygen (% dry)	11.9	12.0	12.6
Volume of Water Collected, V_{wc} (ml)	580.0	670.0	611.0
Silica Gel Net Weight, V_{wsg} (g)	18.0	12.0	14.0
Run Time, θ (minutes)	45	45	45

RESULTS			
Area of Sample Location, A_s (ft^2)	0.196	0.196	0.196
Stack Pressure Absolute (inches Hg)	29.64	29.64	29.64
Volume Metered Standard, $V_{m(std)}$ (ft^3)	23.79	23.86	24.29
Volume of Water Vapor, $V_{w(std)}$ (ft^3)	28.15	32.10	29.42
Percent Moisture, B_{ws} (%)	54.2	57.4	54.8
Moisture Saturation Point, B_{wsat} (%)	27.8	20.7	16.0
Dry Molecular Weight, M_d (lbs/lb mole)	28.86	28.86	28.89
Wet Molecular Weight, M_s (lbs/lb mole)	25.84	26.62	27.15
Gas Velocity, V_s (ft/sec)	5.99	5.28	3.52
Average Flowrate, Q_a (acfm)	70.6	62.1	41.5
Standard Flowrate, Q_{std} (scfm)	60.2	54.0	36.6
Dry Standard Flowrate, Q_{dstd} (dscfm)	43.5	42.9	30.8
Standard Flowrate, Q_{std} (kscfh)	3.61	3.24	2.20
Benzene Concentration (ppm)	6,500	10,083	34,882
Benzene Emission Rate (lb/hr)	4.76	6.62	15.5
Toluene Concentration (ppm)	3,952	3,851	7,975
Toluene Emission Rate (lb/hr)	3.41	2.98	4.19
Xylene Concentration (ppm)	994	1,225	1,238
Xylene Emission Rate (lb/hr)	0.989	1.09	0.750

Koppers

Method 1-4 Parameters
Inlet

Project No. 4035

Parameters	Run 2	Run 3	Run 4
Date	9/12/12	9/12/12	9/12/12
Start Time	16:42	18:05	19:50
Stop Time	17:27	18:50	20:35
Styrene Concentration (ppm)	163.8	213	185
Styrene Emission Rate (lb/hr)	0.160	0.187	0.110
Indan Concentration (ppm)	5.71	36.8	81.2
Indan Emission Rate (lb/hr)	0.00635	0.0368	0.0551
Indene Concentration (ppm)	14.7	59.8	64.4
Indene Emission Rate (lb/hr)	0.0163	0.0594	0.0434
Ethyl Benzene Concentration (ppm)	271	366	475
Ethyl Benzene Emission Rate (lb/hr)	0.269	0.326	0.288
Napthalene Concentration (ppm)	4.45	0.985	6.59
Napthalene Emission Rate (lb/hr)	0.00534	0.00106	0.00482
Methane Concentration (ppm)	54,400	70,000	65,300
Methane Emission Rate (lb/hr)	8.18	9.44	5.98
Ethane Concentration (ppm)	13,100	17,900	16,200
Ethane Emission Rate (lb/hr)	3.69	4.53	2.78
Ethylene Concentration (ppm)	3,000	3,500	3,200
Ethylene Emission Rate (lb/hr)	0.789	0.826	0.512
Hydrogen Concentration (ppm)	36,000	51,000	43,000
Hydrogen Emission Rate (lb/hr)	0.337	0.429	0.245
Nitrogen Concentration (ppm)	542,000	517,000	528,000
Nitrogen Emission Rate (lb/hr)	71.1	60.9	42.2
Carbonyl Sulfide Concentration (ppm)	607	377	665
Carbonyl Sulfide Emission Rate (lb/hr)	0.342	0.191	0.228
Hydrogen Sulfide Concentration (ppm)	120,000	65,300	132,000
Hydrogen Sulfide Emission Rate (lb/hr)	38.3	18.7	25.7
Carbon Disulfide Concentration (ppm)	1,760	1,536	2,340
Carbon Disulfide Emission Rate (lb/hr)	1.26	0.984	1.02
THC Concentration, C (ppmwv)	239,265	159,360	149,288
THC Emission Rate, E (lb/hr)	98.9	59.1	37.6

Parameters	Run 2	Run 3	Run 4
Date	9/12/12	9/12/12	9/12/12
Start Time	16:42	18:05	17:50
Stop Time	17:27	18:50	20:35
RESULTS			
Volume Metered Train A, $V_{m(std)}$ (L)	2.81	2.93	3.16
Volume Metered Train B, $V_{m(std)}$ (L)	2.86	2.49	2.22
Benzene Results			
Concentration Benzene, C (ppmv)	6,500	10,083	34,882
Toluene Results			
Concentration Toluene, C (ppmv)	3,952	3,851	7,975
Xylene Results			
Concentration Xylene, C (ppmv)	994	1,225	1,238
Styrene Results			
Concentration Styrene, C (ppmv)	163.8	213	185
Indane Results			
Concentration Indane, C (ppmv)	5.71	36.8	81.2
Indene Results			
Concentration Indene, C (ppmv)	14.7	59.8	64.4
Ethyl Benzene Results			
Concentration Ethyl Benzene, C (ppmv)	271	366	475
Naphthalene Results			
Concentration Naphthalene, C (ppmv)	4.45	0.985	6.59

Parameters	Run 2	Run 3	Run 4
Date	9/12/12	9/12/12	9/12/12
Start Time	16:42	18:05	17:50
Stop Time	17:27	18:50	20:35
Train A			
Barometric Pressure, P_b (Inches Hg)	29.65	29.65	29.65
Volume Metered, V_m (L)	2.923	3.043	3.264
Meter Temperature, T_m (°F)	87.0	86.0	84.0
Average Sample Rate, P_{avg} (LPM)	0.100	0.100	0.100
Run Time, θ (minutes)	45	45	45
Train B			
Volume Metered, V_m (L)	3.009	2.612	2.321
Meter Temperature, T_m (°F)	87.0	86.0	84.0
Average Sample Pressure, ΔH_{avg} (in. H_2O)	0.100	0.100	0.100
Gas Meter Correction Factor, Y_d	0.9955	0.9955	0.9955
Run Time, θ (minutes)	45	45	45
Total Benzene Collected Train A, m (ug)	59,400	96,100	357,900
Total Toluene Collected Train A, m (ug)	42,600	43,300	96,520
Total Xylene Collected Train A, m (ug)	12,339	15,862	17,270
Total Styrene Collected Train A, m (ug)	1,996	2,710	2,530
Total Indane Collected Train A, m (ug)	78.9	531	1,261
Total Indene Collected Train A, m (ug)	203	862	1,000
Total Ethyl Benzene Collected Train A, m (ug)	3,363	4,735	6,620
Total Naphthalene Collected Train A, m (ug)	66.7	15.4	111

TOTAL HYDROCARBONS, THC

Analyzer Values	Actual	Cal Error	Run 2	Run 3	Run 4
Date		9/12/12	9/12/12	9/12/12	9/12/12
Start Time		16:03	16:42	18:06	19:51
Stop Time		16:10	17:26	18:50	20:35
Concentration, C (ppm)			233,307	156,869	145,676
Zero Cal Gas, C_0 (ppm)	0.0	356	379	340	378
Low Cal Gas (ppm)	2,994	3,042			
Mid Cal Gas (ppm)	5,131	5,078			
High Cal Gas (ppm)	8,158	8,167			
Span Value (ppm)	10,000				
Bias/Drift Check Gas, C_s (ppm)	8,158		8,453	8,291	8,309

RESULTS					
Zero Error (%)	5 % of Actual	3.6			
Low Error (%)		1.6			
Mid Error (%)		-1.0			
High Error (%)		0.1			
Upscale Error (%)					
Zero Drift (%)	3 % of Span		0.2	-0.4	0.4
Upscale Drift (%)			2.9	-1.6	0.2
Concentration Corrected for Drift, C_w (ppm)			**239,265**	**159,360**	**149,288**

Method 1-4 Parameters
Outlet

Parameters	Run 2	Run 3	Run 4
Date	9/12/12	9/12/12	9/12/12
Start Time	16:42	18:05	19:50
Stop Time	17:27	18:50	20:35
Dimensions of Sample Location, D_s (in)	24.0	24.0	24.0
Velocity Pressure, $\Delta P^{1/2}$ avg (in. $H_2O^{1/2}$)	0.626	0.572	0.608
Barometric Pressure, P_b (Inches Hg)	29.60	29.60	29.60
Static Pressure, P_s (Inches H_2O)	-0.2	-0.2	-0.2
Pitot Coefficient, C_p	0.84	0.84	0.84
Sample Location Temperature, T_s (°F)	968	969	990
Volume Metered, V_m (ft^3)	27.20	26.71	26.76
Meter Temperature, T_m (°F)	95.5	98.2	91.9
Average Sample Pressure, ΔH_{avg} (in. H_2O)	1.00	1.00	1.00
Gas Meter Correction Factor, Y_d	0.9944	0.9944	0.9944
Carbon Dioxide (% dry)	7.40	7.84	7.14
Oxygen (% dry)	5.7	5.6	9.6
Volume of Water Collected, V_{wc} (ml)	113.0	102.0	110.0
Silica Gel Net Weight, V_{wsg} (g)	11.0	11.0	5.0
Run Time, θ (minutes)	45	45	45

RESULTS			
Area of Sample Location, A_s (ft^2)	3.14	3.14	3.14
Stack Pressure Absolute (inches Hg)	29.59	29.59	29.59
Volume Metered Standard, $V_{m(std)}$ (ft^3)	25.49	24.91	25.24
Volume of Water Vapor, $V_{w(std)}$ (ft^3)	5.84	5.32	5.41
Percent Moisture, B_{ws} (%)	18.6	17.6	17.7
Moisture Saturation Point, B_{wsat} (%)	100	100	100
Dry Molecular Weight, M_d (lbs/lb mole)	29.41	29.48	29.53
Wet Molecular Weight, M_s (lbs/lb mole)	27.28	27.46	27.49
Gas Velocity, V_s (ft/sec)	59.8	54.5	58.3
Average Flowrate, Q_s (acfm)	11,268	10,272	10,982
Standard Flowrate, Q_{std} (scfm)	4,119	3,752	3,953
Dry Standard Flowrate, Q_{dstd} (dscfm)	3,352	3,093	3,256
Standard Flowrate, Q_{std} (kscfh)	247	225	237
Sulfur Dioxide Concentration, C (ppmwv)	1,737	1,697	1,801
Sulfur Dioxide Emission rate, E (lb/hr)	71.3	63.4	70.9
Carbon Monoxide Concentration, C (ppmwv)	5,865	1,986	2,295
Carbon Monoxide Emission Rate, E (lb/hr)	105	32.5	39.6
Benzene Concentration (ppm)	7.40	9.10	12.5
Benzene Emission Rate (lb/hr)	0.371	0.415	0.601

Toluene Concentration (ppm)	2.84	2.61	2.75
Toluene Emission Rate (lb/hr)	0.168	0.140	0.156
Xylene Concentration (ppm)	0.171	0.148	0.124
Xylene Emission Rate (lb/hr)	0.0117	0.0092	0.00810
Styrene Concentration (ppm)	<0.0279	<0.0283	<0.0270
Styrene Emission Rate (lb/hr)	<0.00187	<0.00172	<0.00173
Indane Concentration (ppm)	<0.0318	<0.0321	<0.0307
Indane Emission Rate (lb/hr)	<0.00242	<0.00223	<0.00225
Indene Concentration (ppm)	<0.0301	<0.0305	<0.0292
Indene Emission Rate (lb/hr)	<0.00228	<0.00211	<0.00212
Ethyl Benzene Concentration (ppm)	0.0752	0.0615	0.0541
Ethyl Benzene Emission Rate (lb/hr)	0.00512	0.00381	0.00354
Napthalene Concentration (ppm)	<0.0265	<0.0268	<0.0256
Napthalene Emission Rate (lb/hr)	<0.00218	<0.00201	<0.00202
Methane Concentration (ppm)	<300	2,000	300
Methane Emission Rate (lb/hr)	<3.09	18.7	2.96
Ethane Concentration (ppm)	<300	<300	<300
Ethane Emission Rate (lb/hr)	<5.79	<5.27	<5.55
Ethylene Concentration (ppm)	<300	<300	<300
Ethylene Emission Rate (lb/hr)	<5.40	<4.92	<5.18
Hydrogen Concentration (ppm)	<1,000	2,000	<1,000
Hydrogen Emission Rate (lb/hr)	<0.641	1.17	<0.616
Nitrogen Concentration (ppm)	813,000	826,000	834,000
Nitrogen Emission Rate (lb/hr)	7,300	6,756	7,188
Carbonyl Sulfide Concentration (ppm)	41.8	1.39	0.09
Carbonyl Sulfide Emission Rate (lb/hr)	1.61	0.0488	0.00333
Hydrogen Sulfide Concentration (ppm)	1.76	0.47	1.98
Hydrogen Sulfide Emission Rate (lb/hr)	0.0385	0.00936	0.0415
Carbon Disulfide Concentration (ppm)	0.51	<0.03	<0.03
Carbon Disulfide Emission Rate (lb/hr)	0.0249	<0.00133	<0.00141
THC Concentration, C (ppmwv)	49.0	140	95.4
THC Emission Rate, E (lb/hr)	1.38	3.62	2.59

Parameters	Run 2	Run 3	Run 4
Date	9/12/12	9/12/12	9/12/12
Start Time	16:42	18:05	19:37
Stop Time	17:27	18:50	20:22
RESULTS			
Volume Metered Un-Spiked, $V_{m(std)}$ (L)	45.6	45.1	47.1
Volume Metered Spiked, $V_{m(std)}$ (L)	42.5	38.9	47.1
Benzene Results			
Concentration Benzene, C (ppmv)	7.40	9.10	12.5
Toluene Results			
Concentration Toluene, C (ppmv)	2.84	2.61	2.75
Xylene Results			
Concentration Xylene, C (ppmv)	0.171	0.148	0.124
Styrene Results			
Concentration Styrene, C (ppmv)	<0.0279	<0.0283	<0.0270
Indane Results			
Concentration Indan, C (ppmv)	<0.0318	<0.0321	<0.0307
Indene Results			
Concentration Indene, C (ppmv)	<0.0301	<0.0305	<0.0292
Ethyl Benzene Results			
Concentration Ethyl Benzene, C (ppmv)	0.0752	0.0615	0.0541
Naphthalene Results			
Concentration Naphthalene, C (ppmv)	<0.0265	<0.0268	<0.0256

Parameters	Run 2	Run 3	Run 4
Date	9/12/12	9/12/12	9/12/12
Start Time	16:42	18:05	19:37
Stop Time	17:27	18:50	20:22
Un-Spiked			
Barometric Pressure, P_b (Inches Hg)	29.65	29.65	29.65
Volume Metered, V_m (L)	48.5	48.0	49.8
Meter Temperature, T_m (°F)	91.2	92.0	87.5
Average Sample Pressure, ΔH_{avg} (In. H_2O)	1.00	1.00	1.00
Gas Meter Correction Factor, Y_d	0.9883	0.9883	0.9883
Run Time, θ (minutes)	45	45	45
Spiked			
Volume Metered, V_m (L)	45.2	41.5	49.8
Meter Temperature, T_m (°F)	94.9	95.7	91.0
Average Sample Pressure, ΔH_{avg} (In. H_2O)	1.00	1.00	1.00
Gas Meter Correction Factor, Y_d	0.9940	0.9940	0.9940
Run Time, θ (minutes)	45	45	45
Total Benzene Collected Un-Spiked, m (ug)	1,096	1,333	1,915
Total Toluene Collected Un-Spiked, m (ug)	497	451	496
Total Xylene Collected Un-Spiked, m (ug)	34.5	29.5	25.8
Total Styrene Collected Un-Spiked, m (ug)	<5.52	<5.52	<5.52
Total Indane Collected Un-Spiked, m (ug)	<7.12	<7.12	<7.12
Total Indene Collected Un-Spiked, m (ug)	<6.76	<6.76	<6.76
Total Ethyl Benzene Collected Un-Spiked, m (ug)	15.1	12.2	11.3
Total Naphthalene Collected Un-Spiked, m (ug)	<6.44	<6.44	<6.44

CARBON DIOXIDE

Analyzer Values	Actual	Cal Error	Run 2	Run 3	Run 4
Date		9/12/12	9/12/12	9/12/12	9/12/12
Start Time		15:17	16:42	18:06	19:51
Stop Time		15:48	17:26	18:50	20:35
Concentration, C (%)			7.33	7.61	6.91
Zero Cal Gas, C_0 (%)	0.0	0.0	0.1	0.0	0.0
Mid Cal Gas (%)	4.880	4.91			
High Cal Gas (%)	9.930	9.94			
Span Value (%)	4.880				
Bias/Drift Check Gas, C_s (%)	4.880		4.80	4.71	4.76

RESULTS					
Zero Error (%)	2 % of Span	0.5			
Mid Error (%)		0.6			
High Error (%)		0.2			
Upscale Error (%)					
Zero Bias (%)	5 % of Span		0.7	0.1	0.1
Upscale Bias (%)			-2.3	-4.1	-3.1
Zero Drift (%)	3 % of Span		0.7	-0.6	0.0
Upscale Drift (%)			-1.7	-1.8	1.0
Concentration Corrected for Drift, C_d (%)			**7.40**	**7.84**	**7.14**

SULFUR DIOXIDE

Analyzer Values	Actual	Cal Error	Run 2	Run 3	Run 4
Date		4/1/10	9/12/12	9/12/12	9/12/12
Start Time		15:17	16:42	18:06	19:51
Stop Time		15:48	17:26	18:50	20:35
Concentration, C (ppm)			1,709	1,655	1,749
Zero Cal Gas, C_0 (ppm)	0.0	1.3	11.8	12.5	12.1
Mid Cal Gas (ppm)	494.9	502			
High Cal Gas (ppm)	920.9	923			
Span Value (ppm)	920.9				
Bias/Drift Check Gas, C_s (ppm)	920.9		895	912	889

RESULTS					
Zero Error (%)	2 % of Span	0.1			
Mid Error (%)		0.8			
High Error (%)		0.2			
Upscale Error (%)					
Zero Bias (%)	5 % of Span		1.1	1.2	1.2
Upscale Bias (%)			-3.0	-1.2	-3.7
Zero Drift (%)	3 % of Span		1.1	0.1	0.0
Upscale Drift (%)			-3.0	1.8	-2.5
Concentration Corrected for Drift, C_d (ppm)			1,737	1,697	1,801

CARBON MONOXIDE

Analyzer Values	Actual	Cal Error	Run 2	Run 3	Run 4
Date		4/1/10	9/12/12	9/12/12	9/12/12
Start Time		15:17	16:42	18:06	19:51
Stop Time		15:48	17:26	18:50	20:35
Concentration, C (ppm)			5,904	2,010	2,326
Zero Cal Gas, C_0 (ppm)	0.0	6.4	1.5	26.7	24.9
Mid Cal Gas (ppm)	500.9	510			
High Cal Gas (ppm)	900.9	910			
Span Value (ppm)	900.9				
Bias/Drift Check Gas, C_s (ppm)	900.9		910	928	929

RESULTS					
Zero Error (%)	2 % of Span	0.7			
Mid Error (%)		1.0			
High Error (%)		1.0			
Upscale Error (%)					
Zero Bias (%)	5 % of Span		-0.5	2.3	2.1
Upscale Bias (%)			0.0	2.0	2.1
Zero Drift (%)	3 % of Span		-0.5	2.8	-0.2
Upscale Drift (%)			0.0	2.0	0.2
Concentration Corrected for Drift, C_d (ppm)			**5,865**	**1,986**	**2,295**

TOTAL HYDROCARBONS, THC

Analyzer Values	Actual	Cal Error	Run 2	Run 3	Run 4
Date		4/1/10	9/12/12	9/12/12	9/12/12
Start Time		15:17	16:42	18:06	19:51
Stop Time		15:48	17:26	18:50	20:35
Concentration, C (ppm)			50.3	145	97.4
Zero Cal Gas, C_0 (ppm)	0.0	1.7	0.7	0.5	0.7
Low Cal Gas (ppm)	30.04	30.4			
Mid Cal Gas (ppm)	50.17	50.4			
High Cal Gas (ppm)	80.10	80.3			
Span Value (ppm)	100				
Bias/Drift Check Gas, C_s (ppm)	80.10		82.9	82.9	80.8

RESULTS					
Zero Error (%)	5 % of Actual	1.7			
Low Error (%)		1.3			
Mid Error (%)		0.5			
High Error (%)		0.2			
Upscale Error (%)					
Zero Drift (%)	3 % of Span		-1.0	-0.2	0.2
Upscale Drift (%)			2.6	0.1	-2.2
Concentration Corrected for Drift, C_w (ppm)			**49.0**	**140**	**95.4**

Field Data Printouts

Project Number	4035
Client	Koppers
Plant	Stickney, IL
Location	Inlet
Date	9/12/2012
Meter ID	M-10
Y_d	1.0046
Pitot C_p	0.84

P_b (inches Hg)	29.65
P_s (inches H_2O)	-0.1
Start Time	16:42
Stop Time	17:27

Volume of Water Collected, V_{lc} (ml)	580.0
Silica Gel Net Weight, V_{wsg} (g)	18.0

Place an "x" in the appropriate Box

Circular?	x
Rectangular?	
Diameter	6
Length	
Width	

Run 2

Traverse Point	Min/Pt 5 Elapsed Time	Velocity Pressure ΔP (in H_2O)	Orifice Setting ΔH (in H_2O)	Gas Sample Volume Initial (ft^3) 869.72	Stack Temp (°F)	DGM Inlet (°F)	DGM Outlet (°F)	Square Root ΔP	Stack Gas Velocity Vs (ft/sec)	Volume Metered Vmstd (ft^3)
1-1	5	0.008	1.00	870.56	156	90	90	0.089	3.6	0.804
1-2	10	0.008	1.00	875.40	156	91	90	0.089	5.8	4.631
1-3	15	0.008	1.00	878.15	156	92	90	0.089	5.9	2.639
1-4	20	0.007	1.00	880.88	156	92	91	0.084	5.4	2.607
1-5	25	0.008	1.00	883.62	156	92	90	0.089	5.8	2.619
1-6	30	0.008	1.00	886.35	156	92	91	0.089	5.8	2.607
1-7	35	0.008	1.00	889.10	156	92	91	0.089	5.8	2.627
1-8	40	0.008	1.00	891.99	156	92	91	0.089	5.8	2.780
2-1	45	0.003	1.00	894.61	154	92	91	0.055	3.5	2.502
2-2		0.004			156			0.063	4.1	
2-3		0.004			156			0.063	4.1	
2-4		0.004			156			0.063	4.1	
2-5		0.004			156			0.063	4.1	
2-6		0.004			155			0.063	4.1	
2-7		0.004			151			0.063	4.1	
2-8		0.004			151			0.063	4.1	
1-1		0.009			151			0.095	6.1	
1-2		0.009			151			0.095	6.1	
1-3		0.009			153			0.095	6.1	
1-4		0.009			153			0.095	6.1	
1-5		0.009			154			0.095	6.1	
1-6		0.010			153			0.100	6.4	
1-7		0.010			152			0.100	6.4	
1-8		0.009			151			0.095	6.1	
2-1		0.006			151			0.077	5.0	
2-2		0.012			151			0.110	7.0	
2-3		0.013			151			0.114	7.3	
2-4		0.013			151			0.114	7.3	
2-5		0.022			151			0.148	9.6	
2-6		0.022			151			0.148	9.5	
2-7		0.023			151			0.152	9.7	
2-8		0.021			151			0.145	9.3	

Totals and Averages

	45		1.00	24.89	153	91.1		0.0933	5.99	23.79

Project Number	4035
Client	Koppers
Plant	Stickney, IL
Location	Inlet
Date	9/12/2012
Meter ID	M-10
Y_d	1.0046
Pitot C_p	0.84

P_b (inches Hg)	29.65
P_s (inches H_2O)	-0.1
Start Time	18:05
Stop Time	18:50

Volume of Water Collected, V_{lc} (ml)	670.0
Silica Gel Net Weight, V_{wsg} (g)	12.0

Place an "x" in the appropriate Box

Circular?	x
Rectangular?	
Diameter	6
Length	
Width	

Run 3

Traverse Point	Min/Pt 5 Elapsed Time	Velocity Pressure Δ P (in H_2O)	Orifice Setting Δ H (in H_2O)	Gas Sample Volume Initial (ft^3) 894.70	Stack Temp (°F)	DGM Inlet (°F)	DGM Outlet (°F)	Square Root Δ P	Stack Gas Velocity Vs (ft/sec)	Volume Metered Vmstd (ft^3)
1-1	5	0.009	1.00	897.49	151	91	89	0.095	6.0	2.672
1-2	10	0.009	1.00	900.28	151	91	89	0.095	6.0	2.672
1-3	15	0.009	1.00	903.00	153	93	91	0.095	6.0	2.596
1-4	20	0.009	1.00	905.81	153	94	90	0.095	6.0	2.681
1-5	25	0.009	1.00	908.54	154	94	91	0.095	6.0	2.603
1-6	30	0.010	1.00	911.27	153	94	91	0.100	6.3	2.603
1-7	35	0.010	1.00	914.06	152	94	91	0.100	6.3	2.660
1-8	40	0.009	1.00	916.85	151	94	90	0.095	6.0	2.682
2-1	45	0.006	1.00	919.69	151	94	91	0.077	4.9	2.708
2-2		0.012			151			0.110	6.9	
2-3		0.013			151			0.114	7.2	
2-4		0.013			151			0.114	7.2	
2-5		0.022			151			0.148	9.4	
2-6		0.022			151			0.148	9.4	
2-7		0.023			151			0.152	9.6	
2-8		0.021			151			0.145	9.2	
1-1		0.001			145			0.032	2.0	
1-2		0.001			145			0.032	2.0	
1-3		0.001			143			0.032	2.0	
1-4		0.001			142			0.032	2.0	
1-5		0.001			142			0.032	2.0	
1-6		0.003			133			0.055	3.4	
1-7		0.005			133			0.071	4.4	
1-8		0.005			131			0.071	4.4	
2-1		0.001			131			0.032	2.0	
2-2		0.002			130			0.045	2.8	
2-3		0.004			129			0.063	3.9	
2-4		0.005			122			0.071	4.4	
2-5		0.005			123			0.071	4.4	
2-6		0.009			119			0.095	5.8	
2-7		0.008			119			0.089	5.5	
2-8		0.009			119			0.095	5.8	

Totals and Averages

	45		1.00	24.99	142		91.8	0.0841	5.28	23.79

Project Number	4035
Client	Koppers
Plant	Stickney, IL
Location	Inlet
Date	9/12/2012
Meter ID	M-10
Y:	1.0046
Pitot C_p	0.84

P_b (Inches Hg)	29.65
P_s (Inches H_2O)	-0.1
Start Time	19:50
Stop Time	20:35

Volume of Water Collected, V_{lc} (ml)	611.0
Silica Gel Net Weight, V_{wsg} (g)	14.0

Place an "x" in the appropriate Box

Circular?	x
Rectangular?	
Diameter	6
Length	
Width	

Run 4

Traverse Point	Min/Pt 5 Elapsed Time	Velocity Pressure ΔP (in. H_2O)	Orifice Setting ΔH (in. H_2O)	Gas Sample Volume Initial (ft³) 919.75	Stack Temp (°F)	DGM Inlet (°F)	DGM Outlet (°F)	Square Root ΔP	Stack Gas Velocity Vs (ft/sec)	Volume Metered Vmstd (ft³)
1-1	5	0.001	1.00	922.50	145	88	89	0.032	2.0	2.641
1-2	10	0.001	1.00	925.24	145	89	88	0.032	2.0	2.631
1-3	15	0.001	1.00	927.87	145	90	87	0.032	2.0	2.526
1-4	20	0.001	1.00	930.62	142	89	87	0.032	2.0	2.643
1-5	25	0.001	1.00	933.36	142	91	88	0.032	2.0	2.626
1-6	30	0.003	1.00	936.15	133	92	89	0.055	3.4	2.670
1-7	35	0.005	1.00	938.90	133	92	90	0.071	4.4	2.629
1-8	40	0.005	1.00	941.57	131	92	90	0.071	4.4	2.552
2-1	45	0.001	1.00	945.10	131	92	91	0.032	1.9	3.371
2-2		0.002			130			0.045	2.7	
2-3		0.004			129			0.063	3.9	
2-4		0.005			122			0.071	4.3	
2-5		0.005			123			0.071	4.3	
2-6		0.009			119			0.095	5.8	
2-7		0.008			119			0.089	5.4	
2-8		0.009			119			0.095	5.8	

Totals and Averages

	45		1.00	25.35	132	89.7		0.0572	3.52	24.29

Project Number	4035
Client	Koppers
Plant	Stickney, IL
Location	Inlet
Date	9/12/12
Meter ID	R19075A
Y_d	1.0060
P_b (Inches Hg)	29.65
Start Time	16:42
Stop Time	17:27

Project Number	4035
Client	Koppers
Plant	Stickney, IL
Location	Inlet
Date	9/12/12
Meter ID	R19075B
Y_d	0.9955
P_b (Inches Hg)	29.65
Start Time	16:42
Stop Time	17:27

Run 2

Min/Pt 5 Elapsed Time	Flow Meter Setting (lpm)	Gas Sample Volume Initial (L) 0.000	DGM Temp (°F)	Volume Metered Vmstd (L)
5	0.100	0.395	87	0.380
10	0.100	0.690	87	0.284
15	0.100	1.067	87	0.363
20	0.100	1.358	87	0.280
25	0.100	1.693	87	0.322
30	0.100	2.027	87	0.321
35	0.100	2.377	87	0.337
40	0.100	2.700	87	0.311
45	0.100	3.038	87	0.325

Totals and Averages

45	0.100	3.038	87.0	2.92

Run 2 Spiked

Min/Pt 5 Elapsed Time	Flow Meter Setting (lpm)	Gas Sample Volume Initial (L) 0.000	DGM Temp (°F)	Volume Metered Vmstd (L)
5	0.100	0.353	87	0.336
10	0.100	0.719	87	0.348
15	0.100	1.039	87	0.305
20	0.100	1.395	87	0.339
25	0.100	1.721	87	0.310
30	0.100	2.046	87	0.309
35	0.100	2.349	87	0.288
40	0.100	2.689	87	0.324
45	0.100	3.009	87	0.305

Totals and Averages

45	0.100	3.009	87.0	2.86

Project Number	4035
Client	Koppers
Plant	Stickney, IL
Location	Inlet
Date	9/12/12
Meter ID	R19075A
Y_d	1.0060
P_b (Inches Hg)	29.65
Start Time	18:05
Stop Time	18:50

Project Number	4035
Client	Koppers
Plant	Stickney, IL
Location	Inlet
Date	9/12/12
Meter ID	R19075B
Y_d	0.9955
P_b (Inches Hg)	29.65
Start Time	18:05
Stop Time	18:50

Run 3

Min/Pt 5 Elapsed Time	Flow Meter Setting (lpm)	Gas Sample Volume Initial (L) 0.000	DGM Temp (°F)	Volume Metered Vmstd (L)
5	0.100	0.313	86	0 302
10	0.100	0.663	86	0 337
15	0.100	1.013	86	0 337
20	0.100	1.394	86	0 367
25	0.100	1.739	86	0 333
30	0.100	2.082	86	0 331
35	0.100	2.384	86	0 291
40	0.100	2.728	86	0 332
45	0.100	3.043	86	0 304

Totals and Averages

45	0.100	3.043	86.0	2.93

Run 3 Spiked

Min/Pt 5 Elapsed Time	Flow Meter Setting (lpm)	Gas Sample Volume Initial (L) 0.000	DGM Temp (°F)	Volume Metered Vmstd (L)
5	0.100	0.378	86	0 361
10	0.100	0.711	86	0 318
15	0.100	1.045	86	0 319
20	0.100	1.369	86	0 309
25	0.100	1.686	86	0 302
30	0.100	2.000	86	0 300
35	0.100	2.274	86	0 261
40	0.100	2.505	86	0 220
45	0.100	2.612	86	0 102

Totals and Averages

45	0.100	2.612	86.0	2.49

Project Number	4035
Client	Koppers
Plant	Stickney, IL
Location	Inlet
Date	9/12/12
Meter ID	R19075A
Y_d	1.0060
P_b (Inches Hg)	29.65
Start Time	17:50
Stop Time	20:35

Project Number	4035
Client	Koppers
Plant	Stickney, IL
Location	Inlet
Date	9/12/12
Meter ID	R19075B
Y_d	0.9955
P_b (Inches Hg)	29.65
Start Time	17:50
Stop Time	20:35

Run 4

Min/Pt 5 Elapsed Time	Flow Meter Setting (lpm)	Gas Sample Volume Initial (L) 0.000	DGM Temp (°F)	Volume Metered Vmstd (L)
5	0.100	0.327	84	0.316
10	0.100	0.653	84	0.315
15	0.100	1.075	84	0.408
20	0.100	1.393	84	0.308
25	0.100	1.777	84	0.372
30	0.100	2.084	84	0.297
35	0.100	2.489	84	0.392
40	0.100	2.792	84	0.293
45	0.100	3.264	84	0.457

Totals and Averages

45	0.100	3.264	84.0	3.16

Run 4 Spiked

Min/Pt 5 Elapsed Time	Flow Meter Setting (lpm)	Gas Sample Volume Initial (L) 0.000	DGM Temp (°F)	Volume Metered Vmstd (L)
5	0.100	0.277	84	0.265
10	0.100	0.553	84	0.264
15	0.100	0.781	84	0.218
20	0.100	1.052	84	0.259
25	0.100	1.306	84	0.243
30	0.100	1.519	84	0.204
35	0.100	1.805	84	0.274
40	0.100	2.048	84	0.233
45	0.100	2.321	84	0.261

Totals and Averages

45	0.100	2.321	84.0	2.22

Project Number	4035
Client	Koppers
Plant	Stickney, IL
Location	Outlet
Date	9/12/2012
Meter ID	M-20
Y_d	0.9944
Pitot C_p	0.84

P_b (inches Hg)	29.60
P_s (inches H_2O)	-0.2
Start Time	16:42
Stop Time	17:27

Volume of Water Collected, V_{lc} (ml)	113.0
Silica Gel Net Weight, V_{wsg} (g)	11.0

Place an "x" in the appropriate Box

Circular?	x
Rectangular?	
Diameter	24
Length	
Width	

Run 2

Traverse Point	Min/Pt 5 Elapsed Time	Velocity Pressure ΔP (in H_2O)	Orifice Setting ΔH (in H_2O)	Gas Sample Volume Initial (ft^3) 169.20	Stack Temp (°F)	DGM Inlet (°F)	DGM Outlet (°F)	Square Root ΔP	Stack Gas Velocity Vs (ft/sec)	Volume Metered Vmstd (ft^3)
1-1	5	0.39	1.00	173.44	960	96	93	0.624	59.9	3.930
1-2	10	0.42	1.00	176.19	959	96	93	0.648	62.1	2.581
1-3	15	0.43	1.00	179.11	961	97	94	0.656	62.9	2.736
1-4	20	0.45	1.00	182.00	959	96	93	0.671	64.3	2.713
1-5	25	0.44	1.00	185.16	960	97	94	0.663	63.6	2.961
1-6	30	0.45	1.00	188.17	964	97	94	0.671	64.4	2.820
1-7	35	0.27	1.00	190.67	970	98	95	0.520	50.0	2.338
1-8	40	0.22	1.00	193.50	972	98	95	0.469	45.1	2.647
2-1	45	0.39	1.00	196.40	968	98	95	0.624	60.0	2.712
2-2		0.40			964			0.632	60.7	
2-3		0.42			971			0.648	62.4	
2-4		0.43			972			0.656	63.1	
2-5		0.46			968			0.678	65.2	
2-6		0.42			957			0.648	62.1	
2-7		0.41			965			0.640	61.5	
2-8		0.31			970			0.557	53.6	
1-1		0.40			958			0.632	60.6	
1-2		0.41			963			0.640	61.4	
1-3		0.43			968			0.656	63.0	
1-4		0.45			970			0.671	64.5	
1-5		0.45			973			0.671	64.6	
1-6		0.46			976			0.678	65.4	
1-7		0.27			976			0.520	50.1	
1-8		0.22			960			0.469	45.0	
2-1		0.40			959			0.632	60.6	
2-2		0.40			965			0.632	60.7	
2-3		0.43			971			0.656	63.1	
2-4		0.44			976			0.663	63.9	
2-5		0.45			979			0.671	64.7	
2-6		0.44			981			0.663	64.1	
2-7		0.42			966			0.648	62.7	
2-8		0.27			969			0.520	50.0	

Totals and Averages

45		1.00	27.20	968		95.5	0.626	60.2	25.49

Project Number	4035
Client	Koppers
Plant	Stickney, IL
Location	Outlet
Date	9/12/2012
Meter ID	M-20
Y_d	0.9944
Pitot C_p	0.84

P_b (Inches Hg)	29.60
P_s (Inches H_2O)	-0.2
Start Time	18:05
Stop Time	18:50

Volume of Water Collected, V_{lc} (ml)	102.0
Silica Gel Net Weight, V_{wsg} (g)	11.0

Place an "x" in the appropriate Box

Circular?	x
Rectangular?	
Diameter	24
Length	
Width	

Run 3

Traverse Point	Min/Pt 5 Elapsed Time	Velocity Pressure ΔP (in H_2O)	Orifice Setting ΔH (in H_2O)	Gas Sample Volume Initial (ft³) 196.60	Stack Temp (°F)	DGM Inlet (°F)	DGM Outlet (°F)	Square Root ΔP	Stack Gas Velocity Vs (ft/sec)	Volume Metered Vmstd (ft³)
1-1	5	0.27	1.00	199.83	961	96	94	0.520	49.4	3.029
1-2	10	0.34	1.00	202.71	961	97	95	0.583	55.4	2.896
1-3	15	0.27	1.00	205.59	971	99	97	0.520	49.5	2.887
1-4	20	0.31	1.00	208.42	964	100	95	0.557	52.9	2.842
1-5	25	0.30	1.00	211.40	961	101	95	0.548	52.0	2.780
1-6	30	0.27	1.00	214.37	968	102	96	0.520	49.5	2.765
1-7	35	0.28	1.00	217.36	966	103	96	0.529	50.3	2.792
1-8	40	0.27	1.00	220.31	948	104	97	0.520	49.1	2.740
2-1	45	0.30	1.00	223.31	954	104	97	0.548	51.8	2.786
2-2		0.32			966			0.566	55.8	
2-3		0.33			968			0.574	54.7	
2-4		0.32			952			0.566	53.6	
2-5		0.33			978			0.574	54.8	
2-6		0.30			974			0.548	52.3	
2-7		0.27			961			0.520	49.4	
2-8		0.28			967			0.529	50.4	
1-1		0.34			951			0.583	55.2	
1-2		0.37			966			0.608	57.9	
1-3		0.40			971			0.632	60.3	
1-4		0.37			973			0.608	58.0	
1-5		0.39			978			0.624	59.7	
1-6		0.41			980			0.640	61.2	
1-7		0.33			976			0.574	54.8	
1-8		0.33			974			0.574	54.8	
2-1		0.38			980			0.616	58.9	
2-2		0.38			981			0.616	59.0	
2-3		0.38			984			0.616	56.0	
2-4		0.40			985			0.632	60.6	
2-5		0.42			984			0.648	62.0	
2-6		0.27			972			0.520	49.5	
2-7		0.30			968			0.548	52.1	
2-8		0.30			964			0.548	52.1	
Totals and Averages	45		1.00	26.71	969	98.2		0.572	54.5	25.49

Project Number	4035
Client	Koppers
Plant	Stickney, IL
Location	Outlet
Date	9/12/2012
Meter ID	M-20
Y_d	0.9944
Pitot C_p	0.84

P_b (Inches Hg)	29.60
P_s (Inches H_2O)	-0.2
Start Time	19:50
Stop Time	20:35

Volume of Water Collected, V_{lc} (ml)	110.0
Silica Gel Net Weight, V_{wsg} (g)	5.0

Place an "x" in the appropriate Box

Circular?	x
Rectangular?	
Diameter	24
Length	
Width	

Run 4

Traverse Point	Min/Pt 5 Elapsed Time	Velocity Pressure ΔP (in. H_2O)	Orifice Setting ΔH (in. H_2O)	Gas Sample Volume Initial (ft³) 223.59	Stack Temp (°F)	DGM Inlet (°F)	DGM Outlet (°F)	Square Root ΔP	Stack Gas Velocity Vs (ft/sec)	Volume Metered Vmstd (ft³)
1-1	5	0.40	1.00	226.97	986	93	93	0.632	60.8	3.181
1-2	10	0.39	1.00	229.77	993	91	91	0.624	59.9	2.845
1-3	15	0.40	1.00	232.70	997	90	90	0.632	60.8	2.773
1-4	20	0.41	1.00	236.12	999	90	90	0.640	61.6	3.237
1-5	25	0.39	1.00	238.61	987	94	94	0.624	59.5	2.339
1-6	30	0.33	1.00	242.00	986	93	93	0.574	55.0	3.191
1-7	35	0.32	1.00	245.31	986	94	94	0.566	54.2	3.110
1-8	40	0.31	1.00	247.51	986	93	89	0.557	53.3	2.078
2-1	45	0.39	1.00	250.35	986	93	90	0.624	59.8	2.680
2-2		0.39			991			0.624	59.9	
2-3		0.40			994			0.632	60.7	
2-4		0.38			994			0.616	59.2	
2-5		0.37			993			0.608	58.4	
2-6		0.34			987			0.583	55.9	
2-7		0.33			985			0.574	55.0	
2-8		0.32			986			0.566	54.2	
1-1		0.39			987			0.624	59.8	
1-2		0.40			990			0.632	60.6	
1-3		0.41			992			0.640	61.4	
1-4		0.40			994			0.632	60.7	
1-5		0.38			997			0.616	58.3	
1-6		0.39			994			0.624	60.0	
1-7		0.36			987			0.600	57.5	
1-8		0.30			981			0.548	52.4	
2-1		0.40			984			0.632	60.5	
2-2		0.38			985			0.616	59.0	
2-3		0.39			987			0.624	59.8	
2-4		0.38			990			0.616	59.1	
2-5		0.38			997			0.616	59.3	
2-6		0.36			994			0.600	57.6	
2-7		0.34			990			0.583	55.9	
2-8		0.31			985			0.557	53.3	

Totals and Averages

	Elapsed Time		Orifice Setting	Gas Sample Volume	Stack Temp	DGM		Square Root ΔP	Stack Gas Velocity	Volume Metered
	45		1.00	26.76	990	91.9		0.608	58.3	25.24

Project Number	4035
Client	Koppers
Plant	Stickney, IL
Location	Outlet
Date	9/12/12
Meter ID	M-11
Y_d	0.9883
P_b (Inches Hg)	29.65
Start Time	16:42
Stop Time	17:27

Project Number	4035
Client	Koppers
Plant	Stickney, IL
Location	Outlet
Date	9/12/12
Meter ID	CAE
Y_d	0.9940
P_b (Inches Hg)	29.65
Start Time	16:42
Stop Time	17:27

Run 2

Min/Pt 5 Elapsed Time	Flow Meter Setting (lpm)	Gas Sample Volume Initial (L) 9,190.1	DGM Inlet (°F)	DGM Outlet (°F)	Volume Metered Vmstd (L)
5	1.00	9197.5	90	90	6 972
10	1.00	9201.0	90	90	3 298
15	1.00	9203.8	90	90	2 638
20	1.00	9210.7	91	91	6 489
25	1.00	9216.5	91	90	5 460
30	1.00	9222.0	92	91	3 168
35	1.00	9227.5	93	91	5 163
40	1.00	9232.0	94	91	4 221
45	1.00	9238.6	95	92	6 179

Totals and Averages

45	1.00	48.5	91.2	45.59

Run 2 Spiked

Min/Pt 5 Elapsed Time	Flow Meter Setting (lpm)	Gas Sample Volume Initial (L) 1,608.2	DGM Inlet (°F)	DGM Outlet (°F)	Volume Metered Vmstd (L)
5	1.00	1613.4	95	94	4 888
10	1.00	1619.5	95	94	5 733
15	1.00	1623.5	95	94	3 760
20	1.00	1629.0	95	94	5 169
25	1.00	1633.0	95	94	3 760
30	1.00	1638.0	96	94	4 700
35	1.00	1643.0	96	95	4 691
40	1.00	1648.4	96	95	5 066
45	1.00	1653.4	97	95	4 687

Totals and Averages

45	1.00	45.2	94.9	42.45

Project Number	4035
Client	Koppers
Plant	Stickney, IL
Location	Outlet
Date	9/12/12
Meter ID	M-11
Y_d	0.9883
P_b (Inches Hg)	29.65
Start Time	18:05
Stop Time	18:50

Project Number	4035
Client	Koppers
Plant	Stickney, IL
Location	Outlet
Date	9/12/12
Meter ID	CAE
Y_d	0.9940
P_b (Inches Hg)	29.65
Start Time	18:05
Stop Time	18:50

Run 3

Min/Pt 5 Elapsed Time	Flow Meter Setting (lpm)	Gas Sample Volume Initial (L) 9,239.0	DGM Inlet (°F)	DGM Outlet (°F)	Volume Metered Vmstd (L)
5	1.00	9244.1	91	91	4 795
10	1.00	9249.8	91	91	5 381
15	1.00	9254.8	91	91	4 702
20	1.00	9260.4	91	91	5 267
25	1.00	9265.6	92	92	4 881
30	1.00	9270.9	93	93	4 966
35	1.00	9276.3	93	93	5 080
40	1.00	9281.6	93	93	4 986
45	1.00	9287.0	93	93	5 060

Totals and Averages

45	1.00	48.0	92.0	45.06

Run 3 Spiked

Min/Pt 5 Elapsed Time	Flow Meter Setting (lpm)	Gas Sample Volume Initial (L) 1,653.8	DGM Inlet (°F)	DGM Outlet (°F)	Volume Metered Vmstd (L)
5	1.00	1658.3	95	95	4 226
10	1.00	1666.0	95	95	7 231
15	1.00	1668.8	96	95	2 627
20	1.00	1674.1	97	95	4 968
25	1.00	1679.3	96	95	4 579
30	1.00	1684.6	97	95	4 968
35	1.00	1689.9	97	95	4 [illegible]
40	1.00	1695.3	97	95	5 062
45	1.00	1670.5	97	95	-23 247

Totals and Averages

45	1.00	41.5	95.7	38.92

Project Number	4035
Client	Koppers
Plant	Stickney, IL
Location	Outlet
Date	9/12/12
Meter ID	M-11
Y_d	0.9883
P_b (Inches Hg)	29.65
Start Time	19:37
Stop Time	20:22

Project Number	4035
Client	Koppers
Plant	Stickney, IL
Location	Outlet
Date	9/12/12
Meter ID	CAE
Y_d	0.9940
P_b (Inches Hg)	29.65
Start Time	19:37
Stop Time	20:22

Run 4

Min/Pt 5 Elapsed Time	Flow Meter Setting (lpm)	Gas Sample Volume Initial (L) 9,287.3	DGM Inlet (°F)	DGM Outlet (°F)	Volume Metered Vmstd (L)
5	1.00	9292.2	88	87	4 838
10	1.00	9298.5	88	87	5 983
15	1.00	9303.7	88	87	4 922
20	1.00	9309.2	88	87	5 206
25	1.00	9314.8	88	87	5 300
30	1.00	9320.0	88	87	4 922
35	1.00	9325.9	88	87	5 584
40	1.00	9331.4	88	87	5 206
45	1.00	9337.1	88	87	5 395

Totals and Averages

45	1.00	49.8	87.5	47.13

Run 4 Spiked

Min/Pt 5 Elapsed Time	Flow Meter Setting (lpm)	Gas Sample Volume Initial (L) 1,701.0	DGM Inlet (°F)	DGM Outlet (°F)	Volume Metered Vmstd (L)
5	1.00	1,706.3	91	91	5 013
10	1.00	1,711.4	91	91	4 824
15	1.00	1,717.5	91	91	5 770
20	1.00	1,723.0	91	91	5 202
25	1.00	1,728.5	91	91	5 202
30	1.00	1,732.0	91	91	3 311
35	1.00	1,739.5	91	91	7 094
40	1.00	1,745.1	91	91	5 297
45	1.00	1,750.8	91	91	5 391

Totals and Averages

45	1.00	49.8	91.0	47.10

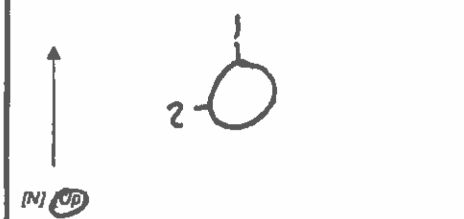
Field Data

AIRTECH ENVIRONMENTAL SERVICES INC

Method 1, Sample and Velocity Traverses Datasheet

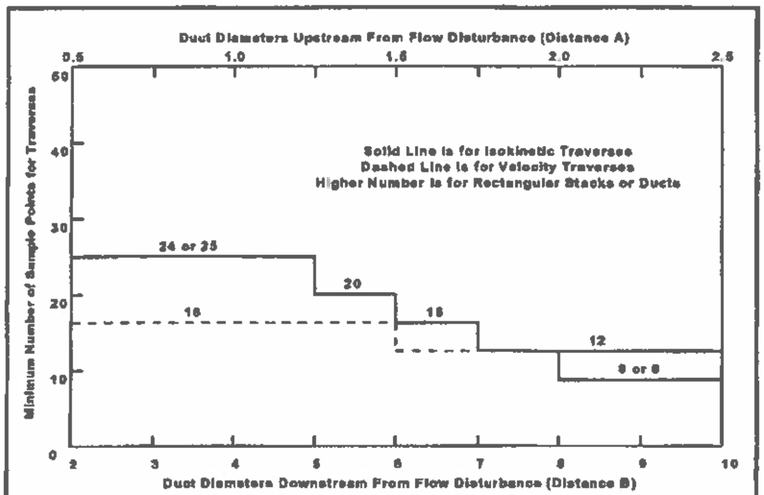
LOCATION Inlet

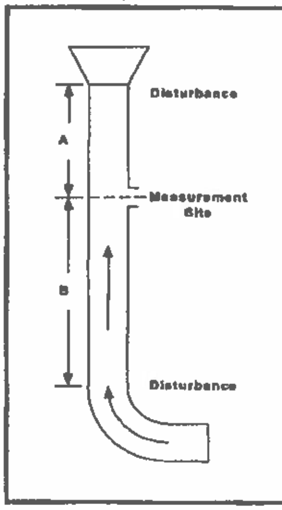
Client	Koppers
Project No.	4085
Plant	Cicero, IL
Date	9-12-12
Technician	MH
Duct Diameter (in.)	6"
Port Diameter (in.)	2"
Port Length (in.)	9.5"
Port Type	Female/ball
Distance A (ft)	43"
Distance B (ft)	12"
Distance A (Duct Diameters)	3.6 7.8 DD
Distance B (Duct Diameters)	2



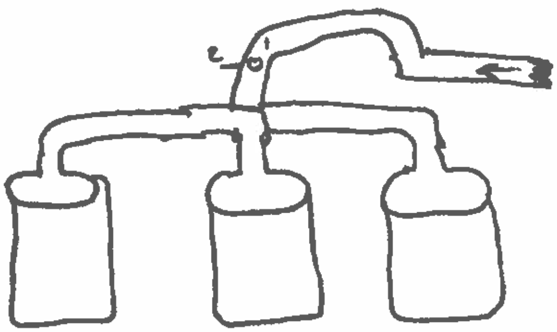
Cross Section of Duct

For rectangular ducts $$ED = \frac{2LW}{(L+W)}$$





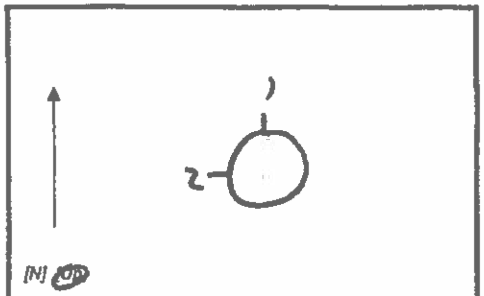
Location Schematic and Notes	Traverse Point	Distance (in.)
A = .1963 ft²	1	9.69
	2	10.13
	3	10.66
	4	11.44
	5	13.56
	6	14.34
	7	14.87
	8	15.31
	9	
	10	
	11	
	12	
	13	
	14	
Indicate sample ports, height from grade, types of disturbances, access, unistrut configuration, etc.	15	
Distance to point must include length of port	16	



AIRTECH ENVIRONMENTAL SERVICES INC.
Methods 2 and 4, Velocity and Moisture Datasheet

RUN NO. 2

Client	Koppers
Plant	Cicero, IL
Location	Inlet
Date	9-12-12
Project No.	4035
Meter Operator	MH
Probe Operator	MH



First point all the way (in) [out]
Gas flow (in) [out] of page
Cross Section of Duct

Method 2

Barometric (inHg)	29.65	Probe ID	AE2-LP-2-1
Ambient Temp (°F)	75	Duct Dim. (in)	6"
Static (inH_2O)	-.1	Port Length (in.)	9.5"

Method 4

Meter ID	M-10	Yd	1.0096	Pitot Cp	.84
Pre-Test Leak Check	0.00	cfm @	15	(in. Hg)	
Post-Test Leak Check	0.00	cfm @	10	(in. Hg)	
Start Time	16:42	Stop Time	~~17:24~~ 17:27		
Water (ml)	580	Silica gel (g)	18		

Min/Point 5 Elapsed Time	Orifice Setting ΔH (inH_2O)	Gas Sample Volume Initial (ft) 869.72	Impinger Outlet Temp (°F)	DGM Inlet Temp (°F)	DGM Outlet Temp (°F)	Pump Vacuum (in Hg)	Notes
5	1.0	872.56	45	90	90	3	
10	↓	875.40	45	91	90	3	
15		878.15	47	92	90	3	
20		880.88	49	92	91	3	
25		883.62	51	92	90	3	
30		886.35	51	92	91	3	
35		889.10	53	92	91	3	
40		891.99	53	92	91	3	
45		894.61	53	92	91	3	
						3	
Total		24.89		825	815		
Average				91.11			

Run Number	2A		Run Number	2B	
Start Time			Start Time		
Stop Time			Stop Time		
Pre Leak Check	✓		Pre Leak Check	✓	
Post Leak Check	✓		Post Leak Check	✓	
Points	Pressure ΔP ($in H_2O$)	Stack Temp (°F)	Points	Pressure ΔP ($in H_2O$)	Stack Temp (°F)
1-1	.008	156	1-1	.009	151
2	.008	156	2	.009	151
3	.008	156	3	.009	153
4	.007	156	4	.009	153
5	.008	156	5	.009	154
6	.008	156	6	.010	153
7	.008	156	7	.010	152
8	.008	156	8	.009	151
2-1	.003	154	2-1	.006	151
2	.004	156	2	.012	151
3	.004	156	3	.013	151
4	.004	156	4	.013	151
5	.004	156	5	.022	151
6	.004	155	6	.022	151
7	.004	151	7	.023	151
8	.004	151	8	.021	151
Total	1.7073		Total	.1111	151.63

Average ΔP	0.0755
Ave. Stack Temp.	155.19

153 UB

AIRTECH ENVIRONMENTAL SERVICES INC.
Methods 2 and 4, Velocity and Moisture Datasheet

RUN NO. 3

Client	Koppers
Plant	Cicero, IL
Location	Inlet
Date	9-12-12
Project No	4035
Meter Operator	MH
Probe Operator	MH

[N] Up

First point all the way (in) [out]

Gas flow [in] (out) of page

Cross Section of Duct

670 12

Method 4

Meter ID	M-10	Yd	1.0046	Pitot Cp	.84
Pre-Test Leak Check	0.00	cfm @	13	(in. Hg)	
Post-Test Leak Check	0.00	cfm @	20	(in. Hg)	
Start Time	18:05	Stop Time	18:50		
Water [ml]	[illegible]	Silica gel (g)	[illegible]		

Min/Point 5 Elapsed Time	Orifice Setting ΔH (inH_2O)	Gas Sample Volume Initial [ft³] 894.70	Impinger Outlet Temp (°F)	DGM Inlet Temp (°F)	DGM Outlet Temp (°F)	Pump Vacuum (in Hg)	Notes
5	1.0	897.49	51	91	89	3	
10	↓	900.28	51	91	89	3	
15		903.00	51	93	91	3	
20		905.81	56	94	90	3	
25		908.54	56	94	91	3	
30		911.27	58	94	91	3	
35		914.06	61	94	91	3	
40		916.85	50	94	90	3	
45		919.69	48	94	91	3	
Total		24.99		839	813		
Average				91.77			

Method 2

Barometric (inHg)	29.65	Probe ID	AEZ-P-2-1
Ambient Temp (°F)	75	Duct Dim. (in)	6"
Static (inH_2O)	-.1	Port Length (in.)	9.5"

Run Number	3A	
Start Time		
Stop Time		
Pre Leak Check	✓	
Post Leak Check	✓	
Points	Pressure ΔP ($in H_2O$)	Stack Temp (°F)
1-1	.009	151
2	.009	151
3	.009	153
4	.009	153
5	.009	154
6	.010	153
7	.010	152
8	.009	151
2-1	.006	151
2	.012	151
3	.013	151
4	.013	151
5	.022	151
6	.022	151
7	.023	151
8	.021	151
Total	1.7776	2426

Run Number	3B	
Start Time		
Stop Time		
Pre Leak Check	✓	
Post Leak Check	✓	
Points	Pressure ΔP ($in H_2O$)	Stack Temp (°F)
1-1	.001	145
2	.001	145
3	.001	145
4	.001	142
5	.001	142
6	.003	133
7	.005	133
8	.005	131
2-1	.001	131
2	.002	130
3	.004	129
4	.005	122
5	.005	123
6	.009	119
7	.008	119
8	.009	119
Total		

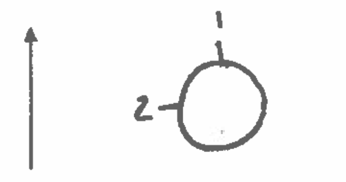
Average ΔP	.1111
Ave. Stack Temp.	151.63

!42 BB

AIRTECH ENVIRONMENTAL SERVICES INC.
Methods 2 and 4, Velocity and Moisture Datasheet

RUN NO. 4

Client	Koppers
Plant	Cicero, IL
Location	Inlet
Date	9-12-12
Project No	4035
Meter Operator	MH
Probe Operator	MH



[N] (up)

First point all the way (in) [out]

Gas flow (in) [out] of page

Cross Section of Duct

Method 2

Barometric (inHg)	29.65	Probe ID	AEZ-1P-2-1
Ambient Temp (°F)	68	Duct Dim (in)	6"
Static (inH$_2$O)	-.1	Port Length (in.)	9.5"

Method 4

Meter ID	M-10	Yd	1.0096	Pitot Cp	.84
Pre-Test Leak Check	0.00	cfm @	18	(in. Hg)	
Post-Test Leak Check	0.00	cfm @	20	(in. Hg)	
Start Time	~~19:32~~ 19:50	Stop Time	20:35		

Water [ml] 611 | Silica gel (g) 14

Min/Point 5 Elapsed Time	Orifice Setting ΔH (inH$_2$O)	Gas Sample Volume Initial [ft] 919.75	Impinger Outlet Temp (°F)	DGM Inlet Temp (°F)	DGM Outlet Temp (°F)	Pump Vacuum (in Hg)	Notes
5	1.0	~~[illegible]~~	42	88	89	3	922.50
10	↓	925.24	42	89	88	3	19:50 Restart
15		927.87	42	90	87	3	
20		930.62	46	89	87	3	
25		933.36	46	91	88	3	
30		936.15	49	92	89	3	
35		938.90	51	92	90	3	
40		941.57	53	92	90	3	
45	↓	945.10	56	92	91	3	
Total		25.35					
Average				89.7			

Run Number	4A		Run Number	4B	
Start Time			Start Time		
Stop Time			Stop Time		
Pre Leak Check	✓		Pre Leak Check	✓	
Post Leak Check	✓		Post Leak Check	✓	
Points	Pressure ΔP (in H$_2$O)	Stack Temp (°F)	Points	Pressure ΔP (in H$_2$O)	Stack Temp (°F)
1-1	.001	145	1-1		
2	.001	145	2		
3	.001	145	3		
4	.001	142	4		
5	.001	142	5		
6	.003	133	6		
7	.005	133	7		
8	.005	131	8		
2-1	.001	131	2-1		
2	.002	130	2		
3	.004	129	3		
4	.005	122	4		
5	.005	123	5		
6	.009	119	6		
7	.008	119	7		
8	.009	119	8		
Total			Total		

Average ΔP	.0572
Ave. Stack Temp.	132

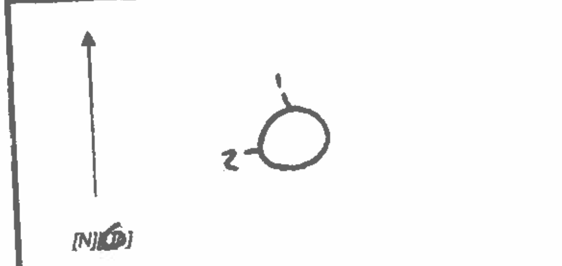
AIRTECH ENVIRONMENTAL SERVICES INC.

Method 30B, Mercury Datasheet

Page	1	of	1

Run No. 2

Client	Koppers
Plant	Cicero, IL
Location	Inlet
Date	9-12-12
Project No.	4035
Meter Reader	MH



Gas flow [in] or [out] of page

Cross Section of Duct

Barometric (in. Hg)	29.65
Static (inH$_2$O)	-.1
Ambient Temp. (°F)	75
Start Time	16:42
Stop Time	17:29

Sample Train A

Trap ID		Meter ID	R19075 A	Yd	1.0060
Pre Leak Check	0.000	lpm @	22	(in. Hg)	
Post Leak Check	0.001	lpm @	22	(in. Hg)	

Min/Point: 5 — Elapsed Time	Flow Meter Setting	Gas Sample Initial [l]: 0.000	Stack Temp (°F)	DGM Temp (°F)	Pump Vaccum (in Hg)	Notes
5	0.100	0.395	NA	87	21	
10	↓	0.690	↓	87	21	
15		1.067		87	21	
20		1.358		87	21	
25		1.693		87	21	
30		2.027		87	21	
35		2.377		87	21	
40		2.700		87	21	
45		3.038		67	21	
		3.038				
Total		3.038				
Average			NA	87		

Sample Train B

Trap ID		Meter ID	R19025 B	Yd	0.9955
Pre Leak Check	0.000	lpm @	21	(in. Hg)	
Post Leak Check	0.001	lpm @	22	(in. Hg)	

Min/Point: 5 — Elapsed Time	Flow Meter Setting	Gas Sample Initial [l]: 0.000	Stack Temp (°F)	DGM Temp (°F)	Pump Vaccum (in Hg)	Notes
5	0.100	0.353	NA	87	21	
10	↓	0.719	↓	87	21	
15		1.039		87	21	
20		1.395		87	21	
25		1.721		87	21	
30		2.046		87	21	
35		2.349		87	21	
40		2.684		87	21	
45		3.009		87	21	
Total		3.009				
Average			NA	87		

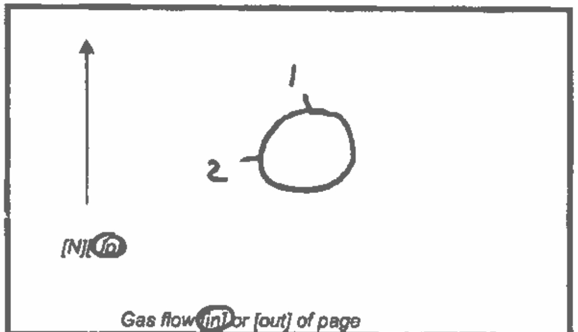
AIRTECH ENVIRONMENTAL SERVICES INC.

Method 30B, Mercury Datasheet

Run No. 3

Page 1 of 1

Client	Koppers
Plant	Cicero, IL
Location	Inlet
Date	9-12-12
Project No.	4035
Meter Reader	MH



Cross Section of Duct

Barometric (in. Hg)	29.65
Static (inH_2O)	-1
Ambient Temp. (°F)	75
Start Time	18:05
Stop Time	18:50

Sample Train A

Trap ID		Meter ID	219075A	Yd	1.0060
Pre Leak Check	0.000	lpm @	22	(in. Hg)	
Post Leak Check	0.001	lpm @	22	(in. Hg)	

Min/Point 5 Elapsed Time	Flow Meter Setting	Gas Sample Initial [l] 0.006	Stack Temp (°F)	DGM Temp (°F)	Pump Vaccum (in Hg)	Notes
5	0.100	.313	NA	86	21	
10	↓	0.663	↓	86	21	
15		1.013		86	21	
20		1.394		86	21	
25		1.739		86	21	
30		2.082		86	21	
35		2.384		86	21	
40		2.728		86	21	
45		3.043		86	21	
Total		3.043				
Average			NA	86		

Sample Train B

Trap ID		Meter ID	219025B	Yd	0.9955
Pre Leak Check	0.000	lpm @	22	(in. Hg)	
Post Leak Check	0.000	lpm @	22	(in. Hg)	

Min/Point 5 Elapsed Time	Flow Meter Setting	Gas Sample Initial [l] 0.000	Stack Temp (°F)	DGM Temp (°F)	Pump Vaccum (in Hg)	Notes
5	0.100	0.378	NA	86	21	
10	↓	0.711	↓	86	21	
15		1.045		86	21	
20		1.369		86	21	
25		1.686		86	21	
30		2.000		86	21	
35		2.274		86	21	
40		2.505		86	21	
45		2.612		86	21	
Total		2.612				
Average			NA	86		

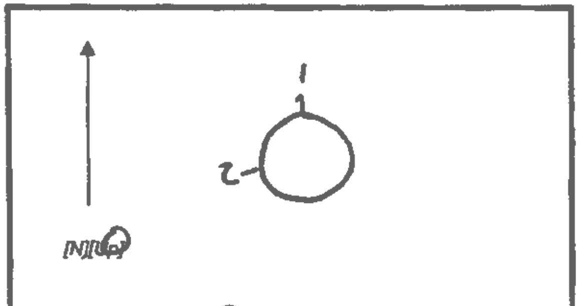
AIRTECH ENVIRONMENTAL SERVICES INC.

Method 30B, Mercury Datasheet

Run No. 4

Page 1 of 1

Client	Koppers
Plant	Cicero, IL
Location	Inlet
Date	9-12-12
Project No.	4035
Meter Reader	MH



Cross Section of Duct

Barometric (in. Hg)	29.65
Static (inH_2O)	-.1
Ambient Temp. (°F)	68
Start Time	~~1737~~ 1750
Stop Time	2035

Sample Train A

Trap ID	Large tube	Meter ID	219025A	Yd	1.0060	
Pre Leak Check	0.008		lpm @	20	(in. Hg)	
Post Leak Check	0.008		lpm @	20	(in. Hg)	

Min/Point 5 Elapsed Time	Flow Meter Setting	Gas Sample Initial [l] 0.00	Stack Temp (°F)	DGM Temp (°F)	Pump Vaccum (in Hg)	Notes VOL
5	0.100	~~0.653~~	NA	84	22	0.327
10		~~1.025~~		84	22	0.653
15		1.075		84	22	
20		1.393		84	22	
25		1.777		84	22	
30		2.084		84	22	
35		2.489		84	22	
40		2.792		84	22	
45		3.264		84	22	
Total						
Average			NA	84		

Sample Train B

Trap ID		Meter ID	R190753	Yd	0.9955	
Pre Leak Check	0.000		lpm @	22	(in. Hg)	
Post Leak Check	0.000		lpm @	22	(in. Hg)	

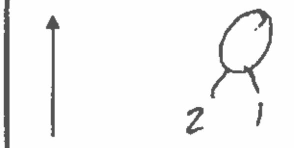
Min/Point 5 Elapsed Time	Flow Meter Setting	Gas Sample Initial [l] 0.00	Stack Temp (°F)	DGM Temp (°F)	Pump Vaccum (in Hg)	Notes VOL
5	0.100	~~0.553~~	NA	84	22	0.277
10		~~0.781~~		84	22	0.553
15		0.781		84	22	
20		1.052		84	22	
25		1.306		84	22	
30		1.519		84	22	
35		1.805		84	22	
40		2.048		84	22	
45		2.321		84	22	
Total						
Average			NA	84		

AIRTECH ENVIRONMENTAL SERVICES INC

Method 1, Sample and Velocity Traverses Datasheet

LOCATION OUTLET

Client	KOPPERS
Project No:	4035
Plant	STICKNEY, IL
Date	9/12/12
Technician	RM
Duct Diameter (in.)	24"
Port Diameter (in.)	2"
Port Length (in.)	9"
Port Type	Flange
Distance A (ft)	216"
Distance B (ft)	60"
Distance A (Duct Diameters)	9
Distance B (Duct Diameters)	2.5



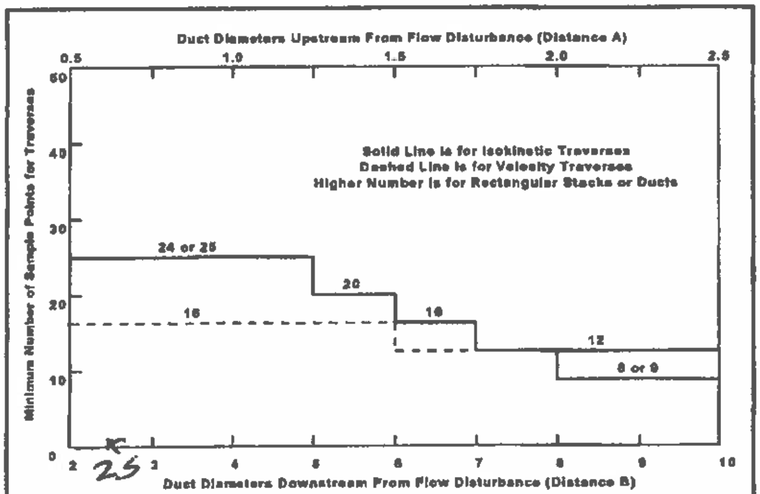
[IN] [Up]

First point all the way [in] [out]

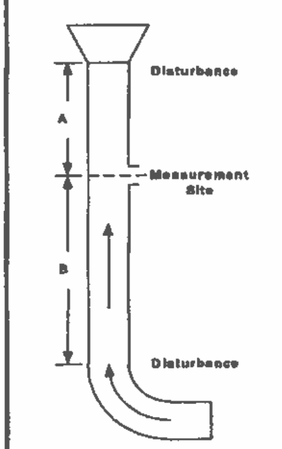
Gas flow [in] [out] of page

Cross Section of Duct

For rectangular ducts $ED = \frac{2LW}{(L+W)}$



x9



Location Schematic and Notes	Traverse Point	Distance (in.)
A= 3.1416	1	9.78
	2	11.51
	3	13.65
	4	16.76
	5	25.24
	6	28.35
	7	30.49
	8	32.22
	9	
	10	
	11	
	12	
	13	
	14	
Indicate sample ports, height from grade, types of disturbances, access, unistrut configuration, etc.	15	
Distance to point must include length of port	16	

AIRTECH ENVIRONM[illegible]AL SERVICES INC.

Methods 2 and 4, Velocity and Moisture Datasheet

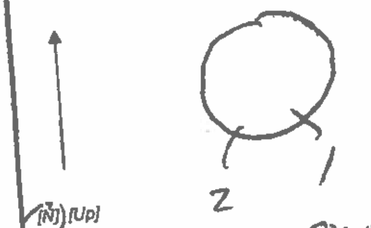
Page 1 of 1

RUN NO. 2

Client	KOPPERS		
Plant	STICKNEY, IL		
Location	STACK OUT		
Date	9/12/12	Project No	4035
Meter Operator	RM		
Probe Operator	BC		

Method 2

Barometric (inHg)	29.60	Probe ID	AE2-4-2
Ambient Temp (°F)	80	Duct Dim. (in)	24
Static (inH$_2$O)	-6.2	Port Length (in.)	9



First point all the way (in) [out]

Gas flow [in] (out) of page

Cross Section of Duct

Method 4

Meter ID	M-20	Yd	.9944	Pitot Cp	.84
Pre-Test Leak Check	.000	cfm @	17	(in. Hg)	
Post-Test Leak Check	.000	cfm @	10	(in. Hg)	
Start Time	16:42	Stop Time	~~16:27~~ 1727		

Water [ml]	113	Silica gel (g)	11

Min/Point 5 / Elapsed Time	Orifice Setting ΔH (inH$_2$O)	Gas Sample Volume Initial [ft] 169.20	Impinger Outlet Temp (°F)	DGM Inlet Temp (°F)	DGM Outlet Temp (°F)	Pump Vacuum (In Hg)	Notes
5	10	173.44	51	96	93	3	
10		176.19	51	94	93	3	
15		179.11	52	97	94	3	
20		182.00	53	96	93	3	
25		185.16	54	97	94	3	
30		188.17	54	97	94	3	
35		190.67	55	98	95	3	
40		193.5	55	98	95	3	
45		196.4	55	98	95		
Total		27.20			95.5		
Average							

Run Number	2	
Start Time	16:56	
Stop Time	17:07	
Pre Leak Check	✓	
Post Leak Check	✓	
Points	Pressure ΔP (in H$_2$O)	Stack Temp (°F)
1-1	.39	960
2	.42	959
3	.43	961
4	.45	959
5	.44	960
6	.45	964
7	.27	970
8	.22	972
2-1	.39	968
2	.40	964
3	.42	971
4	.43	972
5	.46	968
6	.42	957
7	.41	965
8	.31	970
Total	20.0290	15440

Run Number	1	
Start Time	16:44	
Stop Time	16:53	
Pre Leak Check	✓	
Post Leak Check	✓	
Points	Pressure ΔP (in H$_2$O)	Stack Temp (°F)
1-1	.40	958
2	.41	963
3	.43	968
4	.45	970
5	.45	973
6	.46	976
7	.27	970
8	.22	960
2-1	.40	959
2	.46	965
3	.43	971
4	.44	976
5	.45	979
6	.44	981
7	.42	980
8	.27	769
Total	20.0290	15518

15524

Average ΔP	.6259
Ave. Stack Temp.	967.4

967.6

AIRTECH ENVIRONMENTAL SERVICES INC.
Methods 2 and 4, Velocity and Moisture Datasheet

RUN NO. ~~3~~ RM 3 [illegible]

Page	1	of	1

Client	Koppers
Plant	Stickney IL.
Location	Stack output
Date	9/12/12
Project No	4035
Meter Operator	~~Pete~~ RM
Probe Operator	~~RM~~ BC RM

Method 4

Meter ID	M-20	Yd	.9944	Pitot Cp	.84
Pre-Test Leak Check	0.000	cfm @	17	(in. Hg)	
Post-Test Leak Check	0.000	cfm @	10	(in. Hg)	
Start Time	18:05	Stop Time	~~1905~~ 1850 GA		

Water (ml)	102	Silica gel (g)	11

(IN) (Up)

First point all the way (in) (out)
Gas flow (in) (out) of page

Cross Section of Duct

Min/Point 5 Elapsed Time	Orifice Setting ΔH (inH_2O)	Gas Sample Volume Initial (ft) 196.60	Impinger Outlet Temp (°F)	DGM Inlet Temp (°F)	DGM Outlet Temp (°F)	Pump Vacuum (in Hg)	Notes
5	1.0	199.83	51	96	94	3	
10	↓	202.71	52	97	95	3	
15		205.59	52	99	97	3	
20		208.42	53	100	95	3	
25		211.40	53	101	95	3	
30		214.37	53	102	96	3	
35		217.36	54	103	96	3	
40		220.31	54	104	97	3	
45		223.31	54	104	97	3	
Total	9.0	26.71		960.0	862.0		
Average	1.0			98.22			

Method 2

Barometric (inHg)	29.60	Probe ID	AE 2-4-2
Ambient Temp (°F)	80	Duct Dim (in)	24
Static (inH_2O)	-.2	Port Length (in.)	9

Run Number	1	
Start Time	18:10	
Stop Time	18:15	
Pre Leak Check	✓	
Post Leak Check	✓	
Points	Pressure ΔP ($in H_2O$)	Stack Temp (°F)
1-1	.27	961
2	.34	961
3	.27	971
4	.31	964
5	.30	961
6	.27	968
7	.28	966
8	.27	948
2-1	.30	941
2	.32	960
3	.33	968
4	.32	952
5	.33	976
6	.30	974
7	.27	961
8	.28	967
Total	18.3[illegible]	15412

Run Number	2	
Start Time	18:25	
Stop Time	18:33	
Pre Leak Check	✓	
Post Leak Check	✓	
Points	Pressure ΔP ($in H_2O$)	Stack Temp (°F)
1-1	.34	951
2	.37	966
3	.40	971
4	.37	973
5	.39	978
6	.41	980
7	.33	976
8	.33	974
2-1	.38	980
2	.38	981
3	.38	984
4	.40	985
5	.42	984
6	.27	972
7	.30	968
8	.30	964
Total	18.3104	15567

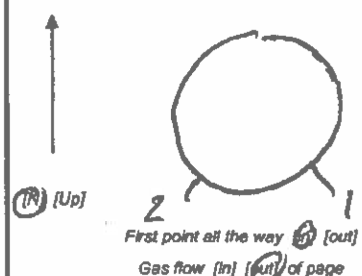
Average ΔP	.5722
Ave. Stack Temp	968.72

AIRTECH ENVIRONMENTAL SERVICES INC.
Methods 2 and 4, Velocity and Moisture Datasheet

RUN NO. 3 4 4

Page 1 of 1

Client	KOPPERS
Plant	STICKNEY, IL
Location	STACK OUTLET
Date	9/12/12
Project No	4035
Meter Operator	RM
Probe Operator	BC



Cross Section of Duct

Method 4

Meter ID	M-20	Yd	.9949	Pitot Cp	.84
Pre-Test Leak Check	0.000	cfm @	17	(in. Hg)	
Post-Test Leak Check	0.000	cfm @	10	(in. Hg)	
Start Time	19:37 (19:50 am)	Stop Time	20:35		

Water [ml] 116 | Silica gel (g) 5

Min/Point 5 Elapsed Time	Orifice Setting ΔH (inH2O)	Gas Sample Volume Initial [ft] 223.59	Impinger Outlet Temp (°F)	DGM Inlet Temp (°F)	DGM Outlet Temp (°F)	Pump Vacuum (In Hg)	Notes
5	1.0	226.97	51	93	93	3	
10	↓	229.79	51	91	91	3	
15		232.70	52	90	90	3	
20		236.12	52	90	90	3	
25		238.61	53	94	94	3	
30		242.00	53	93	93	3	
35		245.31	54	94	94	3	
40		247.51	54	93	89	3	
45	↓	250.35	55	93	90	3	
Total		26.76		831	824		
Average				91.94			

Method 2

Barometric (inHg)	29.40	Probe ID	A62-4-2
Ambient Temp (°F)	80	Duct Dim. (in)	24
Static (inH2O)	-0.2	Port Length (in.)	9

Run Number	1
Start Time	19:55
Stop Time	20:03
Pre Leak Check	✓
Post Leak Check	✓

Points	Pressure ΔP (in H2O)	Stack Temp (°F)
1-1	.40	988
2	.39	993
3	.40	997
4	.41	999
5	.39	987
6	.33	986
7	.32	986
8	.31	986
2-1	.39	986
2	.39	991
3	.40	994
4	.38	994
5	.37	993
6	.34	987
7	.33	985
8	.32	986
Total	19.4451	15838.0

Run Number	2
Start Time	20:10
Stop Time	20:15
Pre Leak Check	✓
Post Leak Check	✓

Points	Pressure ΔP (In H2O)	Stack Temp (°F)
1-1	.39	987
2	.40	990
3	.41	992
4	.40	994
5	.38	997
6	.39	994
7	.36	987
8	.30	981
2-1	.40	984
2	.38	985
3	.39	987
4	.38	990
5	.38	997
6	.36	994
7	.34	990
8	.31	985
Total	19.4451	15834.0

Average ΔP	.6077
Ave. Stack Temp.	989.75

AIRTECH ENVIRONMENTAL SERVICES INC.

Method 18, VOST Datasheet

Run No. 2

Page 1 of 1

Client	Koppers
Plant	Stickney, IL
Location	Outlet
Date	9/12/12
Project No.	4035
Probe Operator	LA

Barometric (in. Hg)	29.65
Static (inH_2O)	N/A
Ambient Temp. (°F)	80
Start Time	1642
Stop Time	1727

[N][Up]

Gas flow [in] or [out] of page

Cross Section of Duct

80-050208-1

Unspiked Train	Meter ID	A-11	Yd	9883	
Pre Leak Check	.000	lpm @	15	(in. Hg)	

Min/Point 5 Elapsed Time	Orifice Setting ΔH (inH_2O)	Gas Sample Volume Initial [l] 9190.1	Flow Meter Setting	DGM Inlet Temp (°F)	DGM Outlet Temp (°F)	Pump Vaccum (in Hg)
5	N/A	9197.5	1lpm	90	90	8
10		9201.0		90	90	8
15		9203.8		90	90	8
20		9210.7		91	91	8
25		9216.5		91	90	8
30		9222.0		92	91	8
35		9227.5		93	91	8
40		9232.0		94	91	8
45		9238.6		95	92	8
Total		48.5				
Average				91.2		

Spiked Train	Meter ID	CAERENTAL	Yd	.9910	
Pre Leak Check	.000	lpm @	15	(in. Hg)	

Min/Point 5 Elapsed Time	Orifice Setting ΔH (inH_2O)	Gas Sample Volume Initial [l] 1608.2	Flow Meter Setting	DGM Inlet Temp (°F)	DGM Outlet Temp (°F)	Pump Vaccum (in Hg)
5	N/A	1613.4	1Lpm	95	94	8
10		1619.5		95	94	8
15		1623.5		95	94	8
20		1629.0		95	94	8
25		1633.0		95	94	8
30		1638.0		95	94	8
35		1643.0		96	95	8
40		1648.4		96	95	8
45		1653.4		97	95	8
Total		45.2				
Average				94.9		

AIRTECH ENVIRONMENTAL SERVICES INC.

Method 18, VOST Datasheet

Page	1	of	1

Run No. 3

Client	Keepus
Plant	Stickney, IL
Location	Outlet
Date	9/12/12
Project No.	4035
Probe Operator	LA

Barometric (in. Hg)	29.65
Static (inH_2O)	N/A
Ambient Temp. (°F)	80
Start Time	1805
Stop Time	1850

[N][Up]

Gas flow [in] or [out] of page

Cross Section of Duct

Unspiked Train	Meter ID	M-11	Yd	.9883
Pre Leak Check	.000	lpm @	15	(in. Hg)

Min/Point 5 Elapsed Time	Orifice Setting ΔH (inH_2O)	Gas Sample Volume Initial [l] 1653.8	Flow Meter Setting	DGM Inlet Temp (°F)	DGM Outlet Temp (°F)	Pump Vaccum (In Hg)
5	N/A	9244.1	1 lpm	91	91	8
10		~~9251.8~~		91	91	8
15		9254.8		91	91	8
20		9260.4		91	91	8
25		9265.6		92	92	8
30		9270.9		93	93	8
35		9276.3		93	93	8
40		9281.6		93	93	8
45		9287.0		93	93	8
						8
						8
						8
Total		48.0				
Average					92.0	

9239.0

9249.8

Spiked Train	Meter ID	CAE RENTAL	Yd	.9940
Pre Leak Check	.000	lpm @	15	(in. Hg)

Min/Point 5 Elapsed Time	Orifice Setting ΔH (inH_2O)	Gas Sample Volume Initial [l] 1653.8	Flow Meter Setting	DGM Inlet Temp (°F)	DGM Outlet Temp (°F)	Pump Vaccum (In Hg)
5	N/A	1658.3	1 lpm	95	95	8
10		1666.0		95	95	8
15		1668.8		96	95	8
20		1674.1		97	95	8
25		1679.3		96	95	8
30		1684.6		97	95	8
35		1689.9		97	95	8
40		1695.3		97	95	8
45		1670.5		97	95	8
~~50~~						8
						8
						8
Total		41.5				
Average					95.7	

AIRTECH ENVIRONMENTAL SERVICES INC.

Method 18, VOST Datasheet

Page	1	of	1

Run No. 4

Client	Koppers
Plant	Stickney, IL
Location	Outlet
Date	9/12/12
Project No.	4035
Probe Operator	LA

Barometric (in. Hg)	29.65
Static (inH$_2$O)	N/A
Ambient Temp. (°F)	80
Start Time	1937
Stop Time	2022

[N][Up]

Gas flow [in] or [out] of page

Cross Section of Duct

Unspiked Train	Meter ID	M-11	Yd	.9883
Pre Leak Check	.000	lpm @	15	(in. Hg)

Min/Point 5 / Elapsed Time	Orifice Setting ΔH (inH$_2$O)	Gas Sample Volume Initial [l]	Flow Meter Setting	DGM Inlet Temp (°F)	DGM Outlet Temp (°F)	Pump Vaccum (in Hg)
		9287.3				
5	N/A	9292.2	1lpm	88	87	8
10	↓	9298.5	↓	88	87	8
15		9303.7		88	87	8
20		9309.2		88	87	8
25		9314.8		88	87	8
30		9320.0		88	87	8
35		9325.9		88	87	8
40		9331.4		88	87	8
45	↓	9337.1	↓	88	87	8
Total		49.8				
Average				87.5		

RENTAL

Spiked Train	Meter ID	CAE	Yd	.9940
Pre Leak Check	.000	lpm @	15	(in. Hg)

Min/Point 5 / Elapsed Time	Orifice Setting ΔH (inH$_2$O)	Gas Sample Volume Initial [l]	Flow Meter Setting	DGM Inlet Temp (°F)	DGM Outlet Temp (°F)	Pump Vaccum (in Hg)
		1701.0				
5	N/A	1706.3	1lpm	91	91	8
10	↓	1711.4	↓	91	91	8
15		1717.5		91	91	8
20		1723.0		91	91	8
25		1728.5		91	91	8
30		1732.0		91	91	8
35		1739.5		91	91	8
40		1745.1	↓	91	91	8
45	↓	1750.8		91	91	8
Total		49.8				
Average				91.0		

AIRTECH ENVIRONMENTAL SERVICES INC.

Method 3B, Orsat Analyzer Datasheet

Page	1	of	1

PROJECT NO. 4035

$F_O = \frac{(20.9 - O_2\%)}{CO2\%}$

Client	Koppers		
Plant	Stickney, IL	Date	9/13/12
Location	Inlet/Outlet	Leak Check	—
Analyzer Type	Servomex O_2		

Run No.	Trial No.	%CO_2	%CO_2+%O_2	%O_2	F_O	Analyst	Date	Time
Ambient Air	Check			21.0		[illegible]		
Run No.	**Trial No.**	**%CO_2**	**%CO_2+%O_2**	**%O_2**	**F_O**	**Analyst**	**Date**	**Time**
Inlet 2	1	2.4		11.9		[illegible]	9/13	
	2	2.4		11.9				
	3	2.4		11.9				
	Average	2.4		11.9				
Inlet 3	1	2.4		12.0		[illegible]	9/13	
	2	2.4		12.0				
	3	2.4		12.0				
	Average	2.4		12.0				
Inlet 4	1	2.8		12.6		[illegible]	9/13	
	2	2.8		12.6				
	3	2.8		12.6				
	Average	2.8		12.6				
	1							
	2							
	3							
	Average							
Outlet 2	1			5.7		[illegible]	9/13	
	2			5.7				
	3			5.7				
	Average			5.7				
Outlet 3	1			5.6		[illegible]	9/3	
	2			5.6				
	3			5.6				
	Average			5.6				
Outlet 4	1			9.6		[illegible]	9/13	
	2			9.6				
	3			9.6				
	Average			9.6				
	1							
	2							
	3							
	Average							
	1							
	2							
	3							
	Average							

Notes:
Run an ambient air check to verify Oxsorb.
Measurements must be made to the nearest 0.2%.
Three different trails should be performed for each sample.
The differences between the trials must not be greater than 0.2% overall.

Expected F_o Ranges

Anthracite/Lignite	1.015-1.130	Nat. Gas	1.600-1.836
Bituminous	1.083-1.230	Wood Bark	1.000-1.120
Distillate Oil	1.260-1.413	Municiple Garbage	1.043-1.177
Residual Oil	1.210-1.370		

Analyzer Data

Koppers
Inlet

Method 25A Data
Bias

Project No. 4035

Date
9/12/2012

Time	THC (ppm)
Zero	356
High	8,167
Mid	5,078
Low	3,042
16:03:17	339.67
16:03:32	343.74
16:03:47	351.88
16:04:02	388.5
16:04:17	257.37
16:04:32	3874.77
16:04:47	7378.25
16:05:02	7890.95
16:05:17	8102.54
16:05:32	8167.65
16:05:47	8157.47
16:06:02	8114.75
16:06:17	8233.06
16:06:32	8131.02
16:06:47	8100.51
16:07:02	8204.51
16:07:17	7699.7
16:07:32	5447.47
16:07:47	5111.77
16:08:02	5111.77
16:08:17	5107.7
16:08:32	5064.98
16:08:47	5026.32
16:09:02	5026.32
16:09:17	4936.8
16:09:32	3070.1
16:09:47	3015.34
16:10:02	3068.28
16:10:17	3015.45

Koppers
Inlet

Method 25A Data
Run 2

Project No. 4035

Date
9/12/2012

Time	THC (ppm)
Average	233,307
16:42:30	197327.64
16:43:30	213432.52
16:44:30	222513.16
16:45:30	230287.63
16:46:30	237113.5
16:47:30	244186.56
16:48:30	250410.72
16:49:30	254899.42
16:50:30	255642.53
16:51:30	257923.25
16:52:30	259758.91
16:53:30	258849.47
16:54:30	257919.17
16:55:30	255954.83
16:56:30	253777.88
16:57:30	253650.22
16:58:30	250201.67
16:59:30	243853.92
17:00:30	241318.89
17:01:30	240309.75
17:02:30	239388.11
17:03:30	238034.13
17:04:30	235716.28
17:05:30	234339.92
17:06:30	233821.63
17:07:30	231491.06
17:08:30	231807.94
17:09:30	230296.28
17:10:30	225883.88
17:11:30	220547.8
17:12:30	214828.72
17:13:30	214543.38
17:14:30	213973.7
17:15:30	214271.77
17:16:30	214256
17:17:30	214113.58
17:18:30	216419.22
17:19:30	217509.73
17:20:30	217037.2
17:21:30	219304.7
17:22:30	224023.3
17:23:30	227219.55
17:24:30	228863.97
17:25:30	230184.89
17:26:30	231614.66

Koppers
Inlet

Method 25A Data
Cal 2

Project No. 4035

Date
9/12/2012

Time	THC (ppm)
Zero	379
Upscale	8,453

17:57:40	448.51
17:57:55	407.82
17:58:10	352.89
17:58:25	308.13
17:58:40	4436.31
17:58:55	7097.48
17:59:10	10977.34
17:59:25	11107.55
17:59:40	11642.63
17:59:55	11508.35
18:00:10	11022.1
18:00:25	10873.58
18:00:40	10682.33
18:00:55	10478.88
18:01:10	10307.98
18:01:25	10106.56
18:01:40	9925.49
18:01:55	9772.9
18:02:10	8693.55
18:02:25	8640.35
18:02:40	8595.89
18:02:55	8518.58
18:03:10	8055.75

Koppers
Inlet

Method 25A Data
Run 3

Project No. 4035

Date
9/12/2012

Time	THC (ppm)
Average	158,869
18:06:12	92966.1
18:07:12	142111.34
18:08:12	160475.06
18:09:12	168437.73
18:10:12	172276.39
18:11:12	173999.64
18:12:12	174642.05
18:13:12	174441.64
18:14:12	175245.8
18:15:12	175519.95
18:16:12	175587.59
18:17:12	175149.67
18:18:12	174500.14
18:19:12	174947.73
18:20:12	175665.92
18:21:12	175945.67
18:22:12	175992.98
18:23:12	176009.77
18:24:12	175799.19
18:25:12	176436
18:26:12	176113.02
18:27:12	175645.58
18:28:12	174883.66
18:29:12	174317.55
18:30:12	172363.38
18:31:12	170027.22
18:32:12	168227.67
18:33:12	166039.02
18:34:12	162969.41
18:35:12	160990.81
18:36:12	158461.38
18:37:12	153853.16
18:38:12	149472.8
18:39:12	146158.55
18:40:12	143342.23
18:41:12	142573.69
18:42:12	143228.81
18:43:12	144052.8
18:44:12	145517.66
18:45:12	136066.73
18:46:12	112478.32
18:47:12	108445.36
18:48:12	105824.37
18:49:12	102831.56
18:50:12	99052.41

Koppers
Inlet

Method 25A Data
Cal 3

Project No. 4035

Date
9/12/2012

Time	THC (ppm)
Zero	340
Upscale	8,291

19:30:32	8182.44
19:31:32	8379.35
19:32:32	8293.42
19:33:32	8309.6
19:34:32	1165.5
19:35:32	1461.42
19:36:32	1139.7
19:37:32	1122.8
19:38:32	1197.42
19:39:32	848.22
19:40:32	673.11
19:41:32	794.14
19:42:32	511.65
19:43:32	607.24
19:44:32	608.6
19:45:32	345.61
19:46:32	326.84
19:47:32	338.91
19:48:32	346.65
19:49:32	349.26

Koppers
Inlet

Method 25A Data
Run 4

Project No. 4035

Date
9/12/2012

Time	THC (ppm)
Average	145,676
19:51:03	168284.13
19:52:03	173797.2
19:53:03	176063.17
19:54:03	178097.2
19:55:03	172068.36
19:56:03	170038.91
19:57:03	166610.2
19:58:03	158175.02
19:59:03	148680.86
20:00:03	138126.19
20:01:03	128837.01
20:02:03	113516.95
20:03:03	120099
20:04:03	135074.9
20:05:03	145654.8
20:06:03	145358.8
20:07:03	146854.5
20:08:03	151452.5
20:09:03	168324.5
20:10:03	178324.5
20:11:03	179325.5
20:12:03	187567.45
20:13:03	146218.56
20:14:03	146571.05
20:15:03	144467.33
20:16:03	144061.95
20:17:03	144000.92
20:18:03	143628.09
20:19:03	142506.03
20:20:03	141139.34
20:21:03	140194.81
20:22:03	140053.41
20:23:03	139231.45
20:24:03	138425.78
20:25:03	137576.36
20:26:03	137923.75
20:27:03	135765.63
20:28:03	138253.34
20:29:03	138860.66
20:30:03	139050.89
20:31:03	135489.94
20:32:03	117248.29
20:33:03	93956.41
20:34:03	112409.15
20:35:03	108067.95

Koppers
Inlet

Method 25A Data
Cal 4

Project No. 4035

Date
9/12/2012

Time	THC (ppm)
Zero	378
Upscale	8,309

20:44:27	390.91
20:44:42	388.42
20:44:57	391.44
20:45:12	339.42
20:45:27	382.25
20:45:42	2507.9
20:45:57	2993.25
20:46:12	7977.34
20:46:27	8336.74
20:46:42	8360.04
20:46:57	8305.52
20:47:12	8384.42
20:47:27	8294.05
20:47:42	8266.11
20:47:57	8290.64

Method 3A, 6C, 10 and 25A Data
Cal Error

Date
9/12/2012

Time	CO_2 (%)	SO_2 (ppm)	CO (ppm)	THC (ppm)
Zero	0.0	1.3	6.4	1.7
High	9.84	923	910	80.3
Mid	4.91	502	510	50.4
Low	NA	NA	NA	30.4
15:17:32	9.95	7.66	17.88	1.86
15:17:47	9.93	4.86	-2.46	1.69
15:18:02	9.94	3.52	0.59	1.63
15:18:17	9.93	2.28	18.09	1.66
15:18:32	9.54	2.21	18.49	1.81
15:18:47	7.11	1.82	1.61	1.82
15:19:02	5.62	1.27	-1.24	1.74
15:19:17	5.12	1.35	4.66	1.7
15:19:32	4.96	1.31	19.92	1.66
15:19:47	4.91	1.22	18.29	1.71
15:20:02	4.93	1.26	-1.85	1.66
15:20:17	4.92	1.35	4.25	1.59
15:20:32	4.87	1.28	20.32	1.66
15:20:47	4.58	24.11	5.06	1.75
15:21:02	2.79	257.4	2.42	1.77
15:21:17	1.03	520.15	17.48	1.72
15:21:32	0.39	658.96	3.23	1.72
15:21:47	0.18	747.41	4.66	1.74
15:22:02	0.09	793.88	15.24	1.81
15:22:17	0.09	822.22	-1.65	1.77
15:22:32	0.05	839.07	12.59	1.77
15:22:47	0.04	850.03	19.31	1.77
15:23:02	0.05	855.28	13.2	1.88
15:23:17	0.07	857.99	0.18	1.81
15:23:32	0.07	860.07	2.22	1.87
15:23:47	0.03	863.21	15.64	1.8
15:24:02	0.07	865.11	6.49	1.88
15:24:17	0.04	863.66	10.76	1.85
15:24:32	0.06	865.45	5.27	1.87
15:24:47	0.03	864.66	10.97	1.94
15:25:02	0.07	866.17	5.27	1.85
15:25:17	0.04	865.11	10.56	1.84
15:25:32	0.02	865.33	9.34	1.91
15:25:47	0.03	863.79	5.06	1.86
15:26:02	0.01	866.66	15.64	1.92
15:26:17	0.03	866.58	3.44	1.82
15:26:32	0.03	869.98	-0.84	1.78
15:26:47	0.02	868.21	13.41	1.79
15:27:02	0.02	870.12	9.13	1.83
15:27:17	0.05	870.06	1	1.71
15:27:32	0.02	866.19	16.46	1.72
15:27:47	0.03	868.05	6.49	1.92
15:28:02	0.04	868.65	-0.02	1.84
15:28:17	0.01	891.73	14.63	1.78
15:28:32	0.03	922.39	7.91	1.8
15:28:47	0.03	924.65	6.69	1.78
15:29:02	0.01	920.31	15.24	1.72
15:29:17	0.03	925.04	1.4	1.75
15:29:32	0.03	921.81	6.29	1.91
15:29:47	0.02	927.22	16.05	1.86
15:30:02	0.02	871.7	15.24	1.86
15:30:17	0.04	719.39	1.81	1.89
15:30:32	0.03	628.54	9.74	1.85

Koopers
Outlet

Method 3A, 6C, 10 and 25A Data
Cal Error

Project No. 4035

Date
9/12/2012

Time	CO_2 (%)	SO_2 (ppm)	CO (ppm)	THC (ppm)
Zero	0.0	1.3	6.4	1.7
High	9.84	923	910	80.3
Mid	4.91	502	510	50.4
Low	NA	NA	NA	30.4
15:30:47	0.01	573.95	19.51	1.82
15:31:02	0.01	544.28	15.44	1.8
15:31:17	0.02	527.76	10.76	1.87
15:31:32	0.02	518.2	8.73	1.86
15:31:47	0.03	511.32	2.62	1.83
15:32:02	0.04	506.06	1.4	1.74
15:32:17	0.01	505.27	12.59	1.74
15:32:32	0.01	503.57	11.78	1.78
15:32:47	0.04	503.68	-0.02	1.73
15:33:02	0.03	501.22	5.47	1.71
15:33:17	0.01	502.17	15.24	1.76
15:33:32	0.01	502.48	10.76	1.83
15:33:47	0.04	501.37	1	1.74
15:34:02	0.01	502.71	14.63	1.81
15:34:17	0.03	470.35	18.49	1.78
15:34:32	0.02	312.12	327.34	1.8
15:34:47	0.01	175.32	668.53	1.81
15:35:02	0.04	106.28	799.96	1.67
15:35:17	0.01	62.98	816.23	1.77
15:35:32	0.05	39.74	800.77	1.8
15:35:47	0.02	25.05	814.61	1.85
15:36:02	0.02	16.05	807.28	1.9
15:36:17	0.03	10.91	799.96	1.83
15:36:32	0.01	7.55	815.42	1.66
15:36:47	0.04	5.78	813.79	1.74
15:37:02	0.04	5.19	900.87	1.74
15:37:17	0.01	3.85	912.67	1.78
15:37:32	0.01	3.26	918.37	1.76
15:37:47	0.02	3.21	911.45	1.77
15:38:02	0.04	3.13	897.82	1.86
15:38:17	0.01	2.32	912.67	1.89
15:38:32	0.01	2.22	915.11	2.08
15:38:47	0.04	2.29	899.04	1.94
15:39:02	0.01	2.55	913.89	1.89
15:39:17	0.03	6.56	826.2	1.93
15:39:32	0.04	6.77	657.95	221.18
15:39:47	0.02	4.86	540.35	81.08
15:40:02	0.01	4.13	518.99	79.17
15:40:17	0.04	3.22	502.51	80.22
15:40:32	0.03	2.51	501.9	79.98
15:40:47	0.01	2.3	515.94	80.09
15:41:02	0.03	2.22	513.9	80.06
15:41:17	0.04	2.3	499.66	80.14
15:41:32	0.02	2.3	515.12	80.22
15:41:47	0.03	2.23	505.15	80.17
15:42:02	0.03	2.19	504.14	80.25
15:42:17	0.01	1.69	513.9	80.36
15:42:32	0.04	1.47	501.29	46.38
15:42:47	0.03	1.33	508.41	42.8
15:43:02	0.01	1.26	517.77	50.52
15:43:17	0.02	1.68	509.22	50.52
15:43:32	0.04	2.4	504.34	50.56
15:43:47	0.04	3.8	424.59	50.58

Koopers
Outlet

Method 3A, 6C, 10 and 25A Data
Cal Error

Project No. 4035

Date
9/12/2012

Time	CO_2 (%)	SO_2 (ppm)	CO (ppm)	THC (ppm)
Zero	0.0	1.3	8.4	1.7
High	9.94	923	910	80.3
Mid	4.91	502	510	50.4
Low	NA	NA	NA	30.4
15:44:02	0.01	7.74	277.49	50.53
15:44:17	0.03	10.71	129.38	50.46
15:44:32	0.03	11.14	112.69	50.57
15:44:47	0.05	9.81	28.06	50.43
15:45:02	0.04	9.12	13.41	50.33
15:45:17	0.06	7.84	5.06	50.43
15:45:32	0.04	7.11	10.76	15.68
15:45:47	0.05	6.32	3.84	13.56
15:46:02	0.04	5.45	13.81	33.36
15:46:17	0.08	4.82	-0.63	30.45
15:46:32	0.07	4.29	17.48	30.6
15:46:47	0.06	4.22	15.64	30.53
15:47:02	0.08	4.21	6.9	30.54
15:47:17	0.09	4.24	2.01	30.46
15:47:32	0.1	4.29	-2.26	30.48
15:47:47	0.08	3.86	10.56	30.35
15:48:02	0.08	3.23	15.24	30.49

Date
9/12/2012

Time	THC-Straight (ppm)		THC-Dilution (ppm)
Average	787	Average	9.35
		Dilution Factor	84.2
15:50:47	785.28	15:59:17	9.54
15:51:02	785.68	15:59:32	9.59
15:51:17	785.87	15:59:47	9.45
15:51:32	785.97	16:00:02	9.5
15:51:47	786.58	16:00:17	9.42
15:52:02	787.22	16:00:32	9.51
15:52:17	787.83	16:00:47	9.47
15:52:32	788.28	16:01:02	9.46
15:52:47	788.37	16:01:17	9.35
15:53:02	788.88	16:01:32	9.41
15:53:17	788.94	16:01:47	9.35
15:53:32	788.82	16:02:02	9.36
15:53:47	788.21	16:02:17	9.42
15:54:02	787.99	16:02:32	9.41
15:54:17	788.27	16:02:47	9.4
15:54:32	788.44	16:03:02	9.35
15:54:47	789.09	16:03:17	8.99
15:55:02	789.42	16:03:32	9.3
15:55:17	788.92	16:03:47	8.89
15:55:32	788.44	16:04:02	8.58
15:55:47	787.49	16:04:17	9.4
15:56:02	786.55	16:04:32	9.41
15:56:17	785.95	16:04:47	9.3
15:56:32	785.72	16:05:02	9.34
15:56:47	785.82	16:05:17	9.45
15:57:02	784.45	16:05:32	9.5
15:57:17	784.82	16:05:47	9.48
15:57:32	785.06	16:06:02	9.22

Date
9/12/2012

Time	CO_2 (%)	SO_2 (ppm)	CO (ppm)	THC (ppm)
Average	7.33	1,709	5,904	50.3
16:42:30	8.44	1197.58	348.31	2.39
16:43:30	8.52	1216.21	283.36	2.01
16:44:30	8.28	1333.62	246.03	1.9
16:45:30	7.33	1779.51	2562.85	93.42
16:46:30	6.67	2724.12	18371.25	240.15
16:47:30	6.38	3071.49	24920.63	234.73
16:48:30	6.32	3229.1	23709.77	198.04
16:49:30	6.33	3195.24	25273.98	183.49
16:50:30	6.35	3257.25	27022.3	205.88
16:51:30	6.17	3204.08	25894.81	170.45
16:52:30	6.07	3170.22	25154.4	230.21
16:53:30	5.34	3073.84	25444.72	338.11
16:54:30	5.64	3202.81	27792.58	204.81
16:55:30	6.31	3277.24	24514.79	99.2
16:56:30	7.56	3021.04	7808.65	8.2
16:57:30	7.23	2437.52	1017.17	5.37
16:58:30	7.16	1846.82	693.98	4.52
16:59:30	7.35	1492.07	547.8	3.85
17:00:30	7.76	1344.31	480.25	3.01
17:01:30	8.17	1314.65	448.26	2.96
17:02:30	8.39	1257.14	345.21	2.64
17:03:30	8.41	1172.5	341.04	2.56
17:04:30	8.38	1132.32	245.11	2.42
17:05:30	8.33	1084.66	252.64	1.95
17:06:30	8.34	1077.31	245.52	2.11
17:07:30	8.26	1057.41	188.6	1.58
17:08:30	8.24	1035.96	155.49	1.45
17:09:30	8.29	1043.23	148.98	1.35
17:10:30	7.03	817.21	150.76	1.35
17:11:30	6.8	680.68	156.76	1.28
17:12:30	6.95	799.94	155.69	1.16
17:13:30	7.08	896.45	130.46	1.14
17:14:30	7.17	936.65	62.21	1.08
17:15:30	7.19	990.46	46.95	1.04
17:16:30	7.26	1021.9	49.24	0.9
17:17:30	7.46	1066.44	47.25	0.84
17:18:30	7.66	1050.42	45.98	0.9
17:19:30	7.73	1036.56	48.47	0.85
17:20:30	7.7	1111.3	46.18	0.73
17:21:30	7.67	1197.61	46.23	0.76
17:22:30	7.66	1277.63	46.08	0.7
17:23:30	7.56	1375.74	47.56	0.73
17:24:30	7.27	1609.02	49.39	0.76
17:25:30	6.92	1857.48	45.27	0.81
17:26:30	6.7	1941.37	45.57	0.79

Date
9/12/2012

Time	CO_2 (%)	SO_2 (ppm)	CO (ppm)	THC (ppm)
Zero	0.1	11.8	1.5	0.7
Upscale	4.80	895	910	82.9
17:30:10	0.09	915.37	7.3	0.71
17:30:25	0.06	902.53	15.24	0.75
17:30:40	0.09	902.39	5.47	0.76
17:30:55	0.09	899.19	7.1	0.77
17:31:10	0.08	892.36	10.76	0.76
17:31:25	0.1	893.09	-0.84	0.71
17:31:40	0.08	893.15	10.35	0.64
17:31:55	0.08	892.6	17.27	0.73
17:32:10	0.08	892.72	9.74	0.7
17:32:25	0.09	902.2	2.83	0.64
17:32:40	0.12	892.32	5.27	0.73
17:32:55	1.13	752.48	1.81	0.68
17:33:10	3.13	455.18	-1.24	0.66
17:33:25	4.13	260.47	0.18	0.72
17:33:40	4.55	166.13	-0.43	0.69
17:33:55	4.67	101.07	-0.84	0.58
17:34:10	4.71	68.05	7.71	0.65
17:34:25	4.7	48.84	15.64	17.45
17:34:40	4.72	34.64	13	6.9
17:34:55	4.74	28.21	-0.22	6.64
17:35:10	4.76	22.84	-0.63	6.63
17:35:25	4.75	19.18	0.59	6.58
17:35:40	4.73	13.42	11.37	6.64
17:35:55	4.73	12.85	14.22	6.69
17:36:10	4.73	12.62	14.42	6.84
17:36:25	4.75	12.4	15.24	6.93
17:36:40	4.75	11.87	6.08	7.05
17:36:55	4.77	12.69	-1.65	5.41
17:37:10	4.76	13.09	7.71	5.52
17:37:25	4.75	12.07	11.78	7.41
17:37:40	4.78	12.52	-0.84	7.48
17:37:55	4.8	13.34	1	7.7
17:38:10	4.78	12.89	11.58	7.81
17:38:25	4.77	12.38	15.44	7.87
17:38:40	4.79	12.07	4.05	5.15
17:38:55	4.79	12.95	7.1	32.3
17:39:10	4.79	12.26	8.12	73.9
17:39:25	4.79	12.89	6.49	699.28
17:39:40	4.79	12.36	5.27	745.48
17:39:55	4.79	12.97	8.73	752.36
17:40:10	4.81	12.14	8.52	611.18
17:40:25	4.7	12.95	0.18	205.68
17:40:40	3.19	19.28	146.06	85.03
17:40:55	1.3	12.18	576.97	83.47
17:41:10	0.47	12.95	767.81	83.16
17:41:25	0.2	12.44	915.52	82.84
17:41:40	0.13	12.26	903.92	82.8
17:41:55	0.09	13.17	905.35	82.73
17:42:10	0.05	12.6	914.5	83.08
17:42:25	0.05	11.95	912.88	83.06
17:42:40	0.05	11.91	908.2	83.32
17:42:55	0.05	11.83	906.16	83.32
17:43:10	0.05	11.81	911.25	84.24

Date
9/12/2012

Time	CO_2 (%)	SO_2 (ppm)	CO (ppm)	THC (ppm)
Zero	0.1	11.8	1.5	0.7
Upscale	4.80	895	910	82.9

17:43:25	0.05	11.71	910.84	85.03
17:43:40	0.05	11.79	910.43	84.02
17:43:55	0.09	11.95	908.4	84.67

Date
9/12/2012

Time	CO_2 (%)	SO_2 (ppm)	CO (ppm)	THC (ppm)
Average	7.61	1,655	2,010	145
18:06:12	7.61	1630.9	46.54	5.53
18:07:12	7.61	1545.27	44.35	47.41
18:08:12	7.62	1461.78	49.03	78.75
18:09:12	7.61	1416.68	51.63	7.03
18:10:12	7.59	1393.99	48.98	5.15
18:11:12	7.59	1393.68	47.05	5.07
18:12:12	7.61	1401.43	45.12	4.23
18:13:12	7.57	1393.86	45.68	4.46
18:14:12	7.56	1401.3	47.3	4.79
18:15:12	7.59	1446.32	45.27	4.38
18:16:12	7.59	1476.16	44.25	4.61
18:17:12	7.56	1429.22	45.73	5.02
18:18:12	7.6	1370.27	44.81	4.18
18:19:12	7.66	1362.99	44.86	5.18
18:20:12	7.74	1405.43	45.42	5.5
18:21:12	7.76	1458.88	45.83	5.4
18:22:12	7.72	1479.2	45.88	5.27
18:23:12	7.7	1481.15	96.59	47.35
18:24:12	7.61	2522.47	9132.83	1614.01
18:25:12	7.28	3422.06	20848.15	1346.36
18:26:12	7.03	3641.14	19884.95	999.2
18:27:12	6.95	3674.89	19086.8	1418.01
18:28:12	6.97	3573.68	16701.51	691.17
18:29:12	7.04	2489.71	1315.43	26.86
18:30:12	6.96	2059.43	449.02	19.59
18:31:12	6.85	1958.55	346.53	15.81
18:32:12	6.82	1731.93	257.37	14.01
18:33:12	7.78	1539.1	245.87	11.67
18:34:12	7.8	1372.02	154.42	10.61
18:35:12	7.86	1296	143.43	9.15
18:36:12	7.89	1258.64	144.66	8.66
18:37:12	7.99	1237.23	143.64	7.84
18:38:12	8.05	1221.87	120.29	6.94
18:39:12	8.06	1218.02	44.35	7.23
18:40:12	7.97	1226.45	45.88	6.87
18:41:12	7.85	1241.72	50.56	6.53
18:42:12	7.81	1268.92	49.24	6.46
18:43:12	7.84	1283.01	45.62	5.84
18:44:12	7.83	1300.55	46.44	5.84
18:45:12	7.8	1317.51	50.3	5.63
18:46:12	7.81	1332.51	42.83	5.39
18:47:12	7.81	1316.24	47.71	5.59
18:48:12	7.82	1318.47	45.93	5.23
18:49:12	7.78	1331.56	48.42	5.34
18:50:12	7.78	1357.63	51.47	5.65

Method 3A, 6C, 10 and 25A Data
Cal 3

Date
9/12/2012

Time	CO_2 (%)	SO_2 (ppm)	CO (ppm)	THC (ppm)
Zero	0.0	12.5	26.7	0.5
Upscale	4.71	912	928	82.9

18:52:32	0.11	77.48	929.27	78.75
18:53:32	0.06	24.77	927.38	85.47
18:54:32	0.06	12.55	926.97	83.24
18:55:32	0.04	12.46	928.25	83.51
18:56:32	2.77	12.56	419.32	82.73
18:57:32	4.66	12.45	45.88	82.3
18:58:32	4.7	12.4	47.51	73.74
18:59:32	4.7	12.68	46.64	4.01
19:00:32	4.7	13.13	47.15	0.44
19:01:32	4.73	12.46	46.85	0.47
19:02:32	3.43	172.22	46.74	0.44
19:03:32	0.2	769.57	32.92	0.44
19:04:32	0.04	892.56	26.74	0.43
19:05:32	0.03	906.02	25.27	0.47
19:06:32	0.03	908.26	25.42	0.45
19:07:32	0.03	912.76	27.86	0.48
19:08:32	0.03	909.41	26.44	0.45
19:09:32	0.14	917.44	27.2	0.62

Date
9/12/2012

Time	CO_2 (%)	SO_2 (ppm)	CO (ppm)	THC (ppm)
Average	6.91	1,749	2,326	97.4
19:51:03	8.2	1379.46	47.51	5.22
19:52:03	8.18	1350.03	47.15	5.5
19:53:03	8.15	1334.49	48.02	4.86
19:54:03	8.1	1304.06	45.98	4.94
19:55:03	8.03	1309.49	45.52	5.2
19:56:03	7.98	1325.42	45.88	5
19:57:03	7.93	1352.3	45.12	5.19
19:58:03	7.88	1391.1	45.88	5.12
19:59:03	7.82	1454.55	46.34	4.98
20:00:03	7.7	1516.33	46.49	4.96
20:01:03	7.5	1595.38	47.2	5.16
20:02:03	7.24	1733.75	45.52	4.69
20:03:03	6.96	1970.76	46.13	5.63
20:04:03	6.77	2293.71	45.32	5.58
20:05:03	6.98	2722.26	45.62	5.87
20:06:03	7.96	3124.4	1548.74	165.84
20:07:03	7.5	3460.36	12775.87	759.4
20:08:03	7.32	3576.1	17421.38	1096.91
20:09:03	7.08	3597.91	20125.94	1053.39
20:10:03	6.88	3597.2	20659.65	669.64
20:11:03	7.02	3550.85	17088.38	309.29
20:12:03	7.95	3461.08	9222.6	83.53
20:13:03	8.11	3232.92	2293.02	18.15
20:14:03	7.16	2729.28	513.16	13.57
20:15:03	6.55	2118.35	363.52	11.37
20:16:03	6.63	1736.53	280.77	9.88
20:17:03	6.28	1472.81	246.18	8.9
20:18:03	4.83	1027.97	196.64	8.01
20:19:03	4.82	843.95	148.06	7.85
20:20:03	4.9	776.06	146.23	6.85
20:21:03	5.02	761.04	147	6.22
20:22:03	5.17	761.83	146.74	6.02
20:23:03	5.3	754.26	113.88	6.13
20:24:03	5.4	759.92	46.44	5.59
20:25:03	5.5	796.88	46.74	5.54
20:26:03	5.72	865.96	48.22	5.27
20:27:03	6.52	934.55	45.68	5.32
20:28:03	6.93	987.29	46.69	5.17
20:29:03	7.02	1052.74	47.2	4.57
20:30:03	7.1	1097.91	46.59	4.5
20:31:03	7.19	1215.2	46.39	5.19
20:32:03	7.21	1320.52	45.57	4.95
20:33:03	7.06	1471.38	45.47	4.93
20:34:03	6.78	1652.2	47	5.5
20:35:03	6.53	1920.48	46.49	5.55

Date
9/12/2012

Time	CO_2 (%)	SO_2 (ppm)	CO (ppm)	THC (ppm)
Zero	0.0	12.1	24.9	0.7
Upscale	4.76	889	929	80.8
20:38:27	0.02	887.27	28.52	74.86
20:38:42	0.02	891.77	27.71	75.76
20:38:57	0.03	893.17	26.29	76.18
20:39:12	0.05	882.98	26.69	76.69
20:39:27	0.97	762.88	30.35	77.14
20:39:42	2.96	422.34	25.88	77.69
20:39:57	4.04	249.2	25.88	77.22
20:40:12	4.43	145.66	26.69	78.16
20:40:27	4.54	93.97	26.9	80.79
20:40:42	4.59	60.96	27.91	80.62
20:40:57	4.73	47.07	26.29	80.79
20:41:12	4.76	31.55	25.27	80.97
20:41:27	4.76	23.14	24.66	78.6
20:41:42	4.77	23	25.06	77.67
20:41:57	4.76	16.96	25.47	316.67
20:42:12	4.75	13.21	24.25	1307.65
20:42:27	4.76	13.6	25.88	396.72
20:42:42	4.76	13.34	29.54	225.88
20:42:57	4.75	12.18	28.12	160.98
20:43:12	4.75	11.75	26.9	120.01
20:43:27	4.77	12.03	25.68	62.76
20:43:42	3.89	15.05	84.68	23.96
20:43:57	1.89	22.92	459.64	13.19
20:44:12	0.67	13.74	746.71	10.96
20:44:27	0.27	13.23	919.04	9.41
20:44:42	0.13	13.38	925.96	8.98
20:44:57	0.07	13.07	926.36	7.62
20:45:12	0.06	12.75	926.57	7.97
20:45:27	0.03	11.91	927.99	1.98
20:45:42	0	11.89	931.04	0.78
20:45:57	0.01	11.97	929.01	0.73
20:46:12	0.01	12.24	929.42	0.71
20:46:27	0.3	12.2	928.4	0.64

Laboratory Data

Analytical Report

Batch # : 121642
September 28, 2012

Prepared for:

James Christ
Phone: (630) 860-4740
Fax: (630) 860-4745

AirTech Environmental Services, Inc.
601A Country Club Drive
Bensenville, IL 60106

Purchase Order No: Verbal

Received Date: September 14, 2012

Disclaimer:

Neither GTI nor any person acting on behalf of GTI assumes any liability with respect to the use of, or for damages resulting from the use of, any information presented in this report.

The results in this report relate only to the items tested.

Submitted by: Karen Crippen, (847) 768-0604
Chemical Research Services

Technical contact for this report: ____________________

Russell J. Bora (847) 768-0693

Analysis of Sulfur Compounds by Gas Chromatography

Client Name: AirTech Environmental Services, Inc.

Date Analyzed: 9/14-28/2012

Sample #	Description	Hydrogen Sulfide ppmv	Carbonyl Sulfide ppmv	Carbon Disulfide ppmv
121642-001	Kop-Inlet-R4-M15	120,000	607	1,760
121642-002	Kop-Inlet-R2-M15	65,300	377	1,536
121642-003	Kop-Inlet-R3-M15	132,000	665	2,340
121642-004	Kop-Outlet-R4-M15	1.76	41.8	0.51
121642-005	Kop-Outlet-R2-M15	0.47	1.39	<0.03
121642-006	Kop-Outlet-R3-M15	1.98	0.09	<0.03

Comments

Analyst: DJ

Gas Technology Institute | 1700 S. Mount Prospect Rd. | Des Plaines, IL 60018 | T: 847 768 0500 | F: 847 768 0501 | www.gastechnology.org

Major Component Analysis by Gas Chromatography

Client Name: AirTech Environmental Services, Inc.

Date Analyzed: 9/17/2012

Sample #	Description	Hydrogen	Carbon Dioxide	Ethene	Ethane	Oxygen / Argon	Nitrogen	Methane	Carbon Monoxide
121642-007	Kop-Inlet-R4-M18	3.6 mol %	1.80 mol %	0.30 mol %	1.31 mol %	13.0 mol %	54.2 mol %	5.44 mol %	0.95 mol %
121642-008	Kop-Inlet-R2-M18	5.1 mol %	2.04 mol %	0.35 mol %	1.79 mol %	11.8 mol %	51.7 mol %	7.00 mol %	1.14 mol %
121642-009	Kop-Inlet-R3-M18	4.3 mol %	2.05 mol %	0.32 mol %	1.62 mol %	12.6 mol %	52.8 mol %	6.53 mol %	1.07 mol %
121642-010	Kop-Outlet-R4-M18	<0.1 mol %	6.23 mol %	<0.03 mol %	<0.03 mol %	10.6 mol %	81.3 mol %	<0.03 mol %	0.12 mol %
121642-011	Kop-Outlet-R2-M18	0.2 mol %	8.55 mol %	<0.03 mol %	<0.03 mol %	6.19 mol %	82.6 mol %	0.20 mol %	0.63 mol %
121642-012	Kop-Outlet-R3-M18	<0.1 mol %	8.71 mol %	<0.03 mol %	<0.03 mol %	6.38 mol %	83.4 mol %	0.03 mol %	0.17 mol %

Analyst: DJ

Gas Technology Institute | 1700 S. Mount Prospect Rd. | Des Plaines, IL 60018 | T: 847 768 0500 | F: 847 768 0501 | www.gastechnology.org

Sample Batch Report

Login #:	121642	**Today's date:**	09/21/2012
Customer:	AIRTECH AirTech Environmental Services, Inc.	**Date Received:**	09/14/2012
Contact:	Kurt Wepprecht	**Date Due:**	09/28/2012
P.O. Number:	4035	**Preferred Report Method:**	Fax

Lab#	Received	Sample ID	Cyl #	Note
121642-001	9/14/2012	Kop-Inlet-R4-M15		H2S, COS, CS2 only
	H2S			
*	SLFRMG			
	ZZZ EVAC			
121642-002	9/14/2012	Kop-Inlet-R2-M15		H2S, COS, CS2 only
	H2S			
*	SLFRMG			
	ZZZ EVAC			
121642-003	9/14/2012	Kop-Inlet-R3-M15		H2S, COS, CS2 only
	H2S			
*	SLFRMG			
	ZZZ EVAC			
121642-004	9/14/2012	Kop-Outet-R4-M15		H2S, COS, CS2 only
*	SLFRTG			
	ZZZ EVAC			
121642-005	9/14/2012	Kop-Outet-R2-M15		H2S, COS, CS2 only
*	SLFRTG			
	ZZZ EVAC			
121642-006	9/14/2012	Kop-Outet-R3-M15		H2S, COS, CS2 only
*	SLFRTG			
	ZZZ EVAC			
121642-007	9/14/2012	Kop-Inlet-R4-M18		
	MAJORGAS			
	ZZZ EVAC			
121642-008	9/14/2012	Kop-Inlet-R2-M18		
	MAJORGAS			
	ZZZ EVAC			
121642-009	9/14/2012	Kop-Inlet-R3-M18		
	MAJORGAS			
	ZZZ EVAC			

Those tests marked with an asterisk fall under this lab's A2LA accreditation, certificate 2139-01.

Gas Technology Institute | 1700 S. Mount Prospect Rd. | Des Plaines, IL 60018 | T: 847 768 0500 | F: 847 768 0501 | www.gastechnology.org

Lab#	Received	Sample ID	Cyl #	Note
121642-010	9/14/2012	Kop-Outlet-R4-M18		
	MAJORGAS			
	ZZZ EVAC			
121642-011	9/14/2012	Kop-Outlet-R2-M18		
	MAJORGAS			
	ZZZ EVAC			
121642-012	9/14/2012	Kop-Outlet-R3-M18		
	MAJORGAS			
	ZZZ EVAC			

Those tests marked with an asterisk fall under this lab's A2LA accreditation, certificate 2139-01.

Page 6 of 7

AIRTECH ENVIRONMENTAL SERVICES INC.
Chain of Custody

Project Number	4035	Location	Tube Furnace Inlet/Outlet
Client	Kopper's Inc.	Date	9/13/12
Plant	Cicero, IL	Completed By	Airtech

Page 1 of 1

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ID No.	Run No.	Date	Sample Description	Cabonyl Sulfide	Hydrogen Sulfide	Carbon Disulfide					Number of Containers	Notes
Kop-Inlet-R4-M15	4	9/12/12	Modified Method 15 Bag Sample	X	X	X					1	
Kop-Inlet-R2-M15	2		Modified Method 15 Bag Sample	X	X	X					1	
Kop-Inlet-R3-M15	3		Modified Method 15 Bag Sample	X	X	X					1	
Kop-Outlet-R4-M15	4		Modified Method 15 Bag Sample	X	X	X					1	
Kop-Outlet-R2-M15	2		Modified Method 15 Bag Sample	X	X	X					1	
Kop-Outlet-R3-M15	3		Modified Method 15 Bag Sample	X	X	X					1	

Relinquished By (signature)	[signature]	Relinquished By (signature)		Carrier	Van
(printed)	Eric Abes	(printed)		Laboratory	
Date/Time	9/13/12 1200	Date/Time		Contact	
Accepted By (signature)	[signature]	Accepted By (signature)		Address	
(printed)		(printed)		Phone	
Date/Time	14 Sept 2012	Date/Time		Fax	
				Date/Time	

AIRTECH Environmental Services Inc.

Airtech Environmental Services Inc.
601A Country Club Drive
Bensenville, IL 60106
Phone: (630) 860-4740, Fax: (630) 860 4745

AIRTECH ENVIRONME... AL SERVICES INC.

Chain of Custody

Project Number	4035	Location	Tube Furnace Inlet/Outlet	Page	1	of	1
Client	Kopper's Inc.	Date	9/13/12				
Plant	Cicero, IL	Completed By	Airtech				

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ID No.	Run No.	Date	Sample Description	Methane	Ethane	Ethylene	Hydrogen	Nitrogen			Number of Containers	Notes
Kop-Inlet-R4-M18	#4	9/12/12	Modified Method 18 Bag Sample	X	X	X	X	X			1	
Kop-Inlet-R2-M18	2		Modified Method 18 Bag Sample	X	X	X	X	X			1	
Kop-Inlet-R3-M18	3		Modified Method 18 Bag Sample	X	X	X	X	X			1	
Kop-Outlet-R4-M18	#4		Modified Method 18 Bag Sample	X	X	X	X	X			1	
Kop-Outlet-R2-M18	2		Modified Method 18 Bag Sample	X	X	X	X	X			1	
Kop-Outlet-R3-M18	3		Modified Method 18 Bag Sample	X	X	X	X	X			1	

Relinquished By		Relinquished By		Carrier	Van
(signature)	[signature]	(signature)		Laboratory	
(printed)	Eric Abas	(printed)		Contact	
Date/Time	9/13/12 1200	Date/Time		Address	
Accepted By		Accepted By			
(signature)	[signature]	(signature)		Phone	
(printed)		(printed)		Fax	
Date/Time	14 Sept 2012	Date/Time		Date/Time	

AIRTECH Environmental Services Inc.

Airtech Environmental Services Inc.
601A Country Club Drive
Bensenville, IL 60106
Phone: (630) 860-4740, Fax: (630) 860 4745

AIRTECH ENVIRONMENTAL SERVICES INC.
Chain of Custody

Project Number	4035	Location	Tube Furnace Inlet/Outlet	Page 1 of 1
Client	Kopper's Inc.	Date	9/13/12	
Plant	Cicero, IL	Completed By	Airtech	

15

ID No.	Run No.	Date	Sample Description	Cabonyl Sulfide	Hydrogen Sulfide	Carbon Disulfide					Number of Containers	Notes
Kop-Inlet-R4-M15	4	9/12/12	Modified Method 15 Bag Sample	X	X	X					1	
Kop-Inlet-R2-M15	2	↓	Modified Method 15 Bag Sample	X	X	X					1	
Kop-Inlet-R3-M15	3	↓	Modified Method 15 Bag Sample	X	X	X					1	
Kop-Outlet-R4-M15	4	↓	Modified Method 15 Bag Sample	X	X	X					1	
Kop-Outlet-R2-M15	2	↓	Modified Method 15 Bag Sample	X	X	X					1	
Kop-Outlet-R3-M15	3	↓	Modified Method 15 Bag Sample	X	X	X					1	

Relinquished By		Relinquished By		Carrier	Van
(signature)	[signature]	(signature)		Laboratory	
(printed)	Eric Abas	(printed)		Contact	
Date/Time	9/13/12 1200	Date/Time		Address	
Accepted By		Accepted By			
(signature)	[signature]	(signature)		Phone	
(printed)		(printed)		Fax	
Date/Time	14 Sept 2012	Date/Time		Date/Time	

AIRTECH Environmental Services Inc.

Airtech Environmental Services Inc.
601A Country Club Drive
Bensenville, IL 60106
Phone: (630) 860-4740, Fax: (630) 860 4745

AIRTECH ENVIRONMENTAL SERVICES INC.
Chain of Custody

Project Number	4035	Location	Tube Furnace Inlet/Outlet	Page	1	of	1
Client	Kopper's Inc.	Date	9/13/12				
Plant	Cicero, IL	Completed By	Airtech				

18

ID No	Run No.	Date	Sample Description	Methane	Ethane	Ethylene	Hydrogen	Nitrogen			Number of Containers	Notes
Kop-Inlet-R1-M18	#4	9/11/12	Modified Method 18 Bag Sample	X	X	X	X	X			1	
Kop-Inlet-R2-M18	2		Modified Method 18 Bag Sample	X	X	X	X	X			1	
Kop-Inlet-R3-M18	3		Modified Method 18 Bag Sample	X	X	X	X	X			1	
Kop-Outlet-R1-M18	#4		Modified Method 18 Bag Sample	X	X	X	X	X			1	
Kop-Outlet-R2-M18	2		Modified Method 18 Bag Sample	X	X	X	X	X			1	
Kop-Outlet-R3-M18	3		Modified Method 18 Bag Sample	X	X	X	X	X			1	

Relinquished By		Relinquished By		Carrier	Van
(signature)	[signature]	(signature)		Laboratory	
(printed)	Eric Abels	(printed)		Contact	
Date/Time	9/13/12 1200	Date/Time		Address	
Accepted By		Accepted By			
(signature)	[signature]	(signature)		Phone	
(printed)		(printed)		Fax	
Date/Time	14 Sept 2012	Date/Time		Date/Time	

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AIRTECH ENVIRONMENTAL SERVICES INC.
Chain of Custody

Project Number	4035	Location	Tube Furnace Inlet/Outlet	Page 1 of 1
Client	Kopper's Inc.	Date	9/14/12	
Plant	Cicero, IL	Completed By	Airtech	

18

ID No.	Run No.	Date	Sample Description	Benzene	Toluene	Xylene	Styrene	Indan	Indene	Naphthalene	Number of Containers	Notes
Kop-Inlet-R4-M18	4	9/12/12	Three SKC Charcoal tubes Train A	X	X	X	X	X	X	X	1	
Kop-Inlet-R4-M18	4	↓	Four SKC Charcoal tubes Train B	X	X	X	X	X	X	X	1	
Kop-Inlet-R2-M18	2		Four SKC Charcoal tubes Train A	X	X	X	X	X	X	X	1	
Kop-Inlet-R2-M18	2		Four SKC Charcoal tubes Train B	X	X	X	X	X	X	X	1	
Kop-Inlet-R3-M18	3		Four SKC Charcoal tubes Train A	X	X	X	X	X	X	X	1	
Kop-Inlet-R3-M18	3		Four SKC Charcoal tubes Train B	X	X	X	X	X	X	X	1	
Kop-Outlet-R4-M18	4		Four SKC Charcoal tubes Un-spiked	X	X	X	X	X	X	X	1	
Kop-Outlet-R4-M18	4		Four SKC Charcoal tubes spiked	X	X	X	X	X	X	X	1	
Kop-Outlet-R2-M18	2		Four SKC Charcoal tubes Un-spiked	X	X	X	X	X	X	X	1	
Kop-Outlet-R2-M18	2		Four SKC Charcoal tubes spiked	X	X	X	X	X	X	X	1	
Kop-Outlet-R3-M18	3	↓	Four SKC Charcoal tubes Un-spiked	X	X	X	X	X	X	X	1	
Kop-Outlet-R3-M18	3		Four SKC Charcoal tubes spiked	X	X	X	X	X	X	X	1	
Kop-[illegible]-R1-M18	1		″	✓	✓	✓	✓	✓	✓	✓	1	
Kop-[illegible]-R1-M18	1	↓	″	✓	✓	✓	✓	✓	✓	✓	1	

Relinquished By		Relinquished By		Carrier	Van
(signature)	[signature]	(signature)	[signature]	Laboratory	
(printed)	Eric Alonzo	(printed)	J. McGhie	Contact	
Date/Time	9/13/12 1200	Date/Time	9/14/12	Address	
Accepted By		Accepted By			
(signature)	[signature]	(signature)		Phone	
(printed)	J. McGhie	(printed)		Fax	
Date/Time	9/14/12	Date/Time		Date/Time	

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AIRTECH
Environmental
Services Inc.

Gas Chromatography Analytical Report

Performed for
Kopper's Inc.
Project No. 4035
October 25, 2012

Analyst: Michael Ogletree

Reviewer: Patrick Clark P.E.

702 WEST 48TH AVENUE, UNIT J - DENVER, COLORADO - TEL: 303.670.0530 - FAX: 303.670.4130

Table of Contents

Project Summary

General

Project Information	
Date Received	9/17/2012
Analytical Protocol	EPA Method 18
Total Number of Samples Received	12
Total Number of Blanks Received	NA

Analytical Equipment

Equipment Information	Manufacturer	Model
Gas Chromatograph	Hewlett Packard	5890 Series II
Analytical Column	Alltech	AT-1

Parameters	Conditions
Carrier Gas	Zero Helium
Sample Volume	0.4 µl
Sample Media	Carbon Tubes
Injection	10 µl syringe
Column Head Pressure	55 PSI

Condition of Samples When Received

Samples were received for analysis in good condition. The samples are summarized in the table below.

Run No.	Sample ID (COC)	Sample ID (Lab)
Run 2	Kop-Inlet-R2-M18	R2 Inlet A
Run 2	Kop-Inlet-R2-M18	R2 Inlet B
Run 2	Kop-Outlet-R2-M18	R2 Outlet Spiked
Run 2	Kop-Outlet-R2-M18	R2 Outlet Unspiked
Run 3	Kop-Inlet-R3-M18	R3 Inlet A
Run 3	Kop-Inlet-R3-M18	R3 Inlet B
Run 3	Kop-Outlet-R3-M18	R3 Outlet Spiked
Run 3	Kop-Outlet-R3-M18	R3 Outlet Unspiked
Run 4	Kop-Inlet-R4-M18	R4 Inlet A
Run 4	Kop-Inlet-R4-M18	R4 Inlet B
Run 4	Kop-Outlet-R4-M18	R4 Outlet Spiked
Run 4	Kop-Outlet-R4-M18	R4 Outlet Unspiked

Methodology

All samples were analyzed according to the EPA Method 18 procedures found in 40 CFR Part 60 Appendix A.

QA/QC

All sample analysis was performed in duplicate. Extractions were completed by combining front and back half of each charcoal tube in a ten (10) ml borosilicate vial, then adding two (2) ml of carbon disulfide. Each vial was shaken periodically for one (1) hour.

All standards were generated by diluting concentrated solutions of 98% or greater for each target compound: benzene, toluene, ethylbenzene, meta-xylenes, ortho-xylene, para-xylene, styrene, indan, indene, and naphthalene.

Naphthalene was received as a solid and dissolved in carbon disulfide. 5.0131g of crystalline naphthalene was measured with an analytical scale and added to a 100ml volumetric flask. Carbon disulfide was then added to the flask, filling to the mark. This solution yielded a concentration of 50,131 μg/ml.

The high indene standard was made by filling a 50 ml volumetric flask with 25 ml carbon disulfide. 37 μl was then added to the flask using a 100 μl syringe. The flask was then filled to the mark with carbon disulfide yielding a concentration of 703 μg/ml.

Exact percentage concentrations used to prepare standards and standard dilution ratios are shown in the table below:

			Low 5 μl in 100 ml	Mid 25 μl in 50 ml	High 50 μl in 50 ml	High 500 μl in 50 ml	High 1000 μl in 50 ml
	Purity	Conc. (μg/ml)	Conc. (μg/ml)	Conc. (μg/ml)	Conc (μg/ml)	Conc. (μg/ml)	Conc. (μg/ml)
Benzene	99.9%	875,624	*43.8*	*438*	*876*	*8756*	*17512*
Toluene	99.9%	869,130	*43.5*	*435*	*869*	*8691*	*17383*
Ethylbenzene	99.8%	864,767	*43.2*	*432*	*865*	*8648*	*17295*
m Xylene	99%	851,400	*42.6*	*426*	*851*	*8514*	*17028*
p Xylene	99%	851,400	*42.6*	*426*	*851*	*8514*	*17028*
o Xylene	98%	862,400	*43.1*	*431*	*862*	*8624*	*17248*
Styrene	99%	899,910	*45.0*	*450*	*900*	*8999*	*17998*
Indan	95%	916,750	*45.8*	*458*	*917*	*9168*	*18335*
Indene	95%	946,200	*47.3*	*473*	*700*		
Napthalene	-	50,131	*50.1*	*501*	*1003*		

Naphthalene Dilution ration	*100 mls*	*50 mls*	*50 mls*
Volume Naphthalene	*0.1 mls*	*0.5 mls*	*1.0 mls*

*Indene was prepared as described above.

AIRTECH Environmental Services Inc.

Appendix

Includes the following:

- **Results**
- **Calibration Data**
- **Raw Data**
- **Chain of Custody**

Results

Includes the following:

- **BTEXSIIN Results**

AIRTECH Environmental Services Inc.

BENZENE ANALYSIS

Sample Parameters	R2 Inlet A F1/2	R2 Inlet A B1/2	R2 Inlet B F1/2	R2 Inlet B B1/2
Volume (ml)	2	2	2	2
Dilution factor	1	1	1	1
Peak Area # 1	74,691,300	56,060,200	91,425,000	74,741,400
Peak Area # 2	82,246,900	56,817,600	91,566,400	68,462,900
Average	78,469,100	56,438,900	91,495,700	71,602,000
Injections % of mean	4.8%	0.7%	0.1%	4.4%

RESULTS

Average Response Factor				
Linear Regression	x	x	x	x
Benzene (µg/ml)	17,257	12,453	20,097	15,759
Benzene (mg)	34.5	24.9	40.2	31.5

TOLUENE ANALYSIS

Sample Parameters	R2 Inlet A F1/2	R2 Inlet A B1/2	R2 Inlet B F1/2	R2 Inlet B B1/2
Volume (ml)	2	2	2	2
Dilution factor	1	1	1	1
Peak Area # 1	61,817,100	22,736,500	77,854,800	19,782,400
Peak Area # 2	67,928,300	22,930,000	78,195,200	18,418,000
Average	64,872,700	22,833,250	78,025,000	19,100,200
Injections % of mean	4.7%	0.4%	0.2%	3.6%

RESULTS

Average Response Factor				
Linear Regression	x	x	x	x
Toluene (µg/ml)	15,683	5,582	18,844	4,685
Toluene (mg)	31.4	11.2	37.7	9.37

ETHYLBENZENE ANALYSIS

Sample Parameters	R2 Inlet A F1/2	R2 Inlet A B1/2	R2 Inlet B F1/2	R2 Inlet B B1/2
Volume (ml)	2	2	2	2
Dilution factor	1	1	1	1
Peak Area # 1	4,787,200	821,007	7,157,050	343,375
Peak Area # 2	5,233,770	848,265	7,199,240	274,721
Average	5,010,485	834,636	7,178,145	309,048
Injections % of mean	4.5%	1.6%	0.3%	11.1%

RESULTS

Average Response Factor				x
Linear Regression	x	x	x	
Ethylbenzene (µg/ml)	1,398	282	1,977	91.4
Ethylbenzene (mg)	2.80	0.563	3.95	0.183

XYLENE M/P ANALYSIS

Sample Parameters	R2 Inlet A F1/2	R2 Inlet A B1/2	R2 Inlet B F1/2	R2 Inlet B B1/2
Volume (ml)	2	2	2	2
Dilution factor	1	1	1	1
Peak Area # 1	17,930,200	2,938,540	25,587,100	1,005,810
Peak Area # 2	19,383,700	2,939,680	25,730,200	738,528
Average	**18,656,950**	**2,939,110**	**25,658,650**	**872,170**
Injections % of mean	3.9%	0.0%	0.3%	15.3%

RESULTS

Average Response Factor				
Linear Regression	x	x	x	x
Xylene m/p (µg/ml)	4,563	853	6,216	365
Xylene m/p (mg)	9.13	1.71	12.4	0 730

XYLENE O ANALYSIS

Sample Parameters	R2 Inlet A F1/2	R2 Inlet A B1/2	R2 Inlet B F1/2	R2 Inlet B B1/2
Volume (ml)	2	2	2	2
Dilution factor	1	1	1	1
Peak Area # 1	1,463,580	250,614	3,844,800	43,942
Peak Area # 2	1,648,190	270,759	3,879,380	20,601
Average	**1,555,885**	**260,687**	**3,862,090**	**32,271**
Injections % of mean	5.9%	3.9%	0.4%	36 2%

RESULTS

Average Response Factor				x
Linear Regression	x	x	x	
Xylene o (µg/ml)	533	215	1,100	9 82
Xylene o (mg)	1.07	0.429	2.20	0.0196

STYRENE ANALYSIS

Sample Parameters	R2 Inlet A F1/2	R2 Inlet A B1/2	R2 Inlet B F1/2	R2 Inlet B B1/2
Volume (ml)	2	2	2	2
Dilution factor	1	1	1	1
Peak Area # 1	3,398,930	480,306	4,932,290	118,199
Peak Area # 2	3,658,860	466,507	4,978,330	78,528
Average	**3,528,895**	**473,407**	**4,955,310**	**98,363**
Injections % of mean	3.7%	1 5%	0.5%	20.2%

RESULTS

Average Response Factor	x	x		x
Linear Regression			x	
Styrene (µg/ml)	878	118	1,236	24.5
Styrene (mg)	1.76	0.236	2.47	0.0490

INDANE ANALYSIS

Sample Parameters	R2 Inlet A F1/2	R2 Inlet A B1/2	R2 Inlet B F1/2	R2 Inlet B B1/2
Volume (ml)	2	2	2	2
Dilution factor	1	1	1	1
Peak Area # 1	116,901	21,902	261,462	0
Peak Area # 2	136,499	23,514	249,724	0
Average	126,700	22,708	255,593	0
Injections % of mean	7.7%	3.5%	2.3%	NA

RESULTS

Average Response Factor	x	x	x	x
Linear Regression				
Indane (µg/ml)	33.5	6.00	67.6	0
Indane (mg)	0.0669	0.0120	0.135	0

INDENE ANALYSIS

Sample Parameters	R2 Inlet A F1/2	R2 Inlet A B1/2	R2 Inlet B F1/2	R2 Inlet B B1/2
Volume (ml)	2	2	2	2
Dilution factor	1	1	1	1
Peak Area # 1	222,192	30,057	409,074	0
Peak Area # 2	249,504	30,808	407,606	0
Average	235,848	30,433	408,340	0
Injections % of mean	5.8%	1.2%	0.2%	NA

RESULTS

Average Response Factor		x		x
Linear Regression	x		x	
Indene (µg/ml)	89.4	11.9	143	0
Indene (mg)	0.179	0.0238	0.286	0

NAPHTHALENE ANALYSIS

Sample Parameters	R2 Inlet A F1/2	R2 Inlet A B1/2	R2 Inlet B F1/2	R2 Inlet B B1/2
Volume (ml)	2	2	2	2
Dilution factor	1	1	1	1
Peak Area # 1	108,223	0	30,234	0
Peak Area # 2	125,366	0	15,724	0
Average	116,795	0	22,979	0
Injections % of mean	7.3%	NA	31.6%	NA

RESULTS

Average Response Factor	x	x	x	x
Linear Regression				
Naphthalene (µg/ml)	33.3	0	6.56	0
Naphthalene (mg)	0.0667	0	0.0131	0

BENZENE ANALYSIS

Sample Parameters	R2 Outlet F1/2 Spiked	R2 Outlet B1/2 Spiked	R2 Outlet F1/2 unspiked	R2 Outlet B1/2 unspiked
Volume (ml)	2	2	2	2
Dilution factor	1	1	1	1
Peak Area # 1	1,327,650	553,622	1,369,110	414,770
Peak Area # 2	1,398,760	549,284	1,360,190	413,961
Average	1,363,205	551,453	1,364,650	414,366
Injections % of mean	2.6%	0.4%	0.3%	0.1%

RESULTS

Average Response Factor		x		x
Linear Regression	x		x	
Benzene (µg/ml)	444	138	444	104
Benzene (mg)	0.888	0.276	0.889	0.207

TOLUENE ANALYSIS

Sample Parameters	R2 Outlet F1/2 Spiked	R2 Outlet B1/2 Spiked	R2 Outlet F1/2 unspiked	R2 Outlet B1/2 unspiked
Volume (ml)	2	2	2	2
Dilution factor	1	1	1	1
Peak Area # 1	472,532	250,266	469,381	141,915
Peak Area # 2	497,756	250,607	465,539	141,871
Average	485,144	250,437	467,460	141,893
Injections % of mean	2.6%	0.1%	0.4%	0.0%

RESULTS

Average Response Factor				x
Linear Regression	x	x	x	
Toluene (µg/ml)	212	156	208	40.5
Toluene (mg)	0.425	0.312	0.416	0.0811

ETHYLBENZENE ANALYSIS

Sample Parameters	R2 Outlet F1/2 Spiked	R2 Outlet B1/2 Spiked	R2 Outlet F1/2 unspiked	R2 Outlet B1/2 unspiked
Volume (ml)	2	2	2	2
Dilution factor	1	1	1	1
Peak Area # 1	19,915	103,358	20,317	5,466
Peak Area # 2	20,821	101,293	19,819	5,492
Average	20,368	102,326	20,068	5,479
Injections % of mean	2.2%	1.0%	1.2%	0.2%

RESULTS

Average Response Factor	x	x	x	x
Linear Regression				
Ethylbenzene (µg/ml)	6.02	30.3	5.94	1.62
Ethylbenzene (mg)	0.0120	0.0605	0.0119	0.00324

XYLENE M/P ANALYSIS

Sample Parameters	R2 Outlet F1/2 Spiked	R2 Outlet B1/2 Spiked	R2 Outlet F1/2 unspiked	R2 Outlet B1/2 unspiked
Volume (ml)	2	2	2	2
Dilution factor	1	1	1	1
Peak Area # 1	47,923	217,109	48,940	13,271
Peak Area # 2	51,033	215,602	48,830	13,309
Average	**49,478**	**216,356**	**48,885**	**13,290**
Injections % of mean	3.1%	0.3%	0.1%	0.1%

RESULTS

Average Response Factor	x	x	x	x
Linear Regression				
Xylene m/p (µg/ml)	13.7	60.0	13.5	3.68
Xylene m/p (mg)	0.0274	0.120	0.0271	0.00737

XYLENE O ANALYSIS

Sample Parameters	R2 Outlet F1/2 Spiked	R2 Outlet B1/2 Spiked	R2 Outlet F1/2 unspiked	R2 Outlet B1/2 unspiked
Volume (ml)	2	2	2	2
Dilution factor	1	1	1	1
Peak Area # 1	4,655	80,001	0	0
Peak Area # 2	5,212	74,938	0	0
Average	**4,933**	**77,469**	**0**	**0**
Injections % of mean	5.6%	3.3%	NA	NA

RESULTS

Average Response Factor	x	x	x	x
Linear Regression				
Xylene o (µg/ml)	1.50	23.6	0	0
Xylene o (mg)	0.00300	0.0471	0	0

STYRENE ANALYSIS

Sample Parameters	R2 Outlet F1/2 Spiked	R2 Outlet B1/2 Spiked	R2 Outlet F1/2 unspiked	R2 Outlet B1/2 unspiked
Volume (ml)	2	2	2	2
Dilution factor	1	1	1	1
Peak Area # 1	4,567	107,491	0	0
Peak Area # 2	5,520	108,682	0	0
Average	**5,043**	**108,087**	**0**	**0**
Injections % of mean	9.4%	0.6%	NA	NA

RESULTS

Average Response Factor	x	x	x	x
Linear Regression				
Styrene (µg/ml)	1.25	26.9	0	0
Styrene (mg)	0.00251	0.0538	0	0

INDANE ANALYSIS

Sample Parameters	R2 Outlet F1/2 Spiked	R2 Outlet B1/2 Spiked	R2 Outlet F1/2 unspiked	R2 Outlet B1/2 unspiked
Volume (ml)	2	2	2	2
Dilution factor	1	1	1	1
Peak Area # 1	0	0	0	0
Peak Area # 2	0	0	0	0
Average	0	0	0	0
Injections % of mean	NA	NA	NA	NA

RESULTS

Average Response Factor	x	x	x	x
Linear Regression				
Indane (µg/ml)	0	0	0	0
Indane (mg)	0	0	0	0

INDENE ANALYSIS

Sample Parameters	R2 Outlet F1/2 Spiked	R2 Outlet B1/2 Spiked	R2 Outlet F1/2 unspiked	R2 Outlet B1/2 unspiked
Volume (ml)	2	2	2	2
Dilution factor	1	1	1	1
Peak Area # 1	0	0	0	0
Peak Area # 2	0	0	0	0
Average	0	0	0	0
Injections % of mean	NA	NA	NA	NA

RESULTS

Average Response Factor	x	x	x	x
Linear Regression				
Indene (µg/ml)	0	0	0	0
Indene (mg)	0	0	0	0

NAPHTHALENE ANALYSIS

Sample Parameters	R2 Outlet F1/2 Spiked	R2 Outlet B1/2 Spiked	R2 Outlet F1/2 unspiked	R2 Outlet B1/2 unspiked
Volume (ml)	2	2	2	2
Dilution factor	1	1	1	1
Peak Area # 1	42,432	0	0	0
Peak Area # 2	23,567	0	0	0
Average	33,000	0	0	0
Injections % of mean	28.6%	NA	NA	NA

RESULTS

Average Response Factor	x	x	x	x
Linear Regression				
Naphthalene (µg/ml)	9.42	0	0	0
Naphthalene (mg)	0.0188	0	0	0

BENZENE ANALYSIS

Sample Parameters	R3 Inlet A F1/2	R3 Inlet A B1/2	R3 Inlet B F1/2	R3 Inlet B B1/2
Volume (ml)	2	2	2	2
Dilution factor	1	1	1	1
Peak Area # 1	157,466,000	60,313,400	191,327,000	22,712,900
Peak Area # 2	160,885,000	59,565,000	184,792,000	23,105,600
Average	**159,175,500**	**59,939,200**	**188,059,500**	**22,909,250**
Injections % of mean	1.1%	0.6%	1.7%	0.9%

RESULTS

Average Response Factor				
Linear Regression	x	x	x	x
Benzene (µg/ml)	34,855	13,216	41,153	5,142
Benzene (mg)	69.7	26.4	82.3	10.3

TOLUENE ANALYSIS

Sample Parameters	R3 Inlet A F1/2	R3 Inlet A B1/2	R3 Inlet B F1/2	R3 Inlet B B1/2
Volume (ml)	2	2	2	2
Dilution factor	1	1	1	1
Peak Area # 1	75,942,000	12,079,300	91,458,700	25,544,400
Peak Area # 2	78,430,200	12,089,300	89,309,000	26,039,300
Average	**77,186,100**	**12,084,300**	**90,383,850**	**25,791,850**
Injections % of mean	1.6%	0.0%	1.2%	1.0%

RESULTS

Average Response Factor				
Linear Regression	x	x	x	x
Toluene (µg/ml)	18,642	2,999	21,813	6,293
Toluene (mg)	37.3	6.00	43.6	12.6

ETHYLBENZENE ANALYSIS

Sample Parameters	R3 Inlet A F1/2	R3 Inlet A B1/2	R3 Inlet B F1/2	R3 Inlet B B1/2
Volume (ml)	2	2	2	2
Dilution factor	1	1	1	1
Peak Area # 1	8,066,960	219,436	4,653,330	4,685,290
Peak Area # 2	8,331,290	220,693	4,593,820	4,739,850
Average	**8,199,125**	**220,065**	**4,623,575**	**4,712,570**
Injections % of mean	1.6%	0.3%	0.6%	0.6%

RESULTS

Average Response Factor				
Linear Regression	x	x	x	x
Ethylbenzene (µg/ml)	2,250	117	1,294	1,318
Ethylbenzene (mg)	4.50	0.235	2.59	2.64

XYLENE M/P ANALYSIS

Sample Parameters	R3 Inlet A F1/2	R3 Inlet A B1/2	R3 Inlet B F1/2	R3 Inlet B B1/2
Volume (ml)	2	2	2	2
Dilution factor	1	1	1	1
Peak Area # 1	26,375,900	193,907	9,280,790	19,000,600
Peak Area # 2	27,196,700	175,851	9,145,570	19,349,600
Average	**26,786,300**	**184,879**	**9,213,180**	**19,175,100**
Injections % of mean	1.5%	4.9%	0.7%	0.9%

RESULTS

Average Response Factor		x		
Linear Regression	x		x	x
Xylene m/p (µg/ml)	6,483	51.2	2,334	4,686
Xylene m/p (mg)	13.0	0.102	4.67	9.37

XYLENE O ANALYSIS

Sample Parameters	R3 Inlet A F1/2	R3 Inlet A B1/2	R3 Inlet B F1/2	R3 Inlet B B1/2
Volume (ml)	2	2	2	2
Dilution factor	1	1	1	1
Peak Area # 1	4,937,710	0	458,687	5,182,520
Peak Area # 2	5,080,610	0	578,828	5,270,010
Average	**5,009,160**	**0**	**518,758**	**5,226,265**
Injections % of mean	1.4%	NA	11.6%	0.8%

RESULTS

Average Response Factor		x		
Linear Regression	x		x	x
Xylene o (µg/ml)	1,382	0	278	1,435
Xylene o (mg)	2.76	0	0.556	2.87

STYRENE ANALYSIS

Sample Parameters	R3 Inlet A F1/2	R3 Inlet A B1/2	R3 Inlet B F1/2	R3 Inlet B B1/2
Volume (ml)	2	2	2	2
Dilution factor	1	1	1	1
Peak Area # 1	5,345,050	0	1,069,610	4,787,960
Peak Area # 2	5,490,710	0	1,057,280	4,883,660
Average	**5,417,880**	**0**	**1,063,445**	**4,835,815**
Injections % of mean	1.3%	NA	0.6%	1.0%

RESULTS

Average Response Factor		x		
Linear Regression	x		x	x
Styrene (µg/ml)	1,354	0	242	1,205
Styrene (mg)	2.71	0	0.483	2.41

INDANE ANALYSIS

Sample Parameters	R3 Inlet A F1/2	R3 Inlet A B1/2	R3 Inlet B F1/2	R3 Inlet B B1/2
Volume (ml)	2	2	2	2
Dilution factor	1	1	1	1
Peak Area # 1	753,118	0	0	1,178,830
Peak Area # 2	776,684	0	0	1,188,930
Average	**764,901**	**0**	**0**	**1,183,880**
Injections % of mean	1.5%	NA	NA	0.4%

RESULTS

Average Response Factor		x	x	
Linear Regression	x			x
Indane (µg/ml)	265	0	0	367
Indane (mg)	0.531	0	0	0.735

INDENE ANALYSIS

Sample Parameters	R3 Inlet A F1/2	R3 Inlet A B1/2	R3 Inlet B F1/2	R3 Inlet B B1/2
Volume (ml)	2	2	2	2
Dilution factor	1	1	1	1
Peak Area # 1	1,314,500	0	0	2,803,280
Peak Area # 2	1,348,000	0	0	2,880,070
Average	**1,331,250**	**0**	**0**	**2,841,675**
Injections % of mean	1.3%	NA	NA	1.4%

RESULTS

Average Response Factor		x	x	
Linear Regression	x			x
Indene (µg/ml)	431	0	0	901
Indene (mg)	0.862	0	0	1.80

NAPHTHALENE ANALYSIS

Sample Parameters	R3 Inlet A F1/2	R3 Inlet A B1/2	R3 Inlet B F1/2	R3 Inlet B B1/2
Volume (ml)	2	2	2	2
Dilution factor	1	1	1	1
Peak Area # 1	26,299	0	0	174,174
Peak Area # 2	27,609	0	0	175,830
Average	**26,954**	**0**	**0**	**175,002**
Injections % of mean	2.4%	NA	NA	0.5%

RESULTS

Average Response Factor	x	x	x	x
Linear Regression				
Naphthalene (µg/ml)	7.70	0	0	50.0
Naphthalene (mg)	0.0154	0	0	0.100

BENZENE ANALYSIS

Sample Parameters	R3 Outlet F1/2 Spiked	R3 Outlet B1/2 Spiked	R3 Outlet F1/2 unspiked	R3 Outlet B1/2 unspiked
Volume (ml)	2	2	2	2
Dilution factor	1	1	1	1
Peak Area # 1	1,679,940	387,432	1,258,270	431,145
Peak Area # 2	1,578,760	386,367	1,323,360	403,182
Average	1,629,350	386,900	1,290,815	417,164
Injections % of mean	3.1%	0.1%	2.6%	3.4%

RESULTS

Average Response Factor				
Linear Regression	x	x	x	x
Benzene (µg/ml)	502	231	428	238
Benzene (mg)	1.00	0.462	0.857	0 476

TOLUENE ANALYSIS

Sample Parameters	R3 Outlet F1/2 Spiked	R3 Outlet B1/2 Spiked	R3 Outlet F1/2 unspiked	R3 Outlet B1/2 unspiked
Volume (ml)	2	2	2	2
Dilution factor	1	1	1	1
Peak Area # 1	678,791	104,244	389,677	121,167
Peak Area # 2	566,733	103,560	409,056	115,793
Average	622,762	103,902	399,367	118,480
Injections % of mean	9.0%	0.3%	2.4%	2.3%

RESULTS

Average Response Factor		x		x
Linear Regression	x		x	
Toluene (µg/ml)	245	29.7	192	33.8
Toluene (mg)	0.491	0.0594	0.383	0.0677

ETHYLBENZENE ANALYSIS

Sample Parameters	R3 Outlet F1/2 Spiked	R3 Outlet B1/2 Spiked	R3 Outlet F1/2 unspiked	R3 Outlet B1/2 unspiked
Volume (ml)	2	2	2	2
Dilution factor	1	1	1	1
Peak Area # 1	43,404	4,498	15,418	4,956
Peak Area # 2	23,889	4,397	16,246	4,697
Average	33,646	4,448	15,832	4,826
Injections % of mean	29.0%	1.1%	2.6%	2.7%

RESULTS

Average Response Factor	x	x	x	x
Linear Regression				
Ethylbenzene (µg/ml)	10 0	1 32	4.68	1 43
Ethylbenzene (mg)	0.0199	0.00263	0.00937	0.00286

XYLENE M/P ANALYSIS

Sample Parameters	R3 Outlet F1/2 Spiked	R3 Outlet B1/2 Spiked	R3 Outlet F1/2 unspiked	R3 Outlet B1/2 unspiked
Volume (ml)	2	2	2	2
Dilution factor	1	1	1	1
Peak Area # 1	139,054	11,273	39,615	13,015
Peak Area # 2	59,338	11,412	42,011	11,848
Average	99,196	11,342	40,813	12,431
Injections % of mean	40.2%	0.6%	2.9%	4.7%

RESULTS

Average Response Factor	x	x	x	x
Linear Regression				
Xylene m/p (µg/ml)	27.5	3.14	11.3	3.44
Xylene m/p (mg)	0.0550	0.00629	0.0226	0.00689

XYLENE O ANALYSIS

Sample Parameters	R3 Outlet F1/2 Spiked	R3 Outlet B1/2 Spiked	R3 Outlet F1/2 unspiked	R3 Outlet B1/2 unspiked
Volume (ml)	2	2	2	2
Dilution factor	1	1	1	1
Peak Area # 1	21,945	0	0	0
Peak Area # 2	3,470	0	0	0
Average	12,707	0	0	0
Injections % of mean	72.7%	NA	NA	NA

RESULTS

Average Response Factor	x	x	x	x
Linear Regression				
Xylene o (µg/ml)	3.87	0	0	0
Xylene o (mg)	0.00773	0	0	0

STYRENE ANALYSIS

Sample Parameters	R3 Outlet F1/2 Spiked	R3 Outlet B1/2 Spiked	R3 Outlet F1/2 unspiked	R3 Outlet B1/2 unspiked
Volume (ml)	2	2	2	2
Dilution factor	1	1	1	1
Peak Area # 1	25,162	0	0	0
Peak Area # 2	4,828	0	0	0
Average	14,995	0	0	0
Injections % of mean	67.8%	NA	NA	NA

RESULTS

Average Response Factor	x	x	x	x
Linear Regression				
Styrene (µg/ml)	3.73	0	0	0
Styrene (mg)	0.00746	0	0	0

INDANE ANALYSIS

Sample Parameters	R3 Outlet F1/2 Spiked	R3 Outlet B1/2 Spiked	R3 Outlet F1/2 unspiked	R3 Outlet B1/2 unspiked
Volume (ml)	2	2	2	2
Dilution factor	1	1	1	1
Peak Area # 1	0	0	0	0
Peak Area # 2	0	0	0	0
Average	0	0	0	0
Injections % of mean	NA	NA	NA	NA

RESULTS

Average Response Factor	x	x	x	x
Linear Regression				
Indane (µg/ml)	0	0	0	0
Indane (mg)	0	0	0	0

INDENE ANALYSIS

Sample Parameters	R3 Outlet F1/2 Spiked	R3 Outlet B1/2 Spiked	R3 Outlet F1/2 unspiked	R3 Outlet B1/2 unspiked
Volume (ml)	2	2	2	2
Dilution factor	1	1	1	1
Peak Area # 1	0	0	0	0
Peak Area # 2	0	0	0	0
Average	0	0	0	0
Injections % of mean	NA	NA	NA	NA

RESULTS

Average Response Factor	x	x	x	x
Linear Regression				
Indene (µg/ml)	0	0	0	0
Indene (mg)	0	0	0	0

NAPHTHALENE ANALYSIS

Sample Parameters	R3 Outlet F1/2 Spiked	R3 Outlet B1/2 Spiked	R3 Outlet F1/2 unspiked	R3 Outlet B1/2 unspiked
Volume (ml)	2	2	2	2
Dilution factor	1	1	1	1
Peak Area # 1	0	0	0	0
Peak Area # 2	0	0	0	0
Average	0	0	0	0
Injections % of mean	NA	NA	NA	NA

RESULTS

Average Response Factor	x	x	x	x
Linear Regression				
Naphthalene (µg/ml)	0	0	0	0
Naphthalene (mg)	0	0	0	0

BENZENE ANALYSIS

Sample Parameters	R4 Outlet F1/2 Spiked	R4 Outlet B1/2 Spiked	R4 Outlet F1/2 unspiked	R4 Outlet B1/2 unspiked
Volume (ml)	2	2	2	2
Dilution factor	1	1	1	1
Peak Area # 1	1,194,800	523,062	2,702,340	350,536
Peak Area # 2	1,187,890	510,190	2,698,960	343,591
Average	1,191,345	516,626	2,700,650	347,064
Injections % of mean	0.3%	1.2%	0.1%	1.0%

RESULTS

Average Response Factor				
Linear Regression	x	x	x	x
Benzene (µg/ml)	407	259	736	223
Benzene (mg)	0.813	0.519	1.47	0.445

TOLUENE ANALYSIS

Sample Parameters	R4 Outlet F1/2 Spiked	R4 Outlet B1/2 Spiked	R4 Outlet F1/2 unspiked	R4 Outlet B1/2 unspiked
Volume (ml)	2	2	2	2
Dilution factor	1	1	1	1
Peak Area # 1	323,439	229,749	493,107	119,629
Peak Area # 2	316,782	221,719	495,002	115,965
Average	320,111	225,734	494,055	117,797
Injections % of mean	1.0%	1.8%	0.2%	1.6%

RESULTS

Average Response Factor				x
Linear Regression	x	x	x	
Toluene (µg/ml)	173	150	214	33.7
Toluene (mg)	0.345	0.300	0.429	0.0673

ETHYLBENZENE ANALYSIS

Sample Parameters	R4 Outlet F1/2 Spiked	R4 Outlet B1/2 Spiked	R4 Outlet F1/2 unspiked	R4 Outlet B1/2 unspiked
Volume (ml)	2	2	2	2
Dilution factor	1	1	1	1
Peak Area # 1	12,903	91,962	14,330	4,845
Peak Area # 2	11,980	90,126	14,059	4,826
Average	12,441	91,044	14,195	4,836
Injections % of mean	3.7%	1.0%	1.0%	0.2%

RESULTS

Average Response Factor	x	x	x	x
Linear Regression				
Ethylbenzene (µg/ml)	3.68	26.9	4.20	1.43
Ethylbenzene (mg)	0.00736	0.0539	0.00840	0.00286

XYLENE M/P ANALYSIS

Sample Parameters	R4 Outlet F1/2 Spiked	R4 Outlet B1/2 Spiked	R4 Outlet F1/2 unspiked	R4 Outlet B1/2 unspiked
Volume (ml)	2	2	2	2
Dilution factor	1	1	1	1
Peak Area # 1	31,110	202,977	34,630	12,148
Peak Area # 2	30,145	199,062	33,910	12.407
Average	**30,627**	**201,020**	**34,270**	**12,277**
Injections % of mean	1.6%	1.0%	1.1%	1.1%

RESULTS

Average Response Factor	x	x	x	x
Linear Regression				
Xylene m/p (µg/ml)	8.49	55.7	9.5	3.40
Xylene m/p (mg)	0.0170	0.111	0.0190	0 00680

XYLENE O ANALYSIS

Sample Parameters	R4 Outlet F1/2 Spiked	R4 Outlet B1/2 Spiked	R4 Outlet F1/2 unspiked	R4 Outlet B1/2 unspiked
Volume (ml)	2	2	2	2
Dilution factor	1	1	1	1
Peak Area # 1	0	67,170	0	0
Peak Area # 2	0	63.876	0	0
Average	**0**	**65,523**	**0**	**0**
Injections % of mean	NA	2.5%	NA	NA

RESULTS

Average Response Factor	x	x	x	x
Linear Regression				
Xylene o (µg/ml)	0	19.9	0	0
Xylene o (mg)	0	0.0399	0	0

STYRENE ANALYSIS

Sample Parameters	R4 Outlet F1/2 Spiked	R4 Outlet B1/2 Spiked	R4 Outlet F1/2 unspiked	R4 Outlet B1/2 unspiked
Volume (ml)	2	2	2	2
Dilution factor	1	1	1	1
Peak Area # 1	0	110,185	0	0
Peak Area # 2	0	108,773	0	0
Average	**0**	**109,479**	**0**	**0**
Injections % of mean	NA	0.6%	NA	NA

RESULTS

Average Response Factor	x	x	x	x
Linear Regression				
Styrene (µg/ml)	0	27.2	0	0
Styrene (mg)	0	0.0545	0	0

INDANE ANALYSIS

Sample Parameters	R4 Outlet F1/2 Spiked	R4 Outlet B1/2 Spiked	R4 Outlet F1/2 unspiked	R4 Outlet B1/2 unspiked
Volume (ml)	2	2	2	2
Dilution factor	1	1	1	1
Peak Area # 1	0	0	0	0
Peak Area # 2	0	0	0	0
Average	0	0	0	0
Injections % of mean	NA	NA	NA	NA

RESULTS

Average Response Factor	x	x	x	x
Linear Regression				
Indane (µg/ml)	0	0	0	0
Indane (mg)	0	0	0	0

INDENE ANALYSIS

Sample Parameters	R4 Outlet F1/2 Spiked	R4 Outlet B1/2 Spiked	R4 Outlet F1/2 unspiked	R4 Outlet B1/2 unspiked
Volume (ml)	2	2	2	2
Dilution factor	1	1	1	1
Peak Area # 1	0	0	0	0
Peak Area # 2	0	0	0	0
Average	0	0	0	0
Injections % of mean	NA	NA	NA	NA

RESULTS

Average Response Factor	x	x	x	x
Linear Regression				
Indene (µg/ml)	0	0	0	0
Indene (mg)	0	0	0	0

NAPHTHALENE ANALYSIS

Sample Parameters	R4 Outlet F1/2 Spiked	R4 Outlet B1/2 Spiked	R4 Outlet F1/2 unspiked	R4 Outlet B1/2 unspiked
Volume (ml)	2	2	2	2
Dilution factor	1	1	1	1
Peak Area # 1	0	40,419	0	0
Peak Area # 2	0	39,910	0	0
Average	0	40,165	0	0
Injections % of mean	NA	0.6%	NA	NA

RESULTS

Average Response Factor	x	x	x	x
Linear Regression				
Naphthalene (µg/ml)	0	11.5	0	0
Naphthalene (mg)	0	0.0229	0	0

BENZENE ANALYSIS

Sample Parameters	R4 Inlet A F1/2	R4 Inlet A B1/2	R4 Inlet B F1/2	R4 Inlet B B1/2
Volume (ml)	4	2	2	2
Dilution factor	1	1	1	1
Peak Area # 1	364,703,000	89,499,500	119,751,000	43,611,800
Peak Area # 2	371,119,000	78,436,700	112,639,000	45,514,700
Average	**367,911,000**	**83,968,100**	**116,195,000**	**44,513,250**
Injections % of mean	0.9%	6.6%	3.1%	2.2%

RESULTS

Average Response Factor				
Linear Regression	x	x	x	x
Benzene (µg/ml)	80,369	18,456	25,483	9,853
Benzene (mg)	321	36.9	51.0	19.7

TOLUENE ANALYSIS

Sample Parameters	R4 Inlet A F1/2	R4 Inlet A B1/2	R4 Inlet B F1/2	R4 Inlet B B1/2
Volume (ml)	4	2	2	2
Dilution factor	1	1	1	1
Peak Area # 1	98,221,000	500.761	83,495,400	38,318,300
Peak Area # 2	100,866,000	450.971	80,832,600	39,643,100
Average	**99,543,500**	**475,866**	**82,164,000**	**38,980,700**
Injections % of mean	1.3%	5.2%	1.6%	1.7%

RESULTS

Average Response Factor				
Linear Regression	x	x	x	x
Toluene (µg/ml)	24,014	210	19,838	9,462
Toluene (mg)	96.1	0.420	39.7	18.9

ETHYLBENZENE ANALYSIS

Sample Parameters	R4 Inlet A F1/2	R4 Inlet A B1/2	R4 Inlet B F1/2	R4 Inlet B B1/2
Volume (ml)	4	2	2	2
Dilution factor	1	1	1	1
Peak Area # 1	5,946,620	0	7,728,830	1,324,360
Peak Area # 2	5,991,850	0	7,516,190	1,325,810
Average	**5,969,385**	**0**	**7,622,510**	**1,325,085**
Injections % of mean	0.4%	NA	1.4%	0.1%

RESULTS

Average Response Factor		x		
Linear Regression	x		x	x
Ethylbenzene (µg/ml)	1,654	0	2.096	413
Ethylbenzene (mg)	6.62	0	4.19	0.825

XYLENE M/P ANALYSIS

Sample Parameters	R4 Inlet A F1/2	R4 Inlet A B1/2	R4 Inlet B F1/2	R4 Inlet B B1/2
Volume (ml)	4	2	2	2
Dilution factor	1	1	1	1
Peak Area # 1	14,667,700	0	23,802,200	2,916,360
Peak Area # 2	14,818,300	0	23,231,700	2,902,700
Average	14,743,000	0	23,516,950	2,909,530
Injections % of mean	0.5%	NA	1.2%	0.2%

RESULTS

Average Response Factor		x		
Linear Regression	x		x	x
Xylene m/p (µg/ml)	3,639	0	5,711	846
Xylene m/p (mg)	14.6	0	11.4	1.69

XYLENE O ANALYSIS

Sample Parameters	R4 Inlet A F1/2	R4 Inlet A B1/2	R4 Inlet B F1/2	R4 Inlet B B1/2
Volume (ml)	4	2	2	2
Dilution factor	1	1	1	1
Peak Area # 1	2,142,540	0	3,892,910	230,662
Peak Area # 2	2,061,080	0	3,800,000	169,959
Average	2,101,810	0	3,846,455	200,311
Injections % of mean	1.9%	NA	1.2%	15.2%

RESULTS

Average Response Factor		x		
Linear Regression	x		x	x
Xylene o (µg/ml)	667	0	1,096	200
Xylene o (mg)	2.67	0	2.19	0.40

STYRENE ANALYSIS

Sample Parameters	R4 Inlet A F1/2	R4 Inlet A B1/2	R4 Inlet B F1/2	R4 Inlet B B1/2
Volume (ml)	4	2	2	2
Dilution factor	1	1	1	1
Peak Area # 1	2,632,190	0	4,327,790	455,674
Peak Area # 2	2,560,340	0	4,245,030	355,847
Average	2,596,265	0	4,286,410	405,761
Injections % of mean	1.4%	NA	1.0%	12.3%

RESULTS

Average Response Factor		x		
Linear Regression	x		x	x
Styrene (µg/ml)	633	0	1,065	73.6
Styrene (mg)	2.53	0	2.13	0.147

INDANE ANALYSIS

Sample Parameters	R4 Inlet A F1/2	R4 Inlet A B1/2	R4 Inlet B F1/2	R4 Inlet B B1/2
Volume (ml)	4	2	2	2
Dilution factor	1	1	1	1
Peak Area # 1	461,694	771,325	578,363	0
Peak Area # 2	421,199	694,464	558,896	0
Average	441,447	732,895	568,630	0
Injections % of mean	4.6%	5.2%	1.7%	NA

RESULTS

Average Response Factor				x
Linear Regression	x	x	x	
Indane (µg/ml)	187	258	218	0
Indane (mg)	0.746	0.515	0.435	0

INDENE ANALYSIS

Sample Parameters	R4 Inlet A F1/2	R4 Inlet A B1/2	R4 Inlet B F1/2	R4 Inlet B B1/2
Volume (ml)	4	2	2	2
Dilution factor	1	1	1	1
Peak Area # 1	759,075	0	1,069,170	0
Peak Area # 2	736,369	0	1,040,250	0
Average	747,722	0	1,054,710	0
Injections % of mean	1.5%	NA	1.4%	NA

RESULTS

Average Response Factor		x		x
Linear Regression	x		x	
Indene (µg/ml)	249	0	345	0
Indene (mg)	1.00	0	0.689	0

NAPHTHALENE ANALYSIS

Sample Parameters	R4 Inlet A F1/2	R4 Inlet A B1/2	R4 Inlet B F1/2	R4 Inlet B B1/2
Volume (ml)	4	2	2	2
Dilution factor	1	1	1	1
Peak Area # 1	171,541	0	29,338	0
Peak Area # 2	22,774	0	26,651	0
Average	97,158	0	27,994	0
Injections % of mean	76.6%	NA	4.8%	NA

RESULTS

Average Response Factor	x	x	x	x
Linear Regression				
Naphthalene (µg/ml)	27.7	0	7.99	0
Naphthalene (mg)	0.111	0	0.0160	0

Calibration Data

Includes the following:

- **BTEXSIIN Standards**
- **BTEXSIIN Calibration Curve**

AIRTECH Environmental Services Inc.

GC OPERATING CONDITIONS	
Gas Chromatograph	Hewlett Packard 5890 II
Data Acquisition	Hewlett Packard Chemstation
Detector Type	FID
Detector Temperature (°C)	250
Carrier Gas	Zero Nitrogen
Carrier Flowrate (cc/min)	6 4
Injection Type	10 µl syringe
Injection Volume (µl)	0.4
Injection Temperature (°C)	200
Column Type	AT-1
Column Length (m)	60
Film Thickness (um)	0 53
Initial Column Temperature (°C)	80.0
Initial Hold Time (m)	0 0
Temperature Ramp (°C/min)	20.0
Ramp final temp (°C)	7 25
Hold time (min)	6 00
Temperature Ramp (°C/min)	30 0
Final Column Temperature (°C)	250
Final Hold Time (min)	0 0

Calibration Summary	Low	Mid	High	High x10	Highx20
Benzene (µg/ml)	43 8	438	879	8,790	17,580
Pre Analysis Injection 1	163,016	1,655,880	3,321,150	37,696,100	79,702,900
Pre Analysis Injection 2	160,778	1,607,290	3,378,680	38,129,000	81,807,100
Average	**161,897**	**1,631,585**	**3,349,915**	**37,912,550**	**80,755,000**

Results					
Response Factor	0.000271	0.000268	0.000262	0.000232	0.000218
Average Response Factor	0.000250				
Slope	0.000218				
Intercept	147				

Calibration Summary	Low	Mid	High	High x10	Highx20
Toluene (µg/ml)	43.5	435	869	8,690	17,380
Pre Analysis Injection 1	153,776	1,594,940	3,160,980	34,717,000	71,468,900
Pre Analysis Injection 2	150,745	1,538,540	3,211,480	34,933,200	73,300,900
Average	**152,261**	**1,566,740**	**3,186,230**	**34,825,100**	**72,384,900**

Results					
Response Factor	0.000286	0.000278	0.000273	0.000250	0.000240
Average Response Factor	0 000265				
Slope	0.000240				
Intercept	95.7				

Calibration Summary	Low	Mid	High	High x10	Highx20
Ethylbenzene (µg/ml)	43.2	432	865	8,650	17,300
Pre Analysis Injection 1	129,735	1,417,930	2,908,840	31,862,300	63,859,700
Pre Analysis Injection 2	126,469	1,384,040	2,962,120	31,997,300	65,390,400
Average	**128,102**	**1,400,985**	**2,935,480**	**31,929,800**	**64,625,050**
Results					
Response Factor	0.000337	0.000308	0.000295	0.000271	0.000268
Average Response Factor	0.000296				
Slope	0.000267				
Intercept	58.5				

Calibration Summary	Low	Mid	High	High x10	Highx20
$Xylene_{Meta/Para}$ (µg/ml)	85.2	852	1,702	17,020	34,040
Pre Analysis Injection 1	310,336	3,266,800	6,370,660	69,706,800	142,382,000
Pre Analysis Injection 2	304,584	3,167,750	6,530,970	69,986,900	146,165,000
Average	**307,460**	**3,217,275**	**6,450,815**	**69,846,850**	**144,273,500**
Results					
Response Factor	0.000277	0.000265	0.000264	0.000244	0.000236
Average Response Factor	0.000257				
Slope	0.000236				
Intercept	159				

Calibration Summary	Low	Mid	High	High x10	Highx20
$Xylene_{Ortho}$ (µg/ml)	43.1	431	862	8,620	17,240
Pre Analysis Injection 1	108,695	1,363,160	2,907,410	32,917,800	69,336,000
Pre Analysis Injection 2	106,435	1,331,680	2,963,640	33,033,200	71,086,400
Average	**107,565**	**1,347,420**	**2,935,525**	**32,975,500**	**70,211,200**
Results					
Response Factor	0.000401	0.000320	0.000294	0.000261	0.000246
Average Response Factor	0.000304				
Slope	0.000246				
Intercept	150				

Calibration Summary	Low	Mid	High	High x10	Highx20
Styrene (µg/ml)	45.0	450	900	8.000	18,000
Pre Analysis Injection 1	185,884	1,877,020	3,568,450	35,599,000	69,446,300
Pre Analysis Injection 2	183,651	1,809,600	3,671,680	35,753,500	71,368,400
Average	**184,768**	**1,843,310**	**3,620,065**	**35,676,250**	**70,407,600**
Results					
Response Factor	0.000244	0.000244	0.000249	0.000252	0.000256
Average Response Factor	0.000249				
Slope	0.000255				
Intercept	-30.1				

Calibration Summary	Low	Mid	High	High x10	Highx20
Indan (µg/ml)	45.8	458	917	9,170	18,340
Pre Analysis Injection 1	167,593	1,650,540	3,345,570	36,735,900	74,511,000
Pre Analysis Injection 2	165,201	1,643,470	3,359,780	36,693,000	75,998,500
Average	**166,397**	**1,647,005**	**3,352,675**	**36,714,450**	**75,254,750**
Results					
Response Factor	0.000275	0.000278	0.000274	0.000250	0.000244
Average Response Factor	0.000264				
Slope	0.000244				
Intercept	79.1				

Calibration Summary	Low	Mid	High
Indene (µg/ml)	47.3	473	700
Pre Analysis Injection 1	121,522	1,403,071	2,283,590
Pre Analysis Injection 2	120,270	1,425,180	2,171,160
Average	**120,896**	**1,414,126**	**2,227,375**
Results			
Response Factor	0.000391	0.000334	0.000314
Average Response Factor	0.000347		
Slope	0.000312		
Intercept	15.9		

Calibration Summary	Low	Mid	High
Naphthalene (µg/ml)	50.1	501	1,003
Pre Analysis Injection 1	177,126	1,870,070	3,662,650
Pre Analysis Injection 2	173,834	1,849,330	3,782,790
Average	**175,480**	**1,859,700**	**3,722,720**
Results			
Response Factor	0.000286	0.000269	0.000269
Average Response Factor	0.000275		
Slope	0.000269		
Intercept	2.42		

Calibration Summary	Drift Check High	Drift Check High	Drift Check High
Benzene (µg/ml)	879	879	879
Pre Analysis Injection 1	3 360,380	3 384 440	3 319 980
Pre Analysis Injection 2	3,376 390	3 339 680	3,233 350
Average	**3,368,385**	**3,362,060**	**3,276,665**
Results			
Response Factor	0.000261	0.000261	0.000268
Average Response Factor			
Slope			
Intercept			

Calibration Summary	Drift Check High	Drift Check High	Drift Check High
Toluene (µg/ml)	369	869	869
Pre Analysis Injection 1	3,244 460	3,250,460	3 185 420
Pre Analysis Injection 2	3,249,380	3,220 930	3,106,050
Average	**3,246,920**	**3,235,695**	**3,145,735**
Results			
Response Factor	0.000268	0.000269	0.000276
Average Response Factor			
Slope			
Intercept			

Calibration Summary	Drift Check High	Drift Check High	Drift Check High
Ethylbenzene (µg/ml)	865	865	865
Pre Analysis Injection 1	3,130,470	3,103,140	3,021,640
Pre Analysis Injection 2	3,117,270	3 061,410	2,928,610
Average	**3.123,870**	**3,082,275**	**2,976,125**
Results			
Response Factor	0.000277	0.000281	0.000291
Average Response Factor			
Slope			
Intercept			

Calibration Summary	Drift Check High	Drift Check High	Drift Check High
$Xylene_{Meta/Para}$ (µg/ml)	1,702	1,702	1,702
Pre Analysis Injection 1	6,454,480	6,488,720	6,659,800
Pre Analysis Injection 2	6,499,230	6,420,340	6,269,660
Average	**6,476,855**	**6,454,530**	**6,464,730**
Results			
Response Factor	0.000263	0.000264	0.000263
Average Response Factor			
Slope			
Intercept			

Calibration Summary	Drift Check High	Drift Check High	Drift Check High
$Xylene_{Ortho}$ (µg/ml)	862	862	862
Pre Analysis Injection 1	3,278,200	3,227,320	3,139,450
Pre Analysis Injection 2	3,253,320	3,178,360	3,011,600
Average	**3,265,760**	**3,202,840**	**3,075,525**
Results			
Response Factor	0.000264	0.000269	0.000280
Average Response Factor			
Slope			
Intercept			

Calibration Summary	Drift Check High	Drift Check High	Drift Check High
Styrene (µg/ml)	900	900	900
Pre Analysis Injection 1	3,394,140	3,443,680	3,423,170
Pre Analysis Injection 2	3,433,250	3,411,730	3,385,970
Average	**3,413,695**	**3,427,705**	**3,404,570**
Results			
Response Factor	0.000264	0.000263	0.000264
Average Response Factor			
Slope			
Intercept			

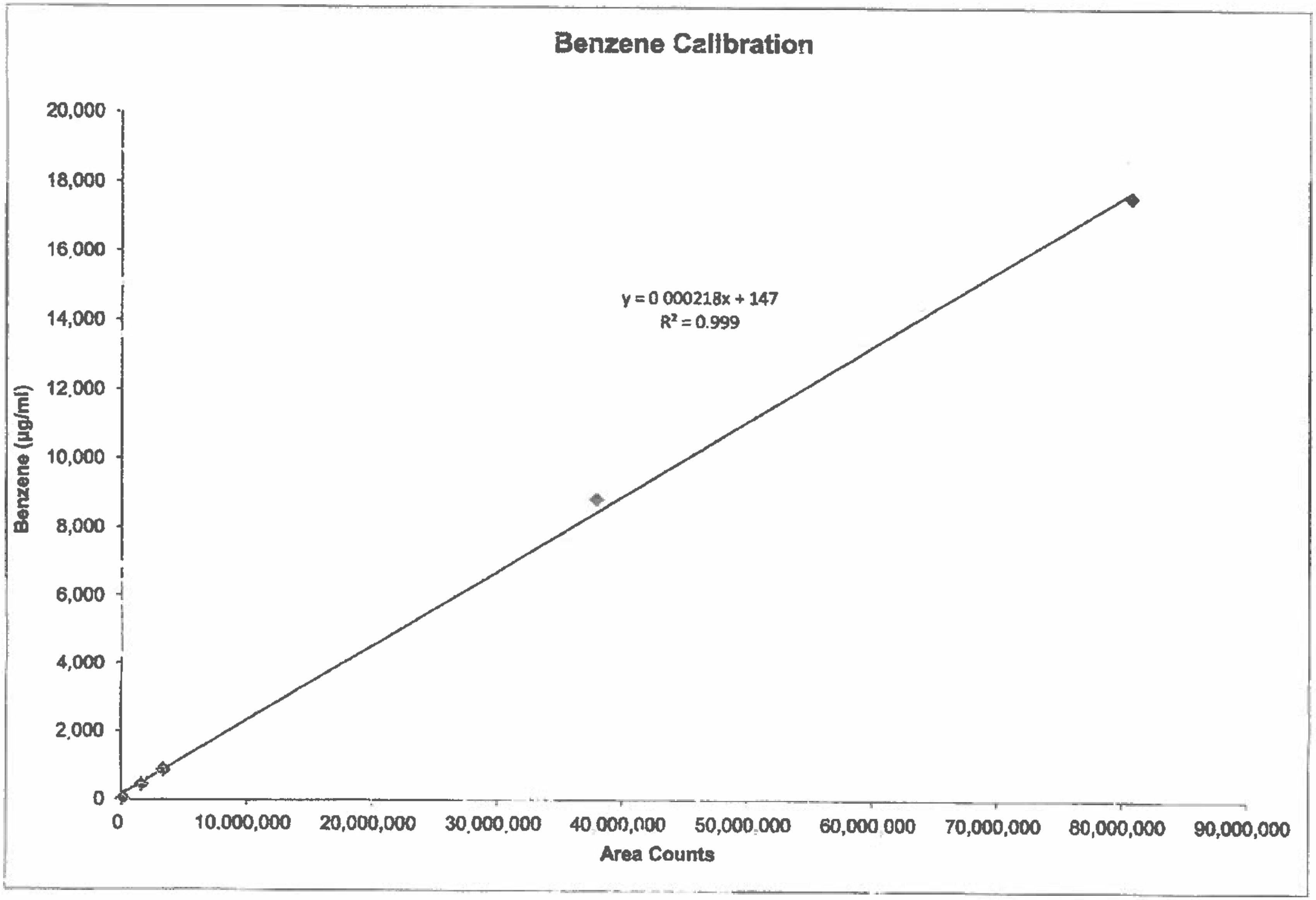
Calibration Summary	Drift Check High	Drift Check High	Drift Check High
Indan (µg/ml)	917	917	917
Pre Analysis Injection 1	3,438,000	3,430,860	3,354,960
Pre Analysis Injection 2	3,419,830	3,387,260	3,279,610
Average	**3,428,915**	**3,409,060**	**3,317,285**
Results			
Response Factor	0.000267	0.000269	0.000276
Average Response Factor			
Slope			
Intercept			

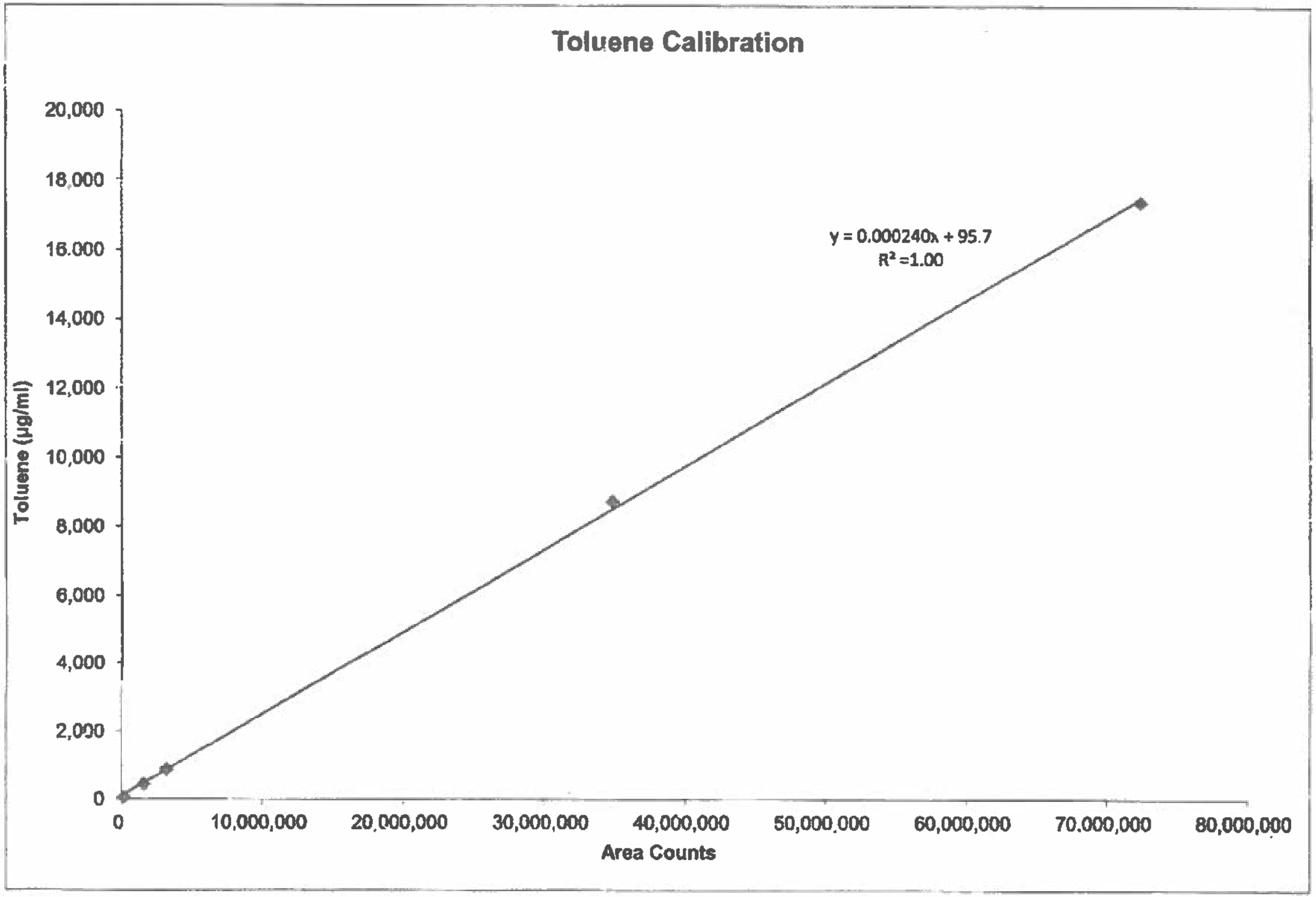
Calibration Summary	Drift Check High	Drift Check High	Drift Check High
Indene (µg/ml)	703	703	703
Pre Analysis Injection 1	2,134,620	2,176,440	2,157,200
Pre Analysis Injection 2	2,145,930	2,133,780	2,111,320
Average	**2,140,275**	**2,155,110**	**2,134,260**
Results			
Response Factor	0.000328	0.000326	0.000329
Average Response Factor			
Slope			
Intercept			

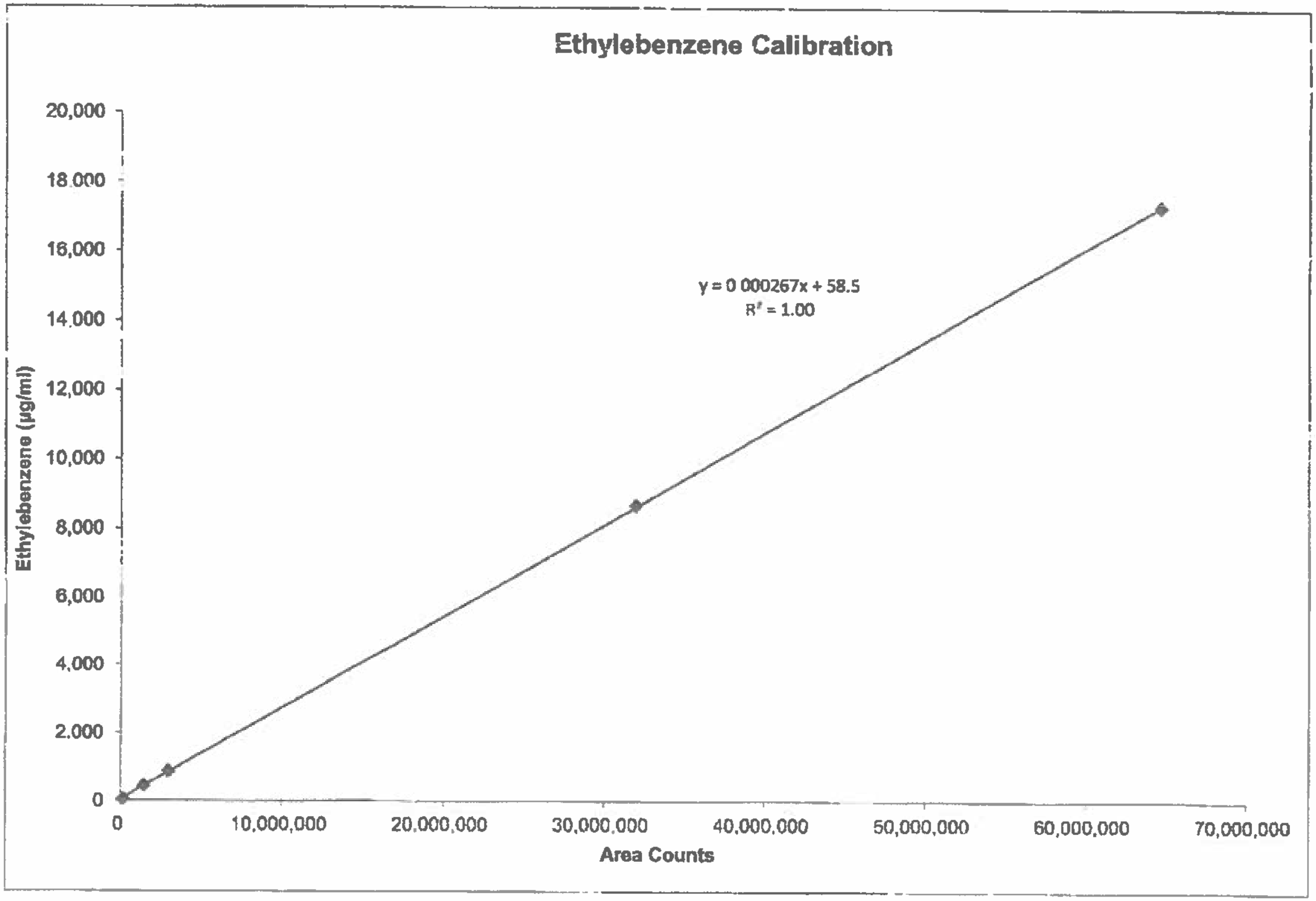
Calibration Summary	Drift Check High	Drift Check High	Drift Check High
Naphthalene (µg/ml)	1,003	1,003	1,003
Pre Analysis Injection 1	3,781,660	3,793,440	3,705,550
Pre Analysis Injection 2	3,779,100	3,731,260	3,555,730
Average	**3,780,380**	**3,762,350**	**3,630,640**
Results			
Response Factor	0.000265	0.000267	0.000276
Average Response Factor			
Slope			
Intercept			

Detection Limit	Benzene	Toluene	Ethylbenzene	Xylene m/p	Xylene o	Styrene	Indan	Indene	Naphthalene
Standard (ug/ml)	43.8	43.5	43.2	85.2	43.1	46.0	45.8	47.3	50.1
Injection 1	164,615	160,110	146,298	314,472	156,356	167,542	174,791	115,193	184,439
Injection 2	163,292	158,054	143,911	312,182	152,335	166,985	170,191	116,540	179,118
Injection 3	163,434	157,929	143,841	312,469	151,275	167,922	172,798	118,114	180,006
Injection 4	164,093	155,665	144,068	315,196	150,359	170,633	172,581	117,970	182,026
Injection 5	163,337	154,889	142,735	313,620	148,495	170,001	173,465	116,232	180,589
Injection 6	159,437	150,604	139,205	305,432	143,959	165,730	168,548	116,676	176,985
Injection 7	162,926	155,915	138,623	310,210	139,853	171,491	167,442	113,537	179,256
Average	**163,019**	**156,179**	**142,668**	**311,940**	**148,962**	**168,615**	**171,402**	**117,023**	**180,345**

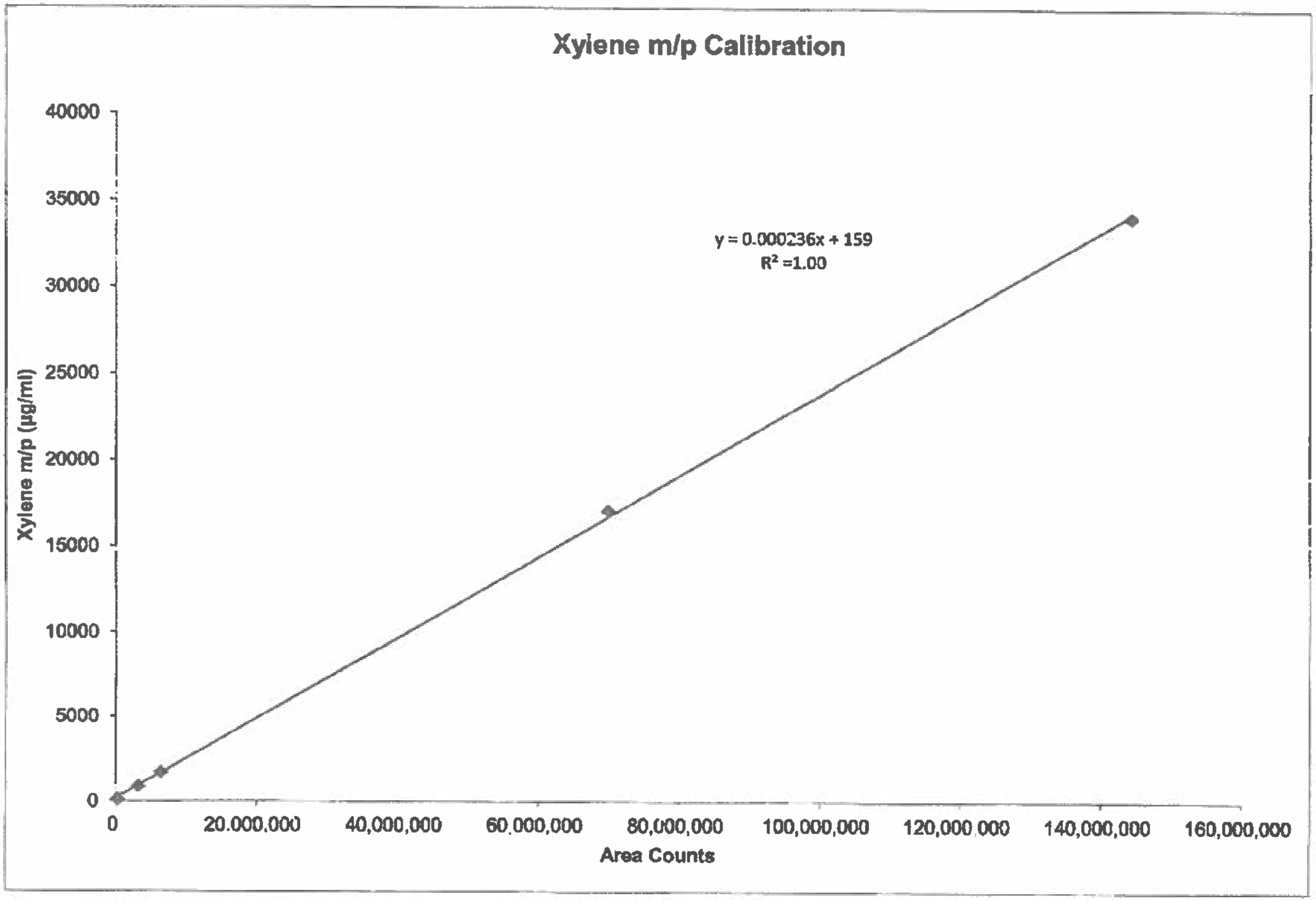
RESULTS									
Response Factor	0.000269	0.000279	0.000303	0.000273	0.000289	0.000267	0.000267	0.000404	0.000278
Standard Deviation	1,678	3,024	2,782	3,305	5,474	2,116	2,719	1,708	2,372
No of Samples (n)	7	7	7	7	7	7	7	7	7
Student t value ($t_{(0.975)}$)	2.447	2.447	2.447	2.447	2.447	2.447	2.447	2.447	2.447
Detection Limit (ug/ml)	1.10	2.06	2.06	2.21	3.86	1.38	1.78	1.689	1.61


Benzene Calibration
y = 0 000218x + 147
R² = 0.999
Benzene (µg/ml)
20,000
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
0
10,000,000
20,000,000
30,000,000
40,000,000
50,000,000
60,000,000
70,000,000
80,000,000
90,000,000
Area Counts

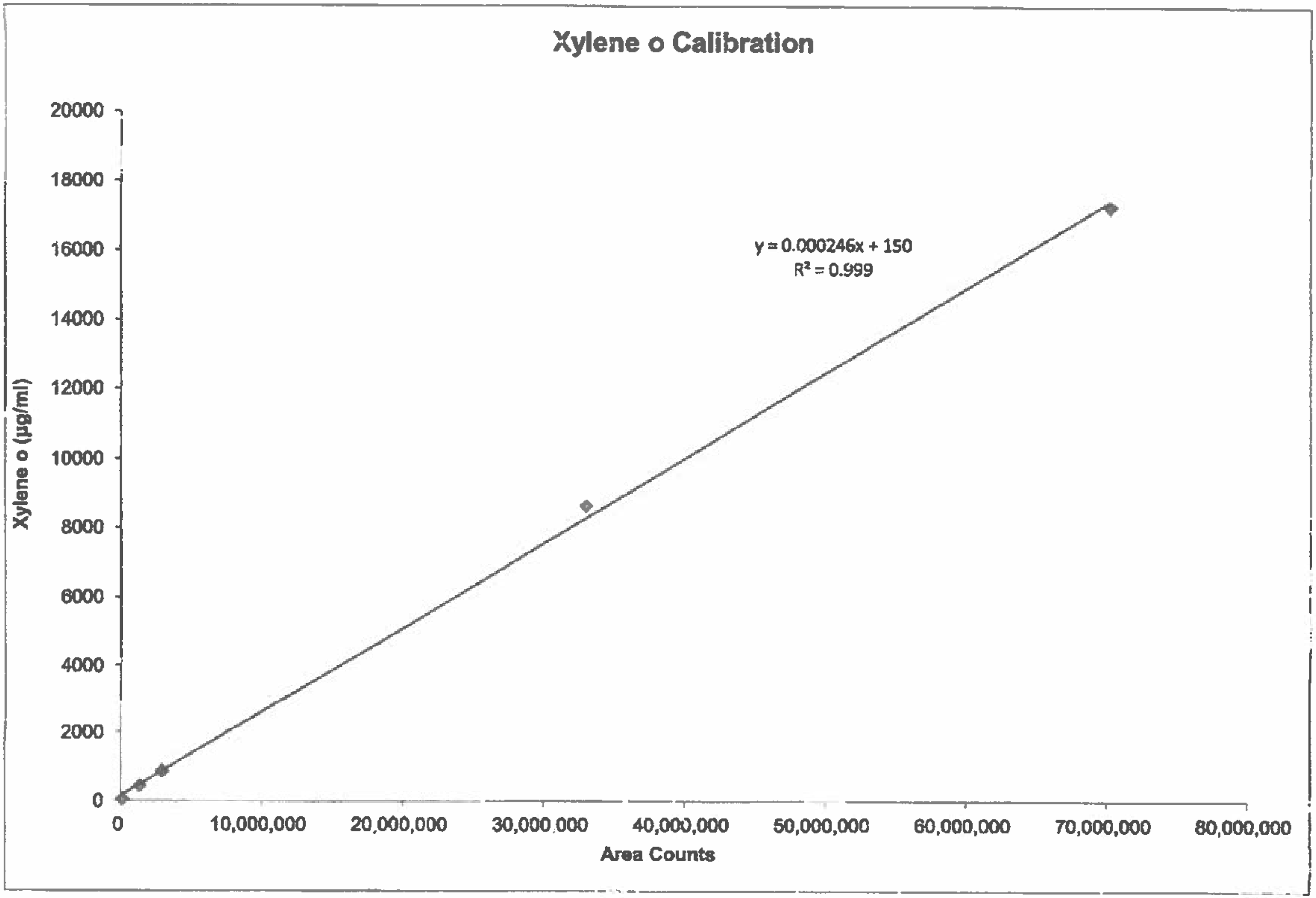

Toluene Calibration
y = 0.000240x + 95.7
R² =1.00
Toluene (µg/ml)
20,000
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
0
10,000,000
20,000,000
30,000,000
40,000,000
50,000,000
60,000,000
70,000,000
80,000,000
Area Counts

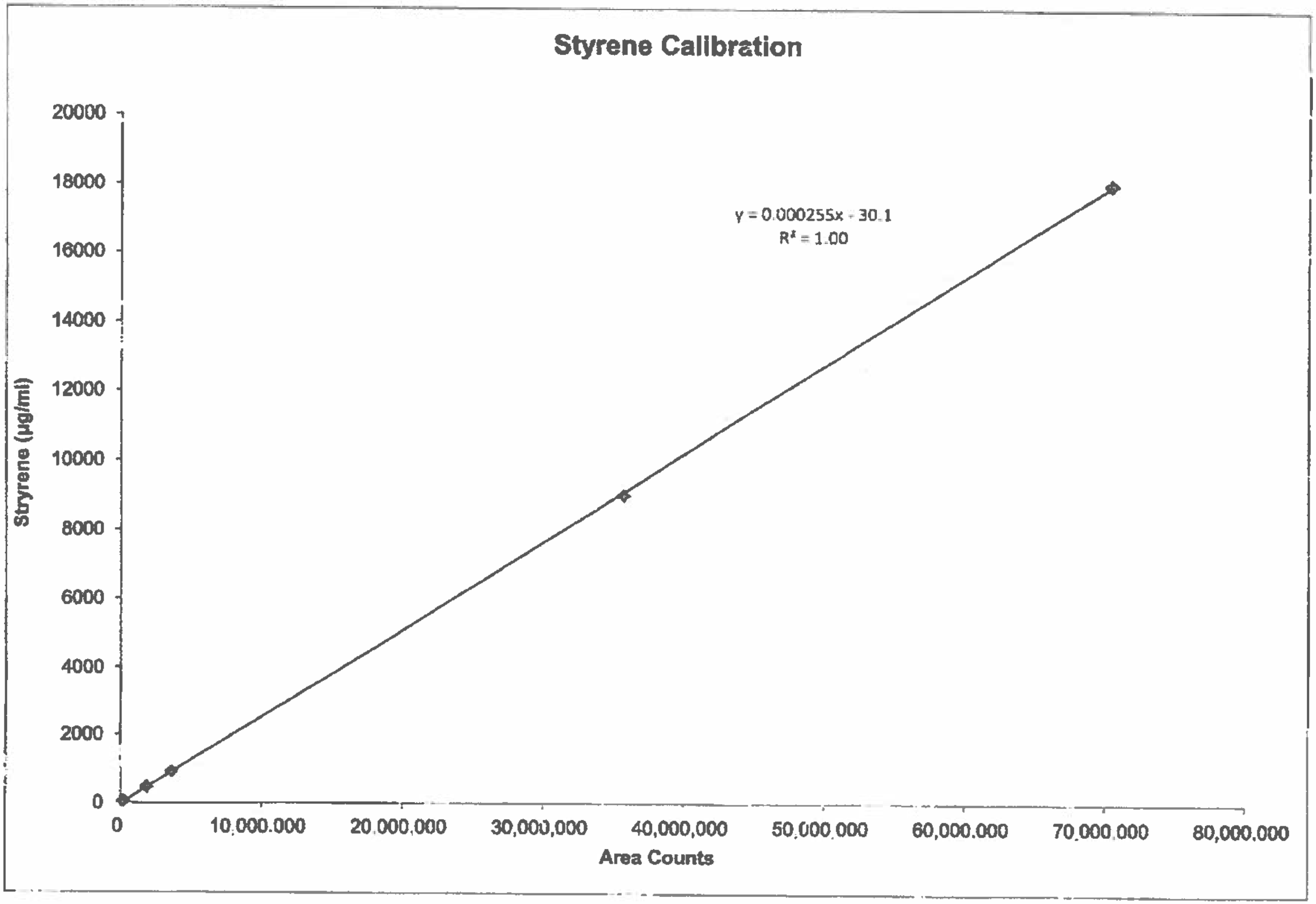


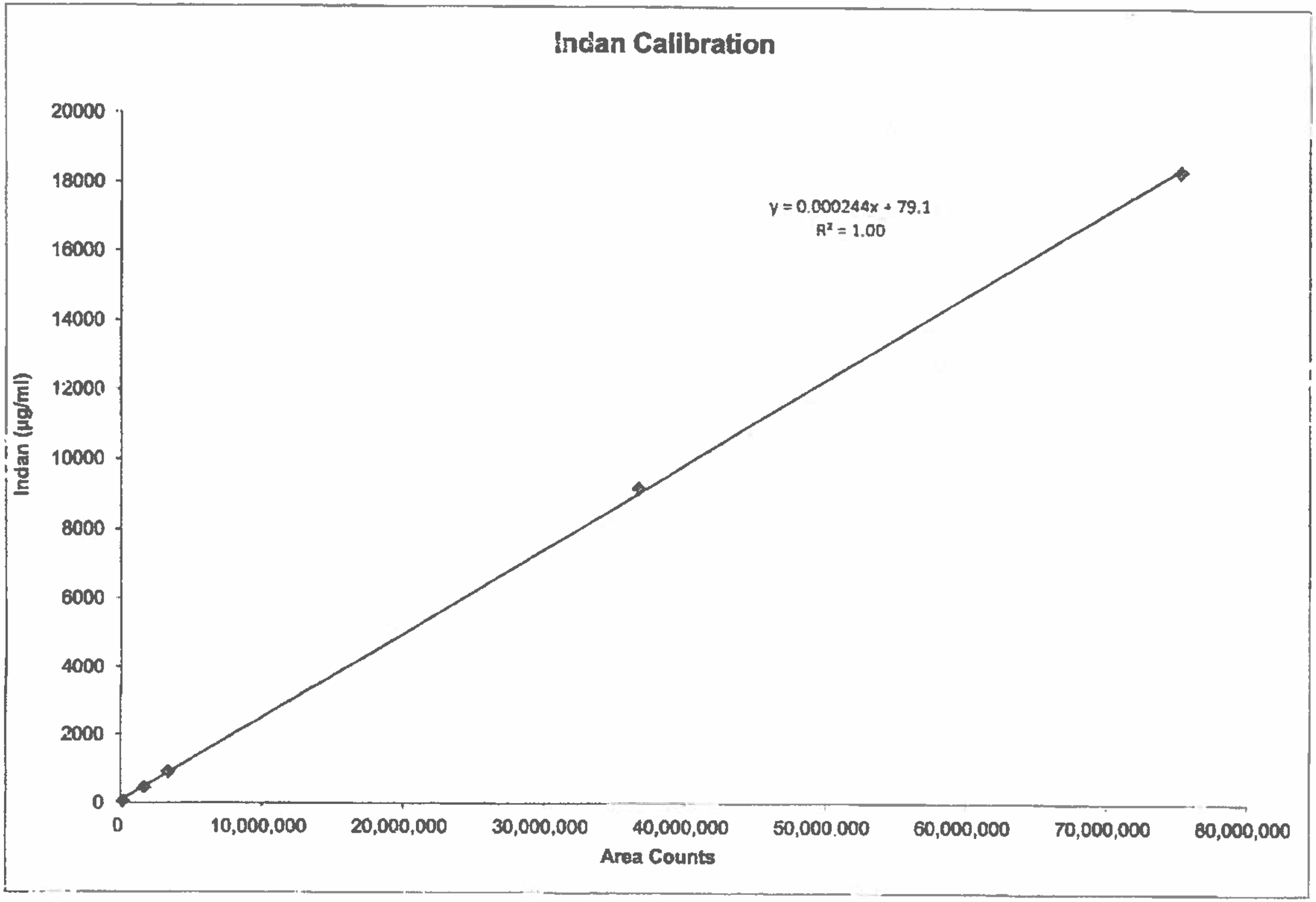
Ethylebenzene Calibration
y = 0 000267x + 58.5
R² = 1.00
Ethylebenzene (µg/ml)
20,000
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
0
10,000,000
20,000,000
30,000,000
40,000,000
50,000,000
60,000,000
70,000,000
Area Counts

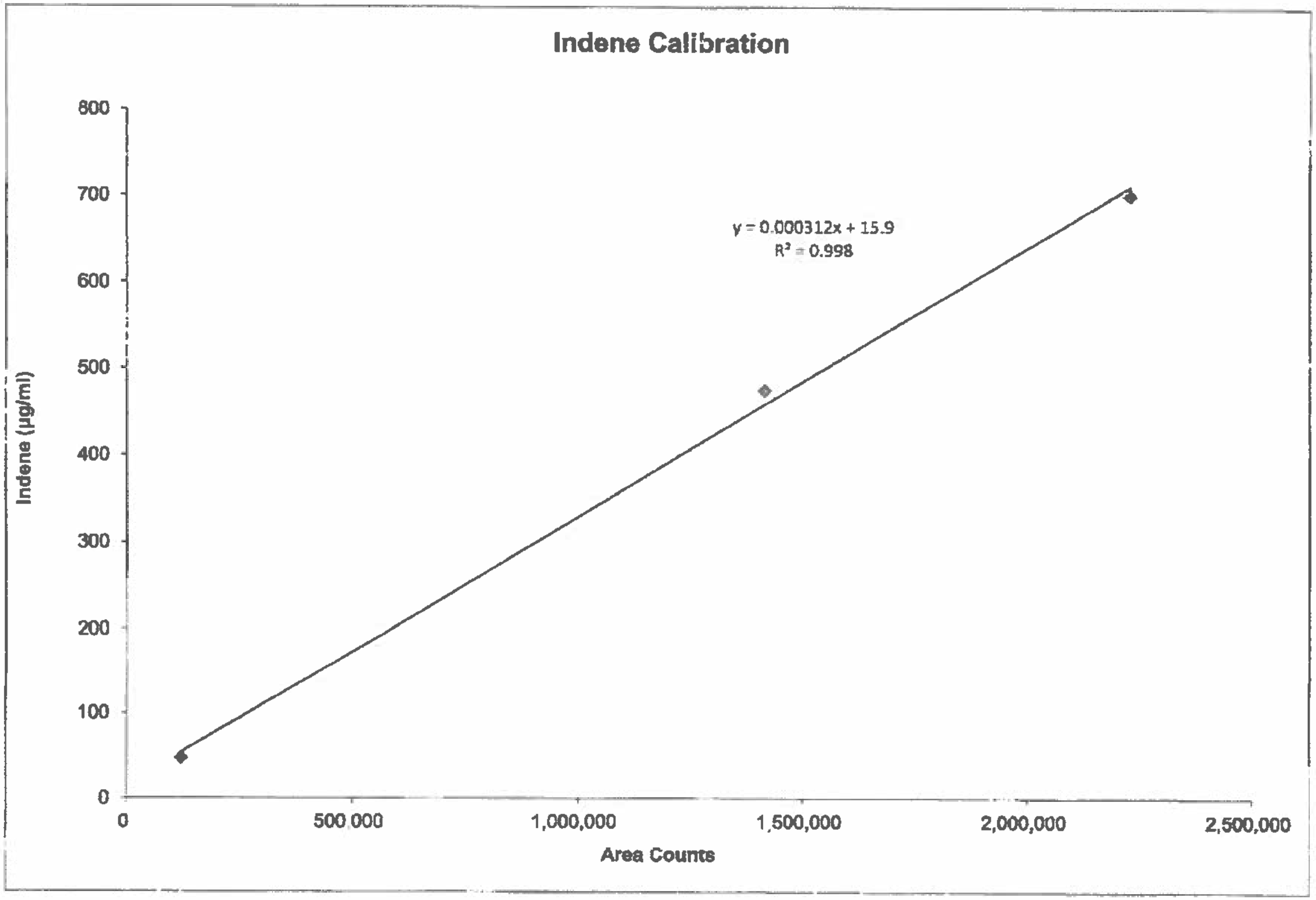


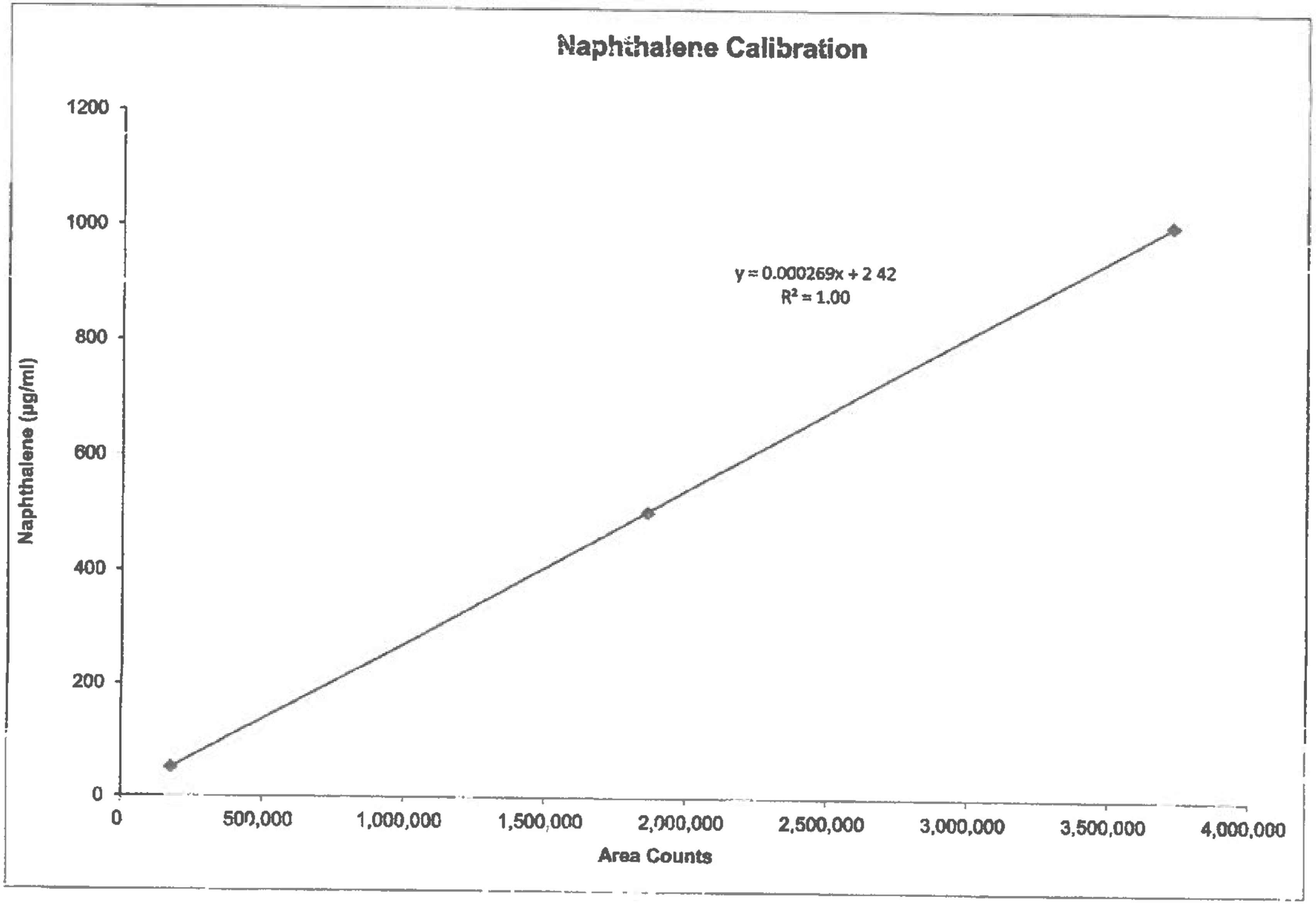
Xylene m/p Calibration
y = 0.000236x + 159
R² =1.00
Xylene m/p (µg/ml)
40000
35000
30000
25000
20000
15000
10000
5000
0
0
20.000.000
40,000,000
60.000,000
80,000,000
100,000,000
120,000,000
140,000,000
160,000,000
Area Counts


Xylene o Calibration
Xylene o (µg/ml)
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
y = 0.000246x + 150
R² = 0.999
0
10,000,000
20,000,000
30,000,000
40,000,000
50,000,000
60,000,000
70,000,000
80,000,000
Area Counts


Styrene Calibration
y = 0.000255x - 30.1
R² = 1.00
Stryrene (µg/ml)
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
0
10,000,000
20,000,000
30,000,000
40,000,000
50,000,000
60,000,000
70,000,000
80,000,000
Area Counts


Indan Calibration
y = 0.000244x + 79.1
R² = 1.00
Indan (µg/ml)
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
0
10,000,000
20,000,000
30,000,000
40,000,000
50,000,000
60,000,000
70,000,000
80,000,000
Area Counts


Indene Calibration
y = 0.000312x + 15.9
R² = 0.998
Indene (µg/ml)
800
700
600
500
400
300
200
100
0
0
500,000
1,000,000
1,500,000
2,000,000
2,500,000
Area Counts


Naphthalene Calibration
y = 0.000269x + 2 42
R² = 1.00
Naphthalene (µg/ml)
1200
1000
800
600
400
200
0
0
500,000
1,000,000
1,500,000
2,000,000
2,500,000
3,000,000
3,500,000
4,000,000
Area Counts

Raw Data

Includes the following:

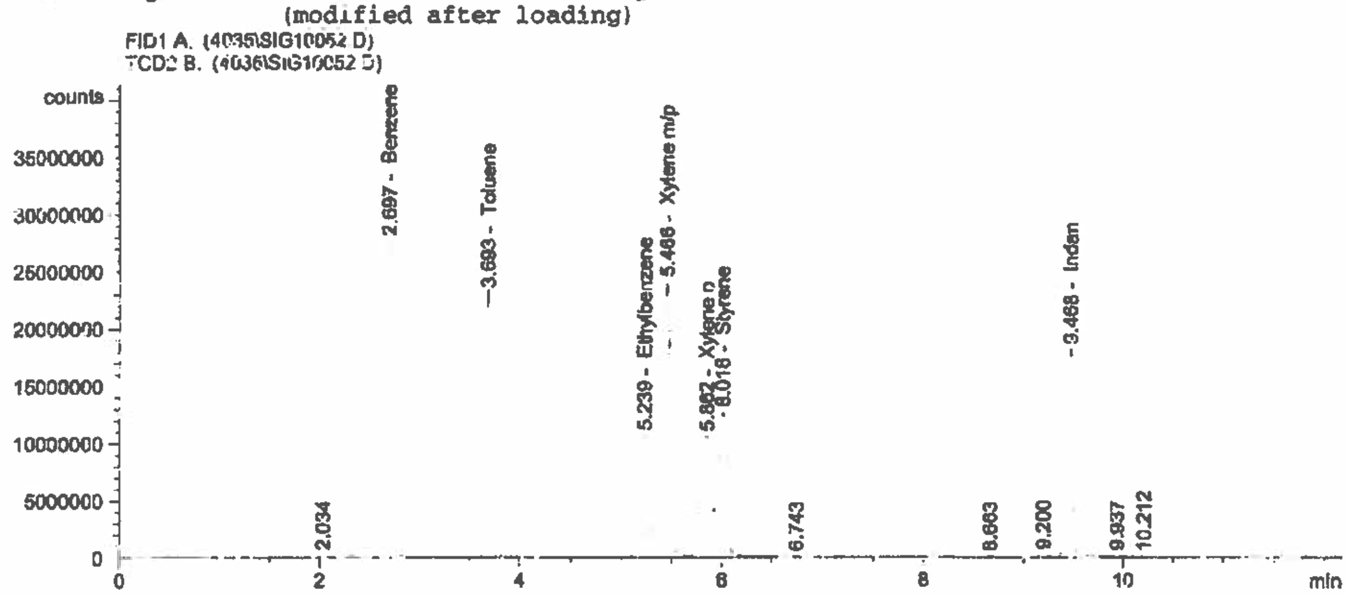
- **Pre Analysis Chromatograms**
- **Sample Chromatograms**
- **Post Analysis Chromatograms**

AIRTECH Environmental Services Inc.

STD High x20, 0.4 ul injection, run 1, 101612MO

===

Injection Date : 10/16/2012 11:13:03 AM
Sample Name : STD High x20 Location : Vial 1
Acq. Operator : mo
Acq. Instrument : Instrument 1 Inj Volume : External
Acq. Method : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed : 10/16/2012 11:10:04 AM by mo
(modified after loading)
Analysis Method : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed : 10/16/2012 11:29:22 AM by mo
(modified after loading)



===

External Standard Report (Sample Amount is 0!)

===

Sorted By : Retention Time
Calib. Data Modified : 10/16/2012 11:29:20 AM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,
Signal 2: TCD2 B,

RetTime [min]	Sig	Type	Area counts*s	Amt/Area	Amount [ng/ul]	Grp	Name
2.697	1	BB	8.18071e7	4.79078e-4	3.91920e4		Benzene
3.693	1	BB	7.33009e7	5.32823e-4	3.90564e4		Toluene
5.239	1	BV	6.53904e7	5.03984e-4	3.29557e4		Ethylbenzene
5.466	1	VV	1.46155e8	5.29711e-4	7.74252e4		Xylene m/p
5.862	1	VV	7.10864e7	8.86445e-4	6.30142e4		Xylene o
6.016	1	VV	7.13684e7	5.39555e-4	3.85072e4		Styrene
9.468	1	VV	7.59985e7	7.05665e-3	5.36295e5		Indan
9.477	1		-	-	-		Indene
11.184	1		-	-	-		Naphthalene

Totals : 8.26446e5

Results obtained with enhanced integrator!
2 Warnings or Errors :

Warning : Calibration warnings (see calibration table listing)

Warning : Calibrated compound(s) not found

===

*** End of Report ***

STD High x10, 0.4 ul injection, run 1, 101612MO

===

```
Injection Date   : 10/16/2012 11:30:48 AM
Sample Name      : STD High x10                     Location : Vial 1
Acq. Operator    : mo
Acq. Instrument  : Instrument 1                  Inj Volume : External
Method           : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed     : 10/16/2012 11:32:09 AM by mo
                   (modified after loading)
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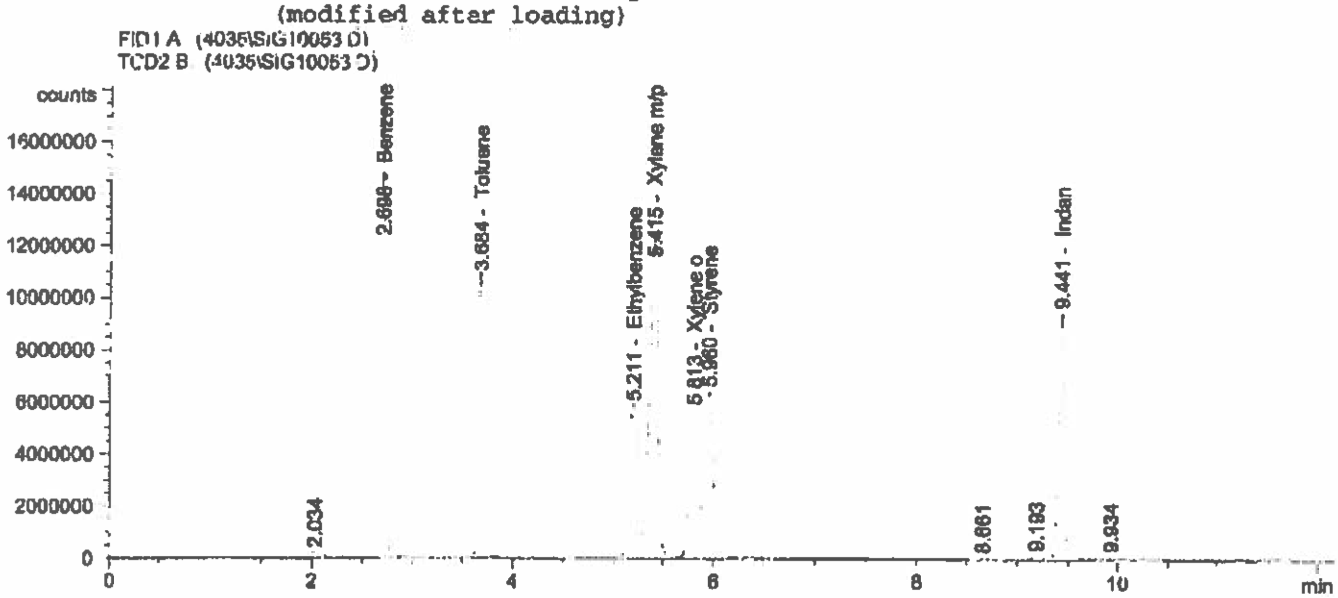


===

External Standard Report (Sample Amount is 0!)

===

```
Sorted By              :      Retention Time
Calib. Data Modified   :      10/16/2012 11:32:08 AM
Multiplier             :      1.0000
Dilution               :      1.0000
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: FID1 A,
Signal 2: TCD2 B,

RetTime [min]	Sig	Type	Area counts*s	Amt/Area	Amount [ng/ul]	Grp	Name
2.698	1	BB	3.76961e7	4.79078e-4	1.80594e4		Benzene
3.684	1	BB	3.47170e7	5.32823e-4	1.84980e4		Toluene
5.211	1	BV	3.18623e7	5.03984e-4	1.60581e4		Ethylbenzene
5.415	1	VV	6.97068e7	5.29711e-4	3.69245e4		Xylene m/p
5.813	1	VV	3.29178e7	8.86445e-4	2.91799e4		Xylene o
5.960	1	VB	3.55990e7	5.39555e-4	1.92076e4		Styrene
9.441	1	VV	3.67359e7	7.05665e-3	2.59232e5		Indan
9.500	1		-	-	-		Indene
11.184	1		-	-	-		Naphthalene

Totals : 3.97160e5

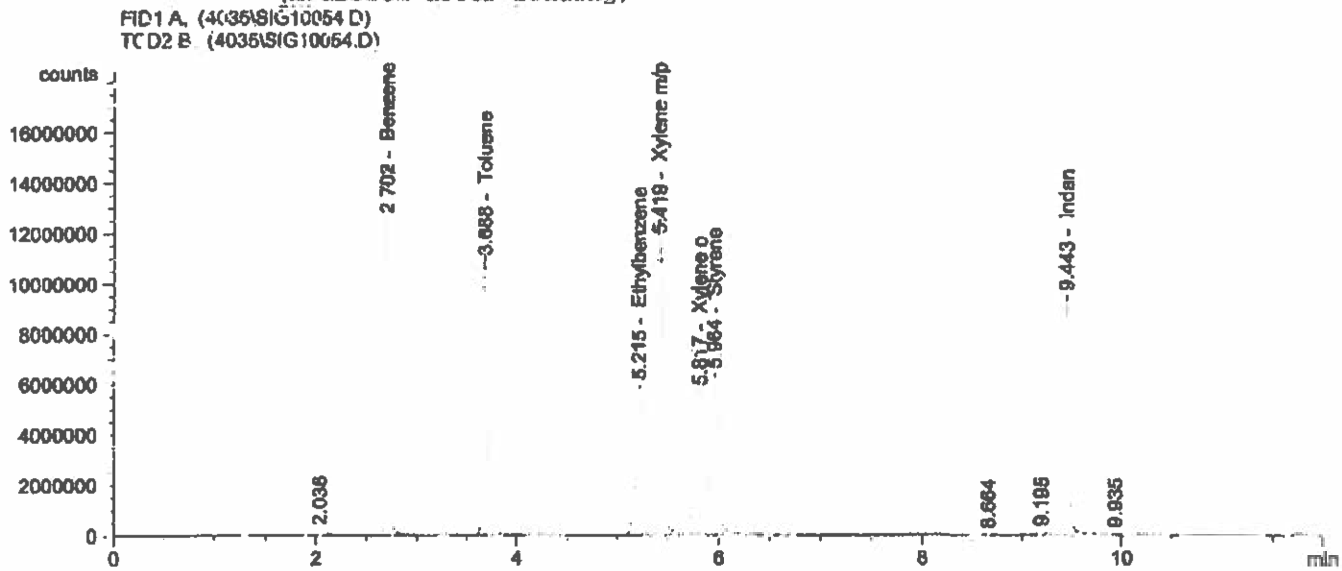
Results obtained with enhanced integrator!
2 Warnings or Errors :

Warning : Calibration warnings (see calibration table listing)
Warning : Calibrated compound(s) not found

===

STD High x10, 0.4 ul injection, run 2, 101612MO

===
Injection Date : 10/16/2012 11:48:00 AM
Sample Name : STD High x10 Location : Vial 1
Acq. Operator : mo
Acq. Instrument : Instrument 1 Inj Volume : External
Acq. Method : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed : 10/16/2012 11:32:09 AM by mo
(modified after loading)
Analysis Method : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed : 10/16/2012 12:52:27 PM by mo
(modified after loading)



===
External Standard Report (Sample Amount is 0!)
===

Sorted By : Retention Time
Calib. Data Modified : 10/16/2012 12:52:24 PM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,
Signal 2: TCD2 B,

RetTime [min]	Sig	Type	Area counts*s	Amt/Area	Amount [ng/ul]	Grp	Name
2.702	1	PB	3.81290e7	4.87437e-4	1.85855e4		Benzene
3.688	1	BB	3.49332e7	5.40214e-4	1.88714e4		Toluene
5.215	1	PV	3.19973e7	5.20652e-4	1.66594e4		Ethylbenzene
5.419	1	VV	6.99869e7	5.36560e-4	3.75522e4		Xylene m/p
5.817	1	VV	3.30332e7	7.98761e-4	2.63857e4		Xylene o
5.964	1	VB	3.57535e7	5.41877e-4	1.93740e4		Styrene
9.443	1	VV	3.66930e7	2.27293e-3	8.34007e4		Indan
9.500	1		-	-	-		Indene
11.184	1		-	-	-		Naphthalene

Totals : 2.20829e5

Results obtained with enhanced integrator!
2 Warnings or Errors :

Warning : Calibration warnings (see calibration table listing)

Warning : Calibrated compound(s) not found

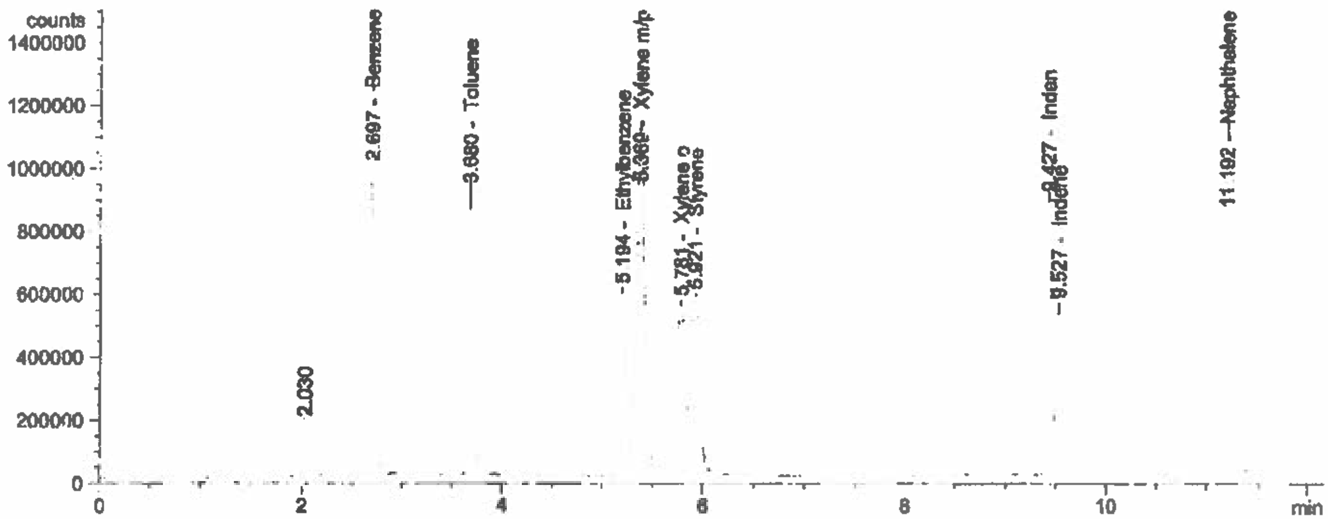
===

*** End of Report ***

STD High, 0.4 ul injection, run 1, 101612MO

===

Injection Date : 10/16/2012 12:53:58 PM
Sample Name : STD High Location : Vial 1
Acq. Operator : mo
Acq. Instrument : Instrument 1 Inj Volume : External
Acq. Method : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed : 10/16/2012 12:52:27 PM by mo
(modified after loading)
Analysis Method : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed : 10/16/2012 1:06:39 PM by mo
(modified after loading)



===

External Standard Report (Sample Amount is 0!)

===

Sorted By : Retention Time
Calib. Data Modified : Tuesday, October 16, 2012 1:06:39 PM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,
Signal 2: TCD2 B,

RetTime [min]	Sig	Type	Area counts*s	Amt/Area	Amount [ng/ul]	Grp	Name
2.697	1	BB	3.32115e6	5.75597e-4	1911.64413		Benzene
3.680	1	PB	3.16098e6	6.37363e-4	2014.68799		Toluene
5.194	1	PV	2.90884e6	5.99841e-4	1744.84169		Ethylbenzene
5.369	1	VV	6.37066e6	6.32945e-4	4032.27175		Xylene m/p
5.781	1	VV	2.90741e6	9.51218e-4	2765.57959		Xylene o
5.921	1	VB	3.56345e6	6.23065e-4	2219.80972		Styrene
9.427	1	VV	3.34557e6	2.67366e-3	8945.60730		Indan
9.527	1	VB	2.28359e6	1.79698e-8	4.10355e-2		Indene
11.192	1	PB	3.66265e6	2.51681e-7	9.21820e-1		Naphthalene

Totals : 3.36354e4

Results obtained with enhanced integrator!
1 Warnings or Errors :

Warning : Calibration warnings (see calibration table listing)

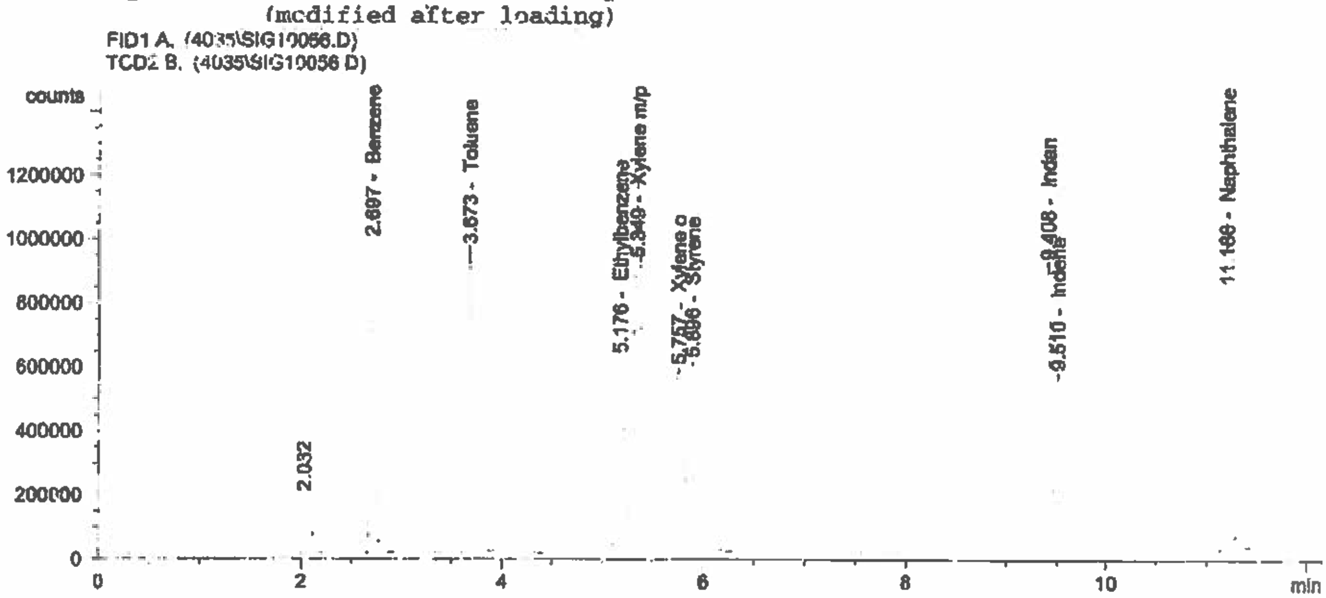
==

*** End of Report ***

STD High, 0.4 ul injection, run 2, 101612MO

===

```
Injection Date   : 10/16/2012 1:10:56 PM
Sample Name      : STD High                       Location : Vial 1
Acq. Operator    : mo
Acq. Instrument  : Instrument 1                 Inj Volume : External
Acq. Method      : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed     : 10/16/2012 1:19:54 PM by mo
                   (modified after loading)
Analysis Method  : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed     : 10/16/2012 1:24:09 PM by mo
                   (modified after loading)
```



===

External Standard Report (Sample Amount is 0!)

===

```
Sorted By            :     Retention Time
Calib. Data Modified :     Tuesday, October 16, 2012 1:24:09 PM
Multiplier           :     1.0000
Dilution             :     1.0000
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: FID1 A,
Signal 2: TCD2 B,

RetTime [min]	Sig	Type	Area counts*s	Amt/Area	Amount [ng/ul]	Grp	Name
2.697	1	PB	3.37868e6	8.23327e-4	2781.75316		Benzene
3.673	1	BB	3.21148e6	9.09459e-4	2920.70599		Toluene
5.176	1	BV	2.96212e6	8.25426e-4	2445.01406		Ethylbenzene
5.349	1	VV	6.53097e6	9.86271e-4	6441.30742		Xylene m/p
5.757	1	VV	2.96364e6	1.16494e-3	3452.47746		Xylene o
5.896	1	VB	3.67168e6	7.74278e-4	2842.90262		Styrene
9.408	1	VV	3.35978e6	3.35391e-3	1.12684e4		Indan
9.510	1	VB	2.17116e6	2.56824e-8	5.57605e-2		Indene
11.186	1	PB	3.78279e6	2.59135e-7	9.80255e-1		Naphthalene

Totals : 3.21536e4

Results obtained with enhanced integrator!
1 Warnings or Errors :

Warning : Calibration warnings (see calibration table listing)

===
*** End of Report ***

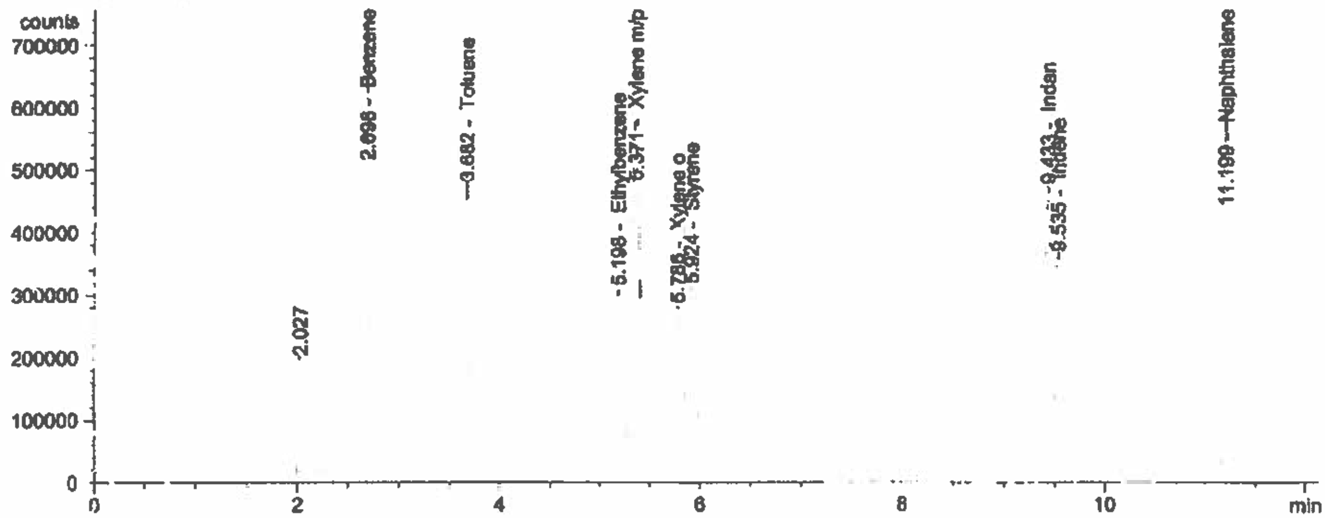
Data File C:\HPCHEM\1\DATA\4035\SIG10057.D Sample Name: STD Mid

STD Mid, 0.4 ul injection, run 1, 101612MO

===

Injection Date : 10/16/2012 1:28:27 PM
Sample Name : STD Mid Location : Vial 1
Acq. Operator : mo
Acq. Instrument : Instrument 1 Inj Volume : External
Method : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed : 10/16/2012 1:24:30 PM by mo
(modified after loading)

FID1 A, (4035\SIG10057.D)
TCD2 B, (4035\SIG10057.D)



===

External Standard Report (Sample Amount is 0!)

===

Sorted By : Retention Time
Calib. Data Modified : 10/16/2012 1:24:24 PM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,
Signal 2: TCD2 B,

RetTime [min]	Sig	Type	Area counts*s	Amt/Area	Amount [ng/ul]	Grp	Name
2.698	1	PB	1.65588e6	8.23327e-4	1363.32725		Benzene
3.682	1	PB	1.59494e6	9.09459e-4	1450.53095		Toluene
5.198	1	PV	1.41793e6	8.25426e-4	1170.39223		Ethylbenzene
5.371	1	VV	3.26680e6	9.86271e-4	3221.94992		Xylene m/p
5.786	1	VV	1.36316e6	1.16494e-3	1588.00904		Xylene o
5.924	1	VB	1.87702e6	7.74278e-4	1453.33649		Styrene
9.433	1	VV	1.65054e6	3.35391e-3	5535.73893		Indan
9.535	1	VB	1.43071e6	2.56824e-8	3.67440e-2		Indene
11.199	1	PB	1.87007e6	2.59135e-7	4.84601e-1		Naphthalene

Totals : 1.57838e4

Results obtained with enhanced integrator!
1 Warnings or Errors :

Warning : Calibration warnings (see calibration table listing)

===

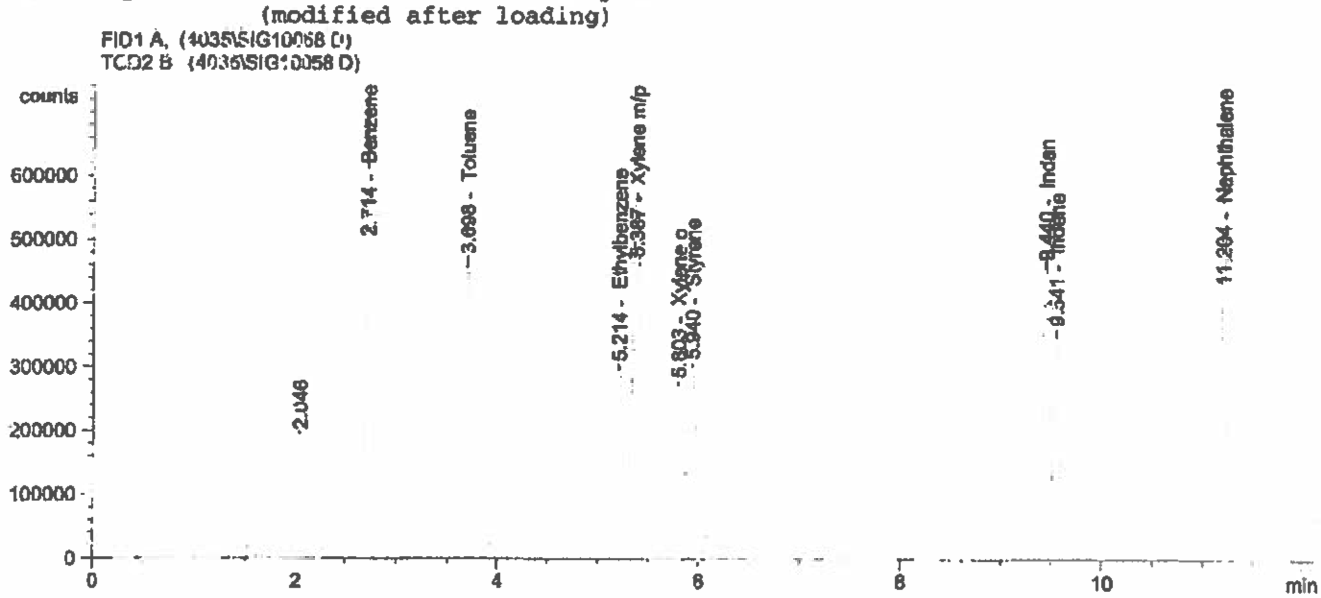
*** End of Report ***

Data File C:\HPCHEM\1\DATA\4035\SIG10058.D Sample Name: STD Mid

STD Mid, 0.4 ul injection, run 2, 101612MO

===

Injection Date : 10/16/2012 1:45:09 PM
Sample Name : STD Mid Location : Vial 1
Acq. Operator : mo
Acq. Instrument : Instrument 1 Inj Volume : External
Acq. Method : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed : 10/16/2012 1:56:28 PM by mo
(modified after loading)
Analysis Method : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed : 10/16/2012 1:59:32 PM by mo
(modified after loading)



===
External Standard Report (Sample Amount is 0!)
===

Sorted By : Retention Time
Calib. Data Modified : Tuesday, October 16, 2012 1:59:32 PM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,
Signal 2: TCD2 B,

RetTime [min]	Sig	Type	Area counts*s	Amt/Area	Amount [ng/ul]	Grp	Name
2.714	1	PB	1.60729e6	2.50362e-3	4024.05012		Benzene
3.698	1	BB	1.53854e6	1.69987e-3	2615.32413		Toluene
5.214	1	BV	1.38404e6	1.20369e-3	1665.95504		Ethylbenzene
5.387	1	VV	3.16775e6	1.42326e-3	4508.54044		Xylene m/p
5.803	1	VV	1.33168e6	1.60961e-3	2143.47509		Xylene o
5.940	1	VB	1.80960e6	1.00858e-3	1825.12939		Styrene
9.440	1	VV	1.64347e6	4.02646e-3	6617.37603		Indan
9.541	1	VB	1.42518e6	3.18119e-8	4.53378e-2		Indene
11.204	1	PB	1.84933e6	3.37176e-7	6.23552e-1		Naphthalene

Totals : 2.34005e4

Results obtained with enhanced integrator!
1 Warnings or Errors :

Warning : Calibration warnings (see calibration table listing)

==

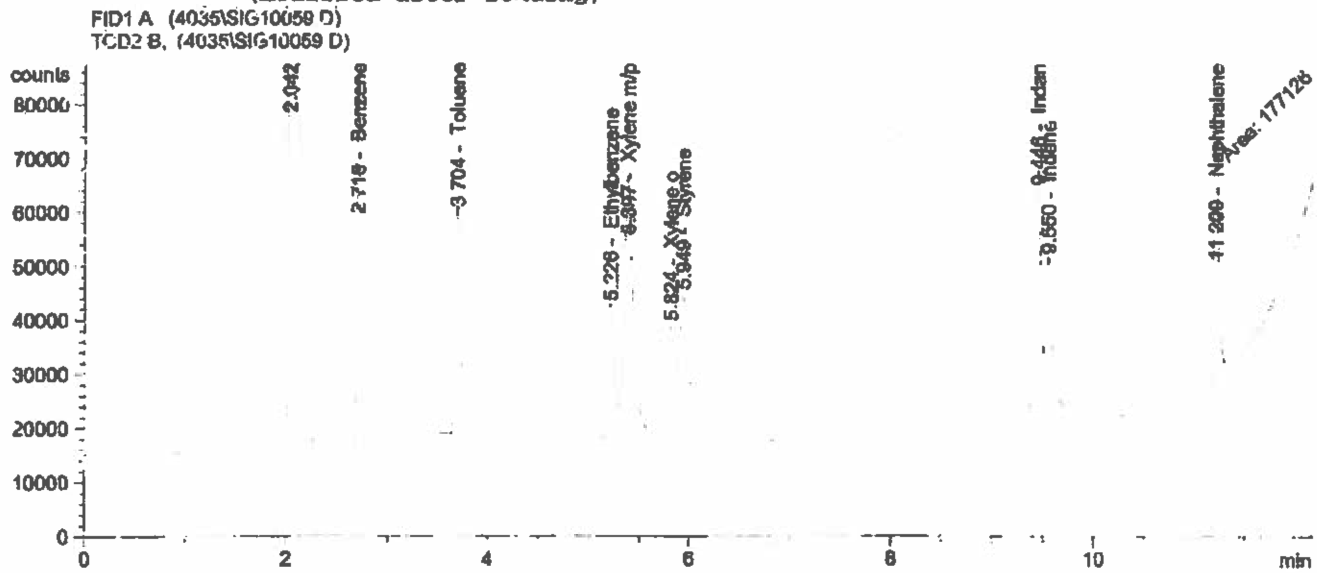
*** End of Report ***

Data File C:\HPCHEM\1\DATA\4035\SIG10059.D Sample Name: STD Mid Low

STD ~~Mid~~ Low 0.4 ul injection, run 2, 101612MO

===

Injection Date : 10/16/2012 2:02:08 PM
Sample Name : STD ~~Mid~~ Low Location : Vial 1
Acq. Operator : mo
Acq. Instrument : Instrument 1 Inj Volume : External
Method : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed : 10/16/2012 1:59:54 PM by mo
(modified after loading)



===

External Standard Report (Sample Amount is 0!)

===

Sorted By : Retention Time
Calib. Data Modified : 10/16/2012 1:59:49 PM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,
Signal 2: TCD2 B,

RetTime [min]	Sig	Type	Area counts*s	Amt/Area	Amount [ng/ul]	Grp	Name
2.716	1	PB	1.63016e5	2.50362e-3	408.12939		Benzene
3.704	1	BB	1.53776e5	1.69987e-3	261.39930		Toluene
5.226	1	PV	1.29735e5	1.20369e-3	156.16153		Ethylbenzene
5.397	1	VB	3.10336e5	1.42326e-3	441.68892		Xylene m/p
5.824	1	BV	1.08695e5	1.60961e-3	174.95650		Xylene o
5.949	1	VB	1.85884e5	1.00858e-3	187.47918		Styrene
9.446	1	BV	1.67593e5	4.02646e-3	674.80819		Indan
9.550	1	VB	1.21522e5	3.18119e-8	3.86586e-3		Indene
11.209	1	MM	1.77126e5	3.37176e-7	5.97228e-2		Naphthalene

Totals : 2304.68651

Results obtained with enhanced integrator!
1 Warnings or Errors :

Warning : Calibration warnings (see calibration table listing)

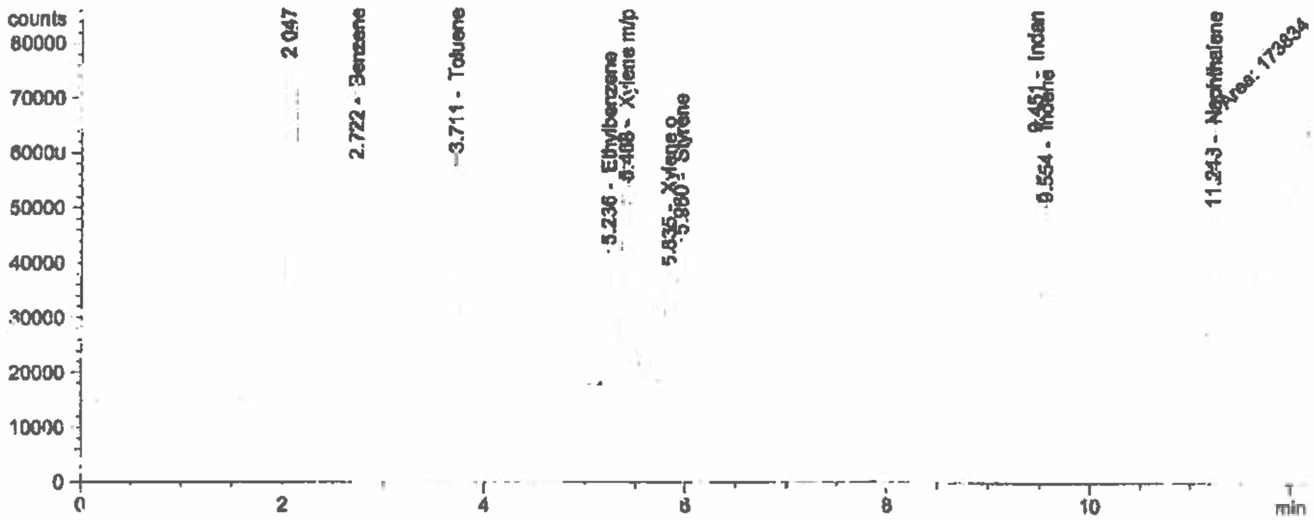
===

*** End of Report ***

STD Low, 0.4 ul injection, run 2, 101612MO

```
=====================================================================
Injection Date  : 10/16/2012 2:20:32 PM
Sample Name     : STD Low                          Location : Vial 1
Acq. Operator   : mo
Acq. Instrument : Instrument 1                   Inj Volume : External
Method          : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed    : 10/16/2012 1:59:54 PM by mo
                  (modified after loading)
```

FID1 A, (4035\SIG10060.D)
TCD2 B, (4035\SIG10060.D)




```
=====================================================================
          External Standard Report (Sample Amount is 0!)
=====================================================================

Sorted By              :    Retention Time
Calib. Data Modified   :    10/16/2012 1:59:49 PM
Multiplier             :    1.0000
Dilution               :    1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,
Signal 2: TCD2 B,
```

RetTime [min]	Sig	Type	Area counts*s	Amt/Area	Amount [ng/ul]	Grp	Name
2.722	1	PB	1.60778e5	2.50362e-3	402.52708		Benzene
3.711	1	BB	1.50745e5	1.69987e-3	256.24678		Toluene
5.236	1	PV	1.26469e5	1.20369e-3	152.22983		Ethylbenzene
5.408	1	VB	3.04584e5	1.42326e-3	433.50325		Xylene m/p
5.835	1	BV	1.06432e5	1.60961e-3	171.31380		Xylene o
5.960	1	VB	1.83651e5	1.00858e-3	185.22691		Styrene
9.451	1	BV	1.65201e5	4.02646e-3	665.17357		Indan
9.554	1	VB	1.20270e5	3.18119e-8	3.82602e-3		Indene
11.213	1	MM	1.73834e5	3.37176e-7	5.86128e-2		Naphthalene

```
Totals :                                   2266.28366

 Results obtained with enhanced integrator!
1 Warnings or Errors :

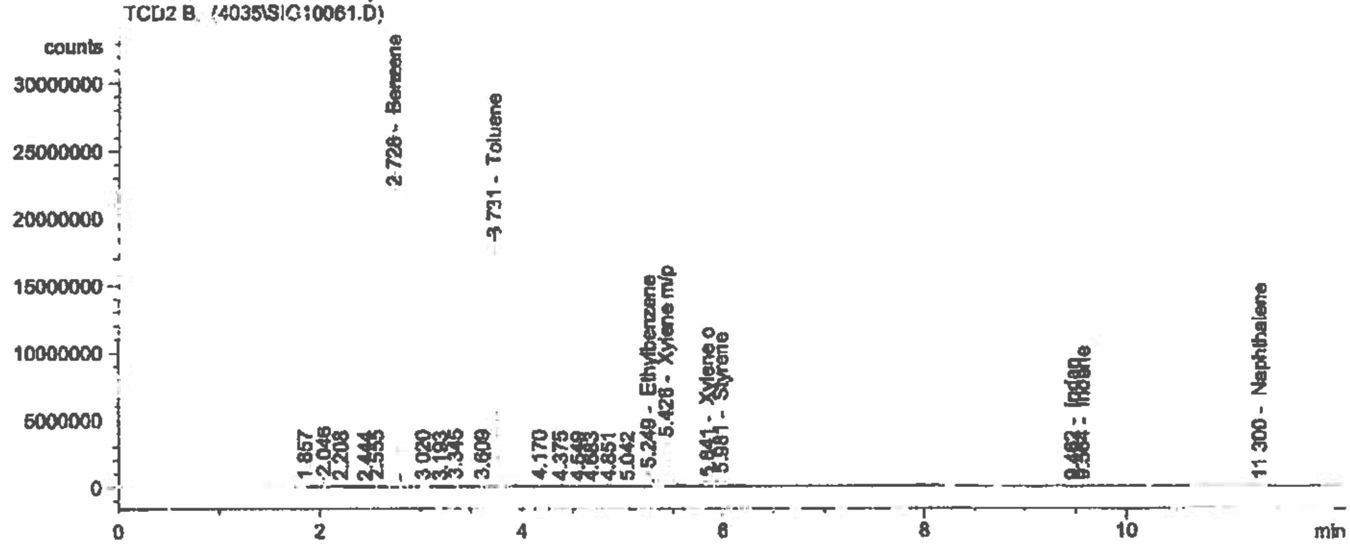
Warning : Calibration warnings (see calibration table listing)

=====================================================================
                         *** End of Report ***
```

Run 2 Inlet A Tube 1, 0.4 ul injection, run 1, 101612MO

===

Injection Date : 10/16/2012 2:42:18 PM
Sample Name : R2 Inlet A T1 Location : Vial 1
Acq. Operator : mo
Acq. Instrument : Instrument 1 Inj Volume : External
Acq. Method : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed : 10/16/2012 2:53:28 PM by mo
(modified after loading)
Analysis Method : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed : 10/16/2012 2:58:52 PM by mo
(modified after loading)



===

External Standard Report (Sample Amount is 0!)

===

Sorted By : Retention Time
Calib. Data Modified : 10/16/2012 1:59:49 PM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,
Signal 2: TCD2 B,

RetTime [min]	Sig	Type	Area counts*s	Amt/Area	Amount [ng/ul]	Grp	Name
2.728	1	VV	7.46913e7	2.50362e-3	1.86998e5		Benzene
3.731	1	VV	6.18171e7	1.69987e-3	1.05081e5		Toluene
5.249	1	VV	4.78720e6	1.20369e-3	5762.31355		Ethylbenzene
5.426	1	VB	1.79302e7	1.42326e-3	2.55193e4		Xylene m/p
5.841	1	BV	1.46358e6	1.60961e-3	2355.78119		Xylene o
5.981	1	VV	3.39893e6	1.00858e-3	3428.09264		Styrene
9.462	1	PV	1.16901e5	4.02646e-3	470.69590		Indan
9.564	1	VV	2.22192e5	3.18119e-8	7.06836e-3		Indene
11.300	1	BP	1.08223e5	3.37176e-7	3.64903e-2		Naphthalene

Totals : 3.29616e5

Results obtained with enhanced integrator!
1 Warnings or Errors :

Warning : Calibration warnings (see calibration table listing)

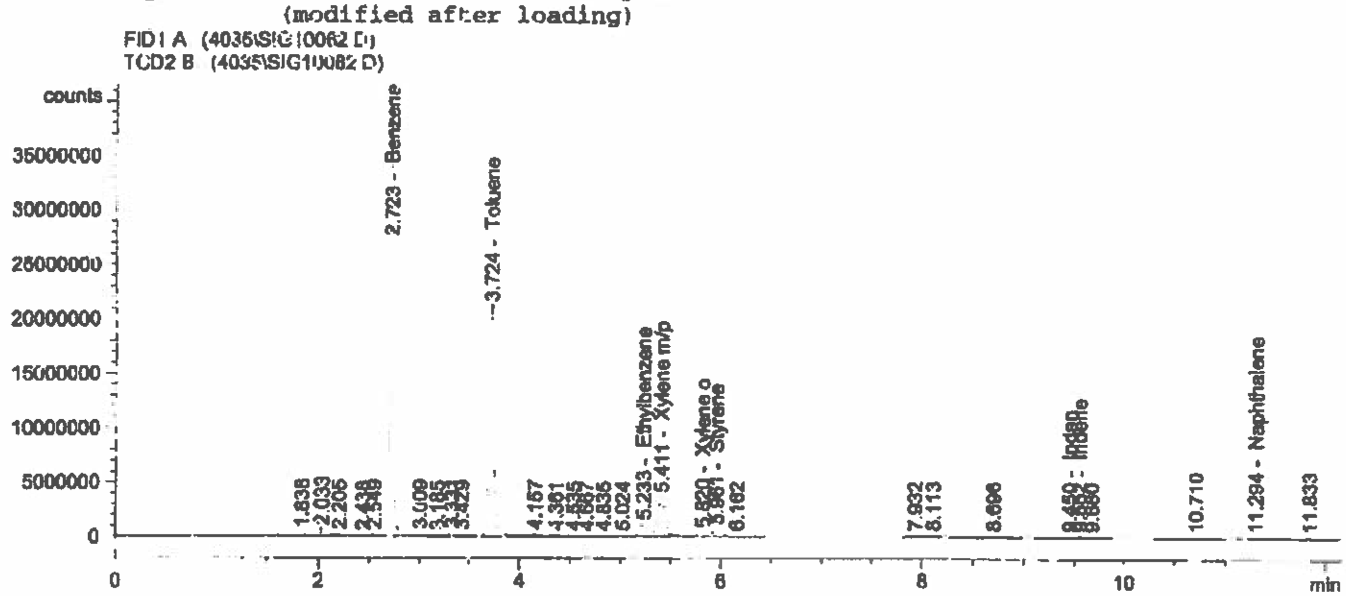
==

*** End of Report ***

Run 2 Inlet A Tube 1, 0.4 ul injection, run 2, 101612MO

===

```
Injection Date  : 10/16/2012 3:00:23 PM
Sample Name     : R2 Inlet A T1                  Location : Vial 1
Acq. Operator   : mo
Acq. Instrument : Instrument 1                 Inj Volume : External
Method          : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed    : 10/16/2012 2:58:52 PM by mo
                  (modified after loading)
```



===

External Standard Report (Sample Amount is 0!)

===

```
Sorted By               :     Retention Time
Calib. Data Modified    :     10/16/2012 1:59:49 PM
Multiplier              :     1.0000
Dilution                :     1.0000
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: FID1 A,
Signal 2: TCD2 B,

RetTime [min]	Sig	Type	Area counts*s	Amt/Area	Amount [ng/ul]	Grp	Name
2.723	1	VV	8.22469e7	2.50362e-3	2.05915e5		Benzene
3.724	1	VV	6.79383e7	1.69987e-3	1.15469e5		Toluene
5.233	1	VV	5.23377e6	1.20369e-3	6299.84129		Ethylbenzene
5.411	1	VB	1.93837e7	1.42326e-3	2.75881e4		Xylene m/p
5.820	1	BV	1.64819e6	1.60961e-3	2652.93248		Xylene o
5.961	1	VV	3.65886e6	1.00858e-3	3690.25178		Styrene
9.450	1	PV	1.36499e5	4.02646e-3	549.60799		Indan
9.552	1	VV	2.49504e5	3.18119e-8	7.93721e-3		Indene
11.294	1	BP	1.25366e5	3.37176e-7	4.22705e-2		Naphthalene

Totals : 3.62165e5

Results obtained with enhanced integrator!
1 Warnings or Errors :

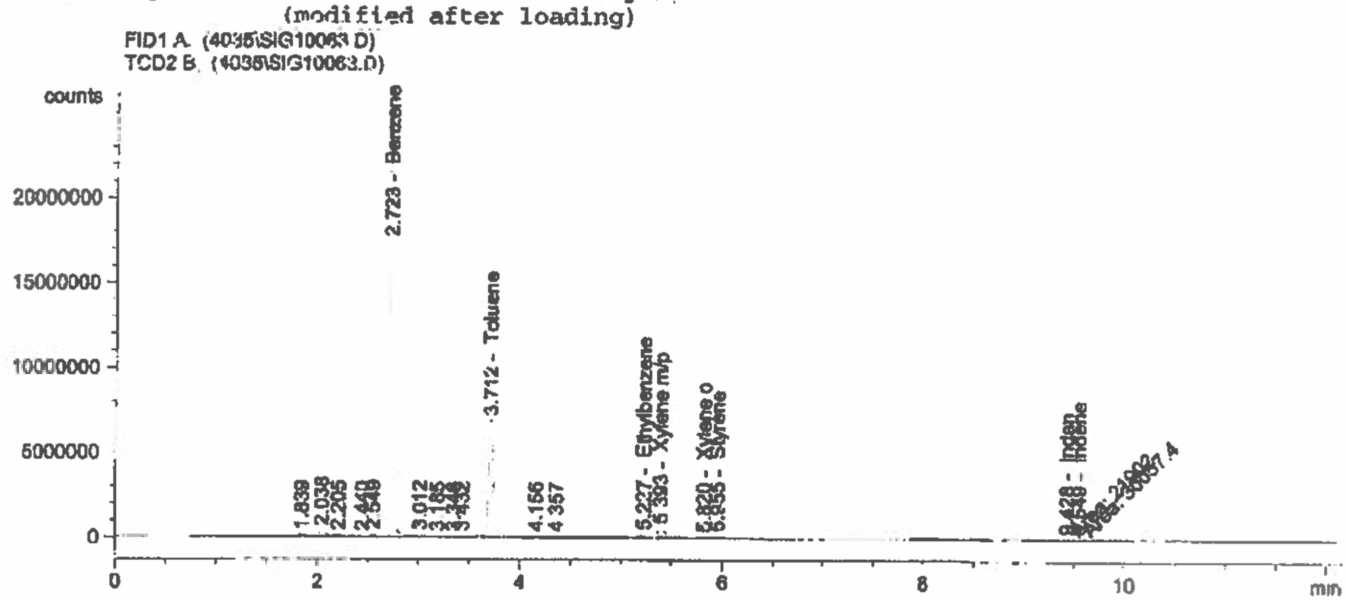
Warning : Calibration warnings (see calibration table listing)

===

*** End of Report ***

Run 2 Inlet A Tube 2, 0.4 ul injection, run 1, 101612MO

===
Injection Date : 10/16/2012 3:17:27 PM
Sample Name : R2 Inlet A T2 Location : Vial 1
Acq. Operator : mo
Acq. Instrument : Instrument 1 Inj Volume : External
Acq. Method : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed : 10/16/2012 2:58:52 PM by mo
(modified after loading)
Analysis Method : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed : 10/16/2012 3:35:01 PM by mo
(modified after loading)



===
External Standard Report (Sample Amount is 0!)
===

Sorted By : Retention Time
Calib. Data Modified : 10/16/2012 1:59:49 PM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,
Signal 2: TCD2 B,

RetTime [min]	Sig	Type	Area counts*s	Amt/Area	Amount [ng/ul]	Grp	Name
2.723	1	VV	5.60602e7	2.50362e-3	1.40353e5		Benzene
3.712	1	VB	2.27365e7	1.69987e-3	3.86491e4		Toluene
5.227	1	PV	8.21007e5	1.20369e-3	988.23959		Ethylbenzene
5.393	1	VB	2.93854e6	1.42326e-3	4182.31979		Xylene m/p
5.820	1	BV	2.50614e5	1.60961e-3	403.39043		Xylene o
5.955	1	VB	4.80306e5	1.00858e-3	484.42711		Styrene
9.428	1	MF	2.19020e4	4.02646e-3	88.18733		Indan
9.549	1	MM	3.00574e4	3.18119e-8	9.56183e-4		Indene
11.194	1		-	-	-		Naphthalene

Totals : 1.85149e5

Results obtained with enhanced integrator!
2 Warnings or Errors :

Warning : Calibration warnings (see calibration table listing)

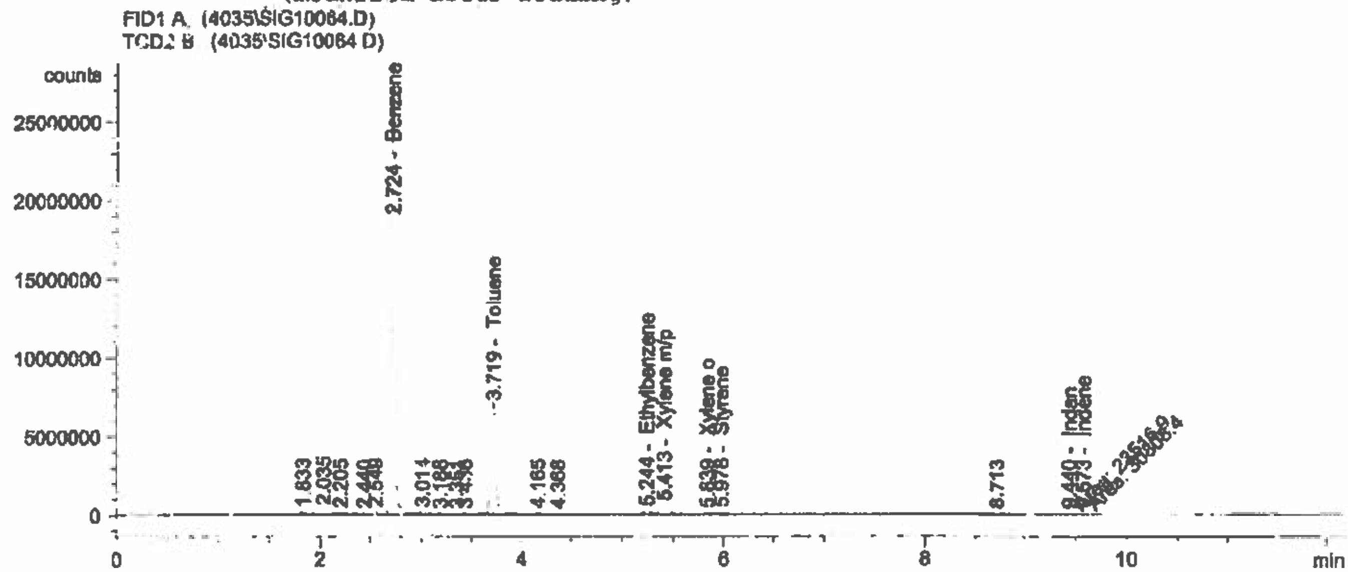
Warning : Calibrated compound(s) not found

==
*** End of Report ***

Run 2 Inlet A Tube 2, 0.4 ul injection, run 2, 101612MO

===

Injection Date : 10/16/2012 3:41:49 PM
Sample Name : R2 Inlet A T2 Location : Vial 1
Acq. Operator : mo
Acq. Instrument : Instrument 1 Inj Volume : External
Method : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed : 10/16/2012 3:35:01 PM by mo
(modified after loading)



===

External Standard Report (Sample Amount is 0!)

===

Sorted By : Retention Time
Calib. Data Modified : 10/16/2012 1:59:49 PM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,
Signal 2: TCD2 B,

RetTime [min]	Sig	Type	Area counts*s	Amt/Area	Amount [ng/ul]	Grp	Name
2.724	1	VV	5.68176e7	2.50362e-3	1.42250e5		Benzene
3.719	1	VB	2.29300e7	1.69987e-3	3.89781e4		Toluene
5.244	1	PV	8.48265e5	1.20369e-3	1021.04899		Ethylbenzene
5.413	1	VB	2.93968e6	1.42326e-3	4183.93839		Xylene m/p
5.839	1	BV	2.70759e5	1.60961e-3	435.81477		Xylene o
5.978	1	VB	4.66507e5	1.00858e-3	470.51040		Styrene
9.440	1	MF	2.35169e4	4.02646e-3	94.68992		Indan
9.573	1	MF	3.08084e4	3.18119e-8	9.80072e-4		Indene
11.194	1		-	-	-		Naphthalene

Totals : 1.87434e5

Results obtained with enhanced integrator!
2 Warnings or Errors :

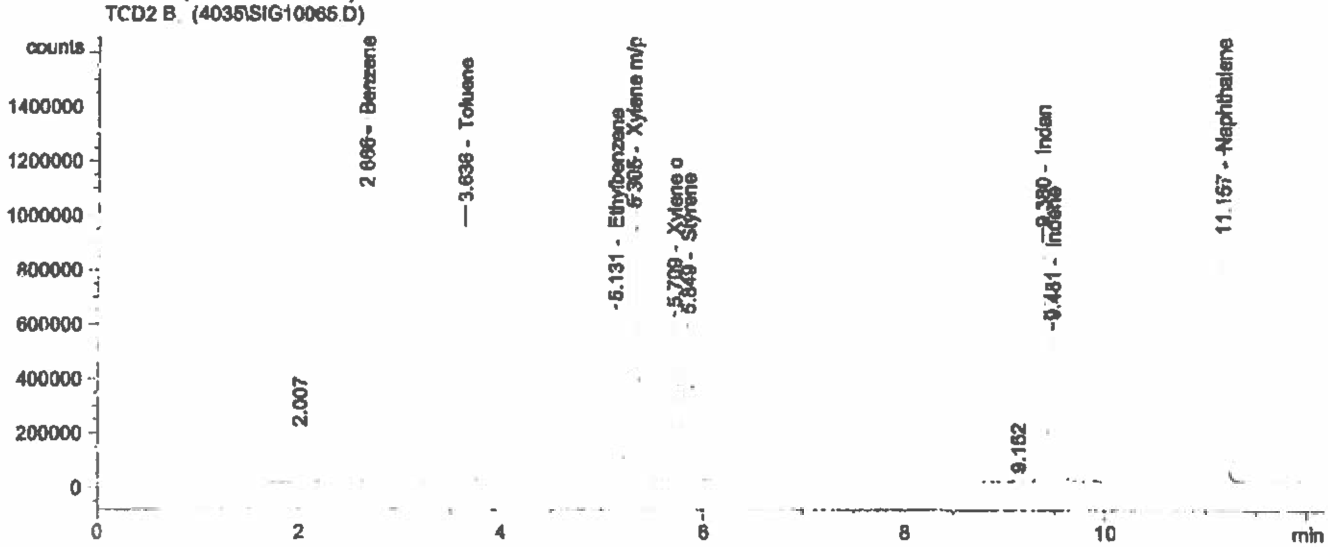
Warning : Calibration warnings (see calibration table listing)
Warning : Calibrated compound(s) not found

===

high cal, 0.4 ul injection, run 1, 101612MO

===

Injection Date : 10/17/2012 8:21:00 AM
Sample Name : drift check high   Location : Vial 1
Acq. Operator : mo
Acq. Instrument : Instrument 1   Inj Volume : External
Acq. Method : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed : 10/16/2012 3:35:01 PM by mo
(modified after loading)
Analysis Method : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed : 10/17/2012 8:34:55 AM by mo
(modified after loading)



===

External Standard Report (Sample Amount is 0!)

===

Sorted By : Retention Time
Calib. Data Modified : Wednesday, October 17, 2012 8:34:55 AM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,
Signal 2: TCD2 B,

RetTime [min]	Sig	Type	Area counts*s	Amt/Area	Amount [ng/ul]	Grp	Name
2.666	1	BB	3.36038e6	5.94575e-3	1.99800e4		Benzene
3.636	1	BB	3.24446e6	6.15820e-3	1.99800e4		Toluene
5.131	1	BV	3.13047e6	6.37603e-3	1.99600e4		Ethylbenzene
5.305	1	VB	6.45448e6	6.13528e-3	3.96000e4		Xylene m/p
5.709	1	BV	3.27820e6	5.97888e-3	1.96000e4		Xylene o
5.849	1	VB	3.39414e6	5.83359e-3	1.98000e4		Styrene
9.380	1	VV	3.43800e6	5.52648e-3	1.90000e4		Indan
9.481	1	VB	2.13462e6	4.68468e-7	1.00000		Indene
11.157	1	BB	3.78166e6	2.64434e-7	1.00000		Naphthalene

Totals : 1.57922e5

Results obtained with enhanced integrator!
1 Warnings or Errors :

Warning : Calibration warnings (see calibration table listing)

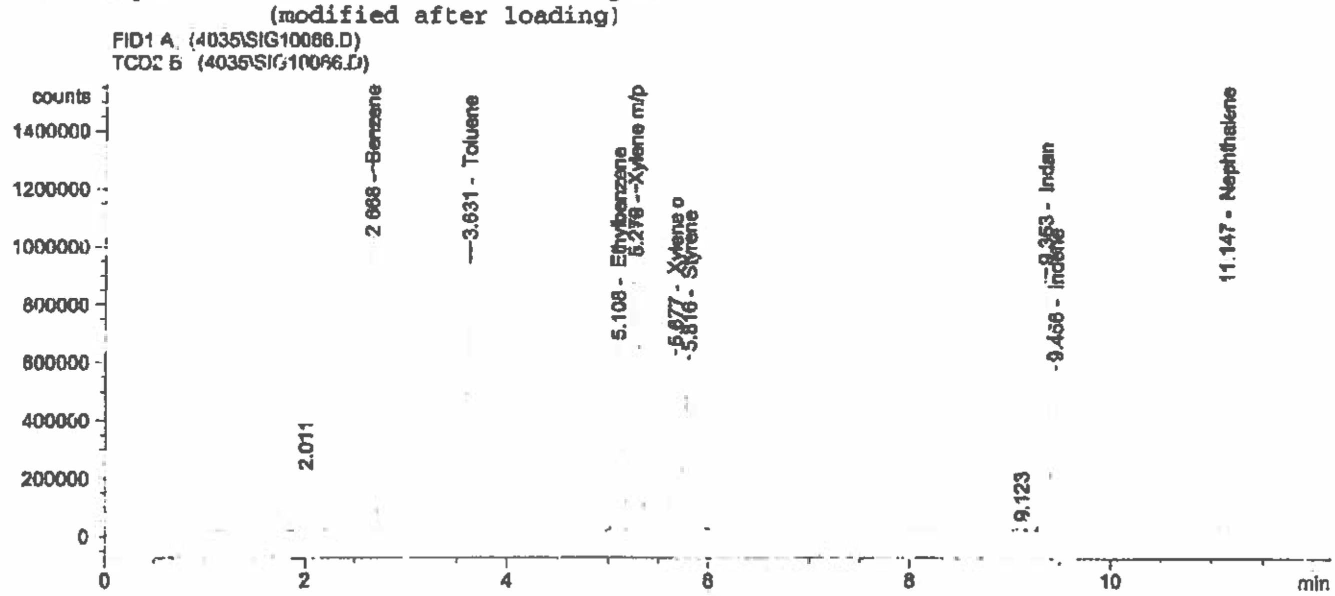
===

*** End of Report ***

high cal, 0.4 ul injection, run 1, 101612MO

===

```
Injection Date  : 10/17/2012 8:37:42 AM
Sample Name     : drift check high              Location : Vial 1
Acq. Operator   : mo
Acq. Instrument : Instrument 1               Inj Volume : External
Method          : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed    : 10/17/2012 8:35:20 AM by mo
                  (modified after loading)
```



===

External Standard Report (Sample Amount is 0!)

===

```
Sorted By              :      Retention Time
Calib. Data Modified   :      10/17/2012 8:35:17 AM
Multiplier             :      1.0000
Dilution               :      1.0000
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: FID1 A,
Signal 2: TCD2 B,

RetTime [min]	Sig	Type	Area counts*s	Amt/Area	Amount [ng/ul]	Grp	Name
2.668	1	PB	3.37639e6	5.94575e-3	2.00752e4		Benzene
3.631	1	BB	3.24938e6	6.15820e-3	2.00103e4		Toluene
5.108	1	BV	3.11727e6	6.37603e-3	1.98758e4		Ethylbenzene
5.279	1	VB	6.49923e6	6.13528e-3	3.98746e4		Xylene m/p
5.677	1	BV	3.25332e6	5.97888e-3	1.94512e4		Xylene o
5.816	1	VB	3.43325e6	5.83359e-3	2.00282e4		Styrene
9.353	1	VV	3.41983e6	5.52648e-3	1.88995e4		Indan
9.456	1	VB	2.14593e6	4.68468e-7	1.00530		Indene
11.147	1	PB	3.77910e6	2.64434e-7	9.99324e-1		Naphthalene

Totals : 1.58217e5

Results obtained with enhanced integrator!
1 Warnings or Errors :

Warning : Calibration warnings (see calibration table listing)

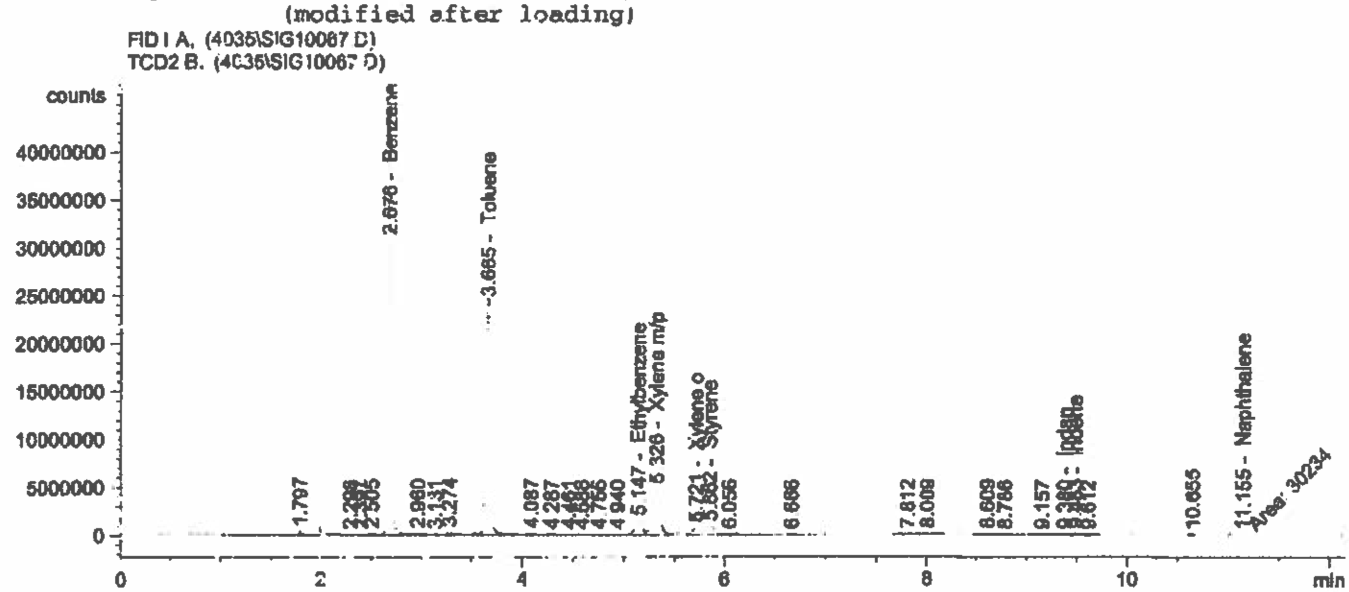
===

*** End of Report ***

high cal, 0.4 ul injection, run 1, 101612MO

===

```
Injection Date  : 10/17/2012 9:00:53 AM
Sample Name     : drift check high                 Location : Vial 1
Acq. Operator   : mo
Acq. Instrument : Instrument 1                   Inj Volume : External
Acq. Method     : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed    : 10/17/2012 8:35:20 AM by mo
                  (modified after loading)
Analysis Method : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed    : 10/17/2012 9:13:58 AM by mo
                  (modified after loading)
```



===

External Standard Report (Sample Amount is 0!)

===

```
Sorted By             :     Retention Time
Calib. Data Modified  :     10/17/2012 9:14:14 AM
Multiplier            :     1.0000
Dilution              :     1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,
Signal 2: TCD2 B,
```

RetTime [min]	Sig	Type	Area counts*s	Amt/Area	Amount [ng/ul]	Grp	Name
2.676	1	VV	9.14250e7	2.18540e-4	1.99800e4		Benzene
3.665	1	VV	7.78548e7	2.56632e-4	1.99800e4		Toluene
5.147	1	VV	7.15705e6	2.78896e-3	1.99600e4		Ethylbenzene
5.326	1	VV	2.55871e7	1.54765e-3	3.96000e4		Xylene m/p
5.721	1	VV	3.84480e6	5.09779e-3	1.96000e4		Xylene o
5.863	1	VV	4.93229e6	4.01437e-3	1.98000e4		Styrene
9.380	1	VV	2.61462e5	7.26682e-2	1.90000e4		Indan
9.483	1	VV	4.09074e5	2.44455e-6	1.00000		Indene
11.155	1	MM	3.02340e4	1.83394e-5	5.54474e-1		Naphthalene

Totals : 1.57922e5

Results obtained with enhanced integrator!
1 Warnings or Errors :

Warning : Calibration warnings (see calibration table listing)

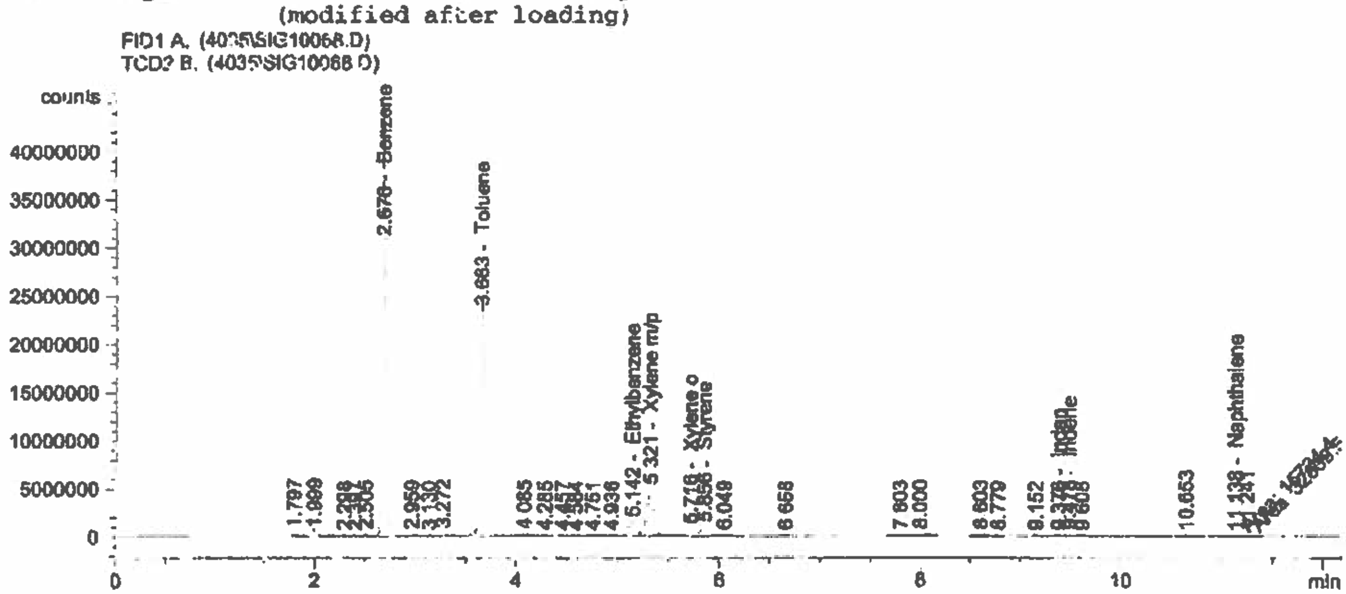
==
*** End of Report ***

Data File C:\HPCHEM\1\DATA\4035\SIG10068.D Sample Name: R2 Inlet B T1

Run 2 Inlet B F1/2, 0.4 ul injection, run 2, 101712MO

===

```
Injection Date   : 10/17/2012 9:19:14 AM
Sample Name      : R2 Inlet B T1                    Location : Vial 1
Acq. Operator    : mo
Acq. Instrument  : Instrument 1                    Inj Volume : External
Method           : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed     : 10/17/2012 9:13:58 AM by mo
                   (modified after loading)
```



===

External Standard Report (Sample Amount is 0!)

===

```
Sorted By              :      Retention Time
Calib. Data Modified   :      10/17/2012 9.14.14 AM
Multiplier             :      1.0000
Dilution               :      1.0000
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: FID1 A,
Signal 2: TCD2 B,

RetTime [min]	Sig	Type	Area counts*s	Amt/Area	Amount [ng/ul]	Grp	Name
2.676	1	VV	9.15564e7	2.18540e-4	2.00109e4		Benzene
3.663	1	VV	7.81952e7	2.56632e-4	2.00674e4		Toluene
5.143	1	VV	7.19924e6	2.78886e-3	2.00777e4		Ethylbenzene
5.321	1	VV	2.57302e7	1.54765e-3	3.98215e4		Xylene m/p
5.716	1	VV	3.87938e6	5.09779e-3	1.97762e4		Xylene o
5.856	1	VV	4.97833e6	4.01437e-3	1.99848e4		Styrene
9.376	1	VV	2.49724e5	7.26682e-2	1.81470e4		Indan
9.478	1	VV	4.07606e5	2.44455e-6	9.96413e-1		Indene
11.138	1	MF	1.57244e4	1.83394e-5	2.88376e-1		Naphthalene

Totals : 1.57887e5

Results obtained with enhanced integrator!
1 Warnings or Errors :

Warning : Calibration warnings (see calibration table listing)

===

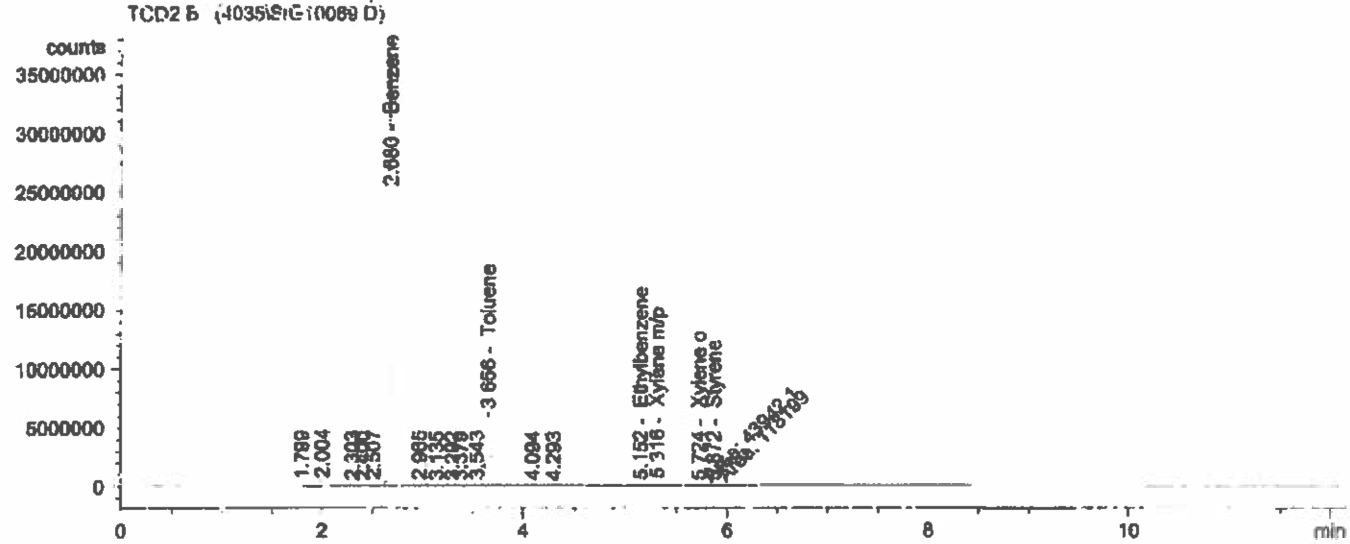
*** End of Report ***

Data File C:\HPCHEM\1\DATA\4035\SIG10069.D Sample Name: R2 Inlet B T2

Run 2 Inlet B B1/2, 0.4 ul injection, run 1, 101712MO

===

```
Injection Date   : 10/17/2012 9:43:32 AM
Sample Name      : R2 Inlet B T2                 Location : Vial 1
Acq. Operator    : mo
Acq. Instrument  : Instrument 1                Inj Volume : External
Method           : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed     : 10/17/2012 9:13:58 AM by mo
                   (modified after loading)
```



===

External Standard Report (Sample Amount is 0!)

===

```
Sorted By              :      Retention Time
Calib. Data Modified   :      10/17/2012 9:14:14 AM
Multiplier             :      1.0000
Dilution               :      1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,
Signal 2: TCD2 B,
```

RetTime [min]	Sig	Type	Area counts*s	Amt/Area	Amount [ng/ul]	Grp	Name
2.680	1	VV	7.47414e7	3.18540e-4	1.63340e4		Benzene
3.656	1	VB	1.97824e7	2.56632e-4	5076.77772		Toluene
5.152	1	FV	3.43375e5	2.78856e-3	957.62459		Ethylbenzene
5.316	1	VB	1.00581e6	1.54765e-3	1556.64512		Xylene m/p
5.724	1	MF	4.39421e4	5.09779e-3	224.00741		Xylene o
5.872	1	FM	1.18199e5	4.01437e-3	474.49367		Styrene
9.380	1		-	-	-		Indan
9.483	1		-	-	-		Indene
11.155	1		-	-	-		Naphthalene

Totals : 2.46235e4

Results obtained with enhanced integrator!
2 Warnings or Errors :

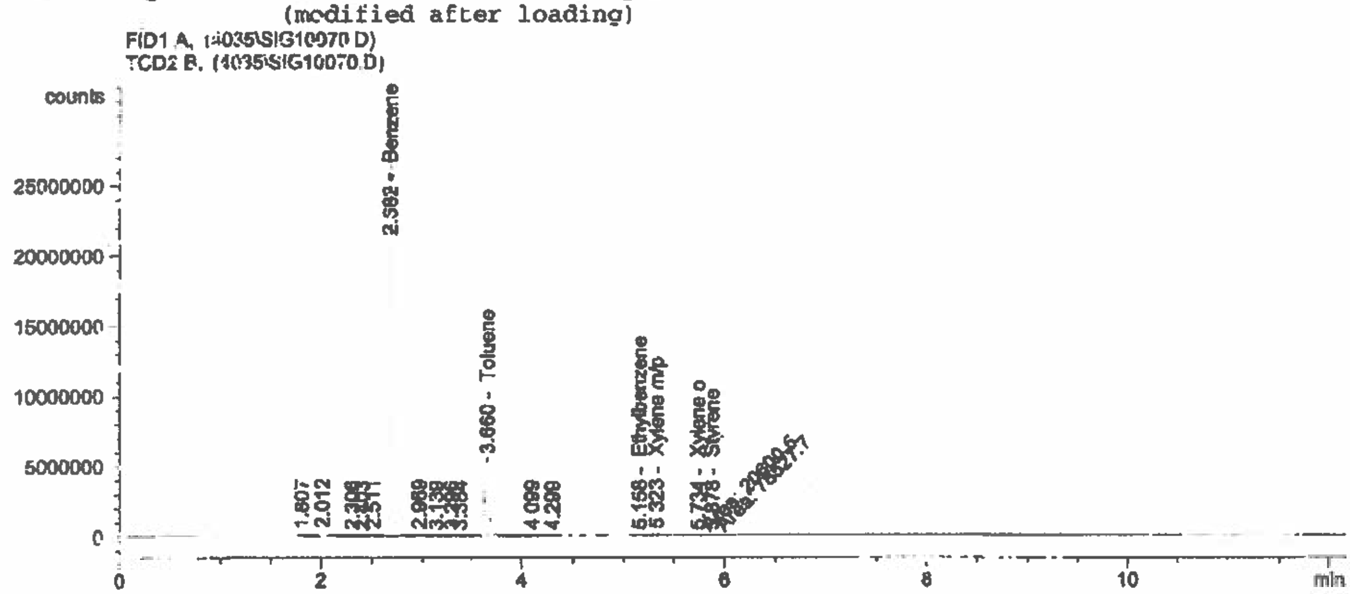
Warning : Calibration warnings (see calibration table listing)
Warning : Calibrated compound(s) not found

===

Run 2 Inlet B B1/2, 0.4 ul injection, run 2, 101712MO

===

Injection Date : 10/17/2012 10:11:26 AM
Sample Name : R2 Inlet B T2 Location : Vial 1
Acq. Operator : mo
Acq. Instrument : Instrument 1 Inj Volume : External
Method : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed : 10/17/2012 9:13:58 AM by mo
(modified after loading)



===

External Standard Report (Sample Amount is 0!)

===

Sorted By : Retention Time
Calib. Data Modified : 10/17/2012 9:14:14 AM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,
Signal 2: TCD2 B,

RetTime [min]	Sig	Type	Area counts*s	Amt/Area	Amount [ng/ul]	Grp	Name
2.682	1	VV	6.84626e7	2.18540e-4	1.49618e4		Benzene
3.660	1	VB	1.84180e7	2.56632e-4	4726.63415		Toluene
5.158	1	PV	2.74721e5	2.78886e-3	766.15817		Ethylbenzene
5.323	1	VB	7.38529e5	1.54765e-3	1142.98696		Xylene m/p
5.734	1	MF	3.06005e4	5.09779e-3	105.01728		Xylene o
5.878	1	FM	7.85277e4	4.01437e-3	315.23839		Styrene
9.380	1		-	-	-		Indan
9.483	1		-	-	-		Indene
11.155	1		-	-	-		Naphthalene

Totals : 2.20178e4

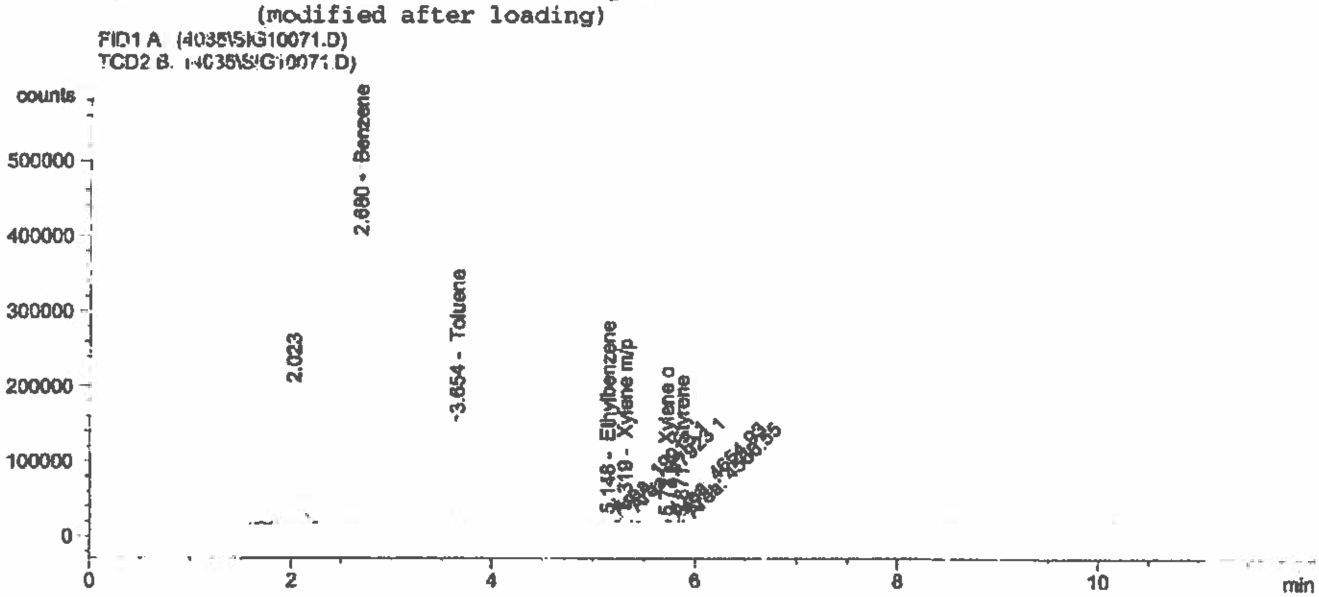
Results obtained with enhanced integrator!
2 Warnings or Errors :

Warning : Calibration warnings (see calibration table listing)
Warning : Calibrated compound(s) not found

===

Run 2 Spike Outlet F1/2, 0.4 ul injection, run 1, 10171
2MO

===
Injection Date : 10/17/2012 10:54:03 AM
Sample Name : R2 Spike Out 1 Location : Vial 1
Acq. Operator : mo
Acq. Instrument : Instrument 1 Inj Volume : External
Acq. Method : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed : 10/17/2012 9:13:58 AM by mo
(modified after loading)
Analysis Method : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed : 10/17/2012 11:09:16 AM by mo
(modified after loading)



===
External Standard Report (Sample Amount is 0!)
===

Sorted By : Retention Time
Calib. Data Modified : 10/17/2012 9:14:14 AM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,
Signal 2: TCD2 B,

RetTime [min]	Sig	Type	Area counts*s	Amt/Area	Amount [ng/ul]	Grp	Name
2.680	1	BB	1.32765e6	2.18540e-4	290.14497		Benzene
3.654	1	PB	4.72532e5	2.56632e-4	121.26657		Toluene
5.148	1	MF	1.99151e4	2.78886e-3	55.54052		Ethylbenzene
5.319	1	FM	4.79231e4	1.54765e-3	74.16838		Xylene m/p
5.721	1	MF	4654.93457	5.09779e-3	23.72988		Xylene o
5.871	1	FM	4566.54688	4.01437e-3	18.33179		Styrene
9.380	1		-	-	-		Indan
9.483	1		-	-	-		Indene
11.155	1		-	-	-		Naphthalene

Totals : 583.18210

Results obtained with enhanced integrator!
2 Warnings or Errors :

Warning : Calibration warnings (see calibration table listing)
Warning : Calibrated compound(s) not found

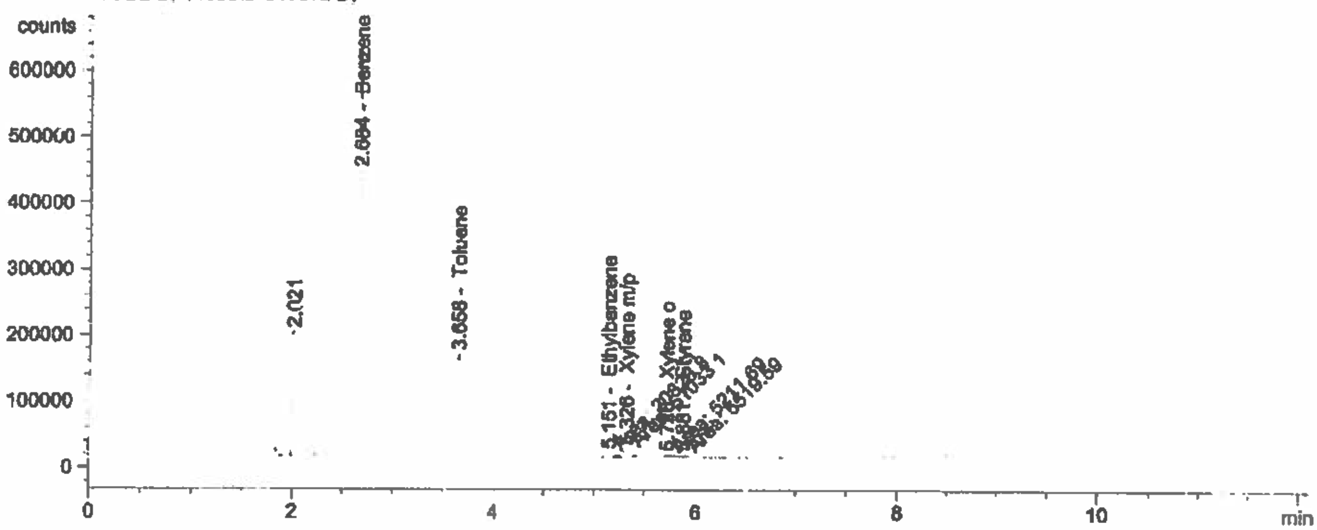
==

*** End of Report ***

Run 2 Spike Outlet F1/2, 0.4 ul injection, run 1, 10171
2MO

===

Injection Date : 10/17/2012 11:10:54 AM
Sample Name : R2 Spike Out 1 Location : Vial 1
Acq. Operator : mo
Acq. Instrument : Instrument 1 Inj Volume : External
Method : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed : 10/17/2012 11:09:16 AM by mo
(modified after loading)



===

External Standard Report (Sample Amount is 0!)

===

Sorted By : Retention Time
Calib. Data Modified : 10/17/2012 9:14:14 AM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,
Signal 2: TCD2 B,

RetTime [min]	Sig	Type	Area counts*s	Amt/Area	Amount [ng/ul]	Grp	Name
2.664	1	BB	1.39876e6	2.18540e-4	305.68528		Benzene
3.658	1	BB	4.97756e5	2.56632e-4	127.73980		Toluene
5.151	1	MF	2.08208e4	2.78886e-3	58.06628		Ethylbenzene
5.326	1	FM	5.10331e4	1.54765e-3	78.98161		Xylene m/p
5.726	1	MF	5211.68896	5.09779e-3	26.56810		Xylene o
5.881	1	FM	5519.58887	4.01437e-3	22.15765		Styrene
9.380	1		-	-	-		Indan
9.483	1		-	-	-		Indene
11.155	1		-	-	-		Naphthalene

Totals : 619.19872

Results obtained with enhanced integrator!
2 Warnings or Errors :

Warning : Calibration warnings (see calibration table listing)
Warning : Calibrated compound(s) not found

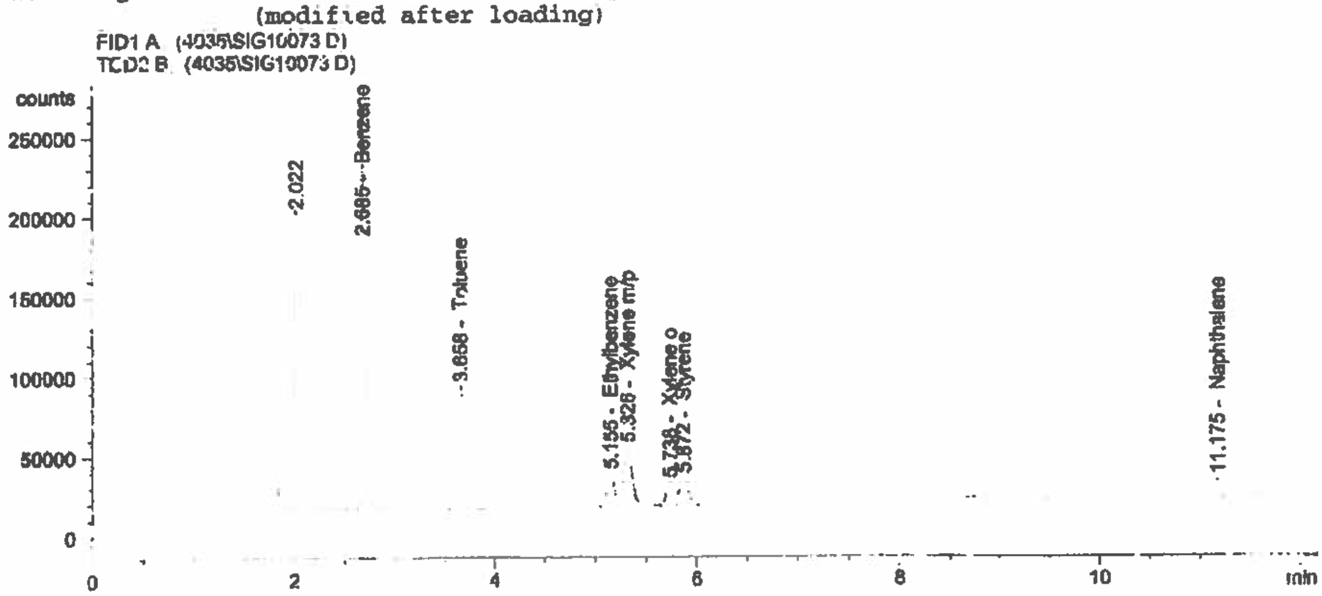
==

*** End of Report ***

Run 2 Spike Outlet B1/2, 0.4 ul injection, run 1, 10171
2MO

===

Injection Date : 10/17/2012 11:27:43 AM
Sample Name : R2 Spike Out 2 Location : Vial 1
Acq. Operator : mo
Acq. Instrument : Instrument 1 Inj Volume : External
Acq. Method : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed : 10/17/2012 11:09:16 AM by mo
(modified after loading)
Analysis Method : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed : 10/17/2012 11:40:58 AM by mo
(modified after loading)



===

External Standard Report (Sample Amount is 0!)

===

Sorted By : Retention Time
Calib. Data Modified : Wednesday, October 17, 2012 11:40:58 AM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,
Signal 2: TCD2 B,

RetTime [min]	Sig	Type	Area counts*s	Amt/Area	Amount [ng/ul]	Grp	Name
2.685	1	BB	5.53622e5	3.60896e-2	1.99800e4		Benzene
3.658	1	BB	2.50266e5	7.98352e-2	1.99800e4		Toluene
5.155	1	BV	1.03358e5	1.93114e-1	1.99600e4		Ethylbenzene
5.325	1	VB	2.17109e5	1.82397e-1	3.96000e4		Xylene m/p
5.738	1	BV	8.00009e4	2.44997e-1	1.96000e4		Xylene o
5.872	1	VB	1.07491e5	1.84201e-1	1.98000e4		Styrene
9.380	1		-	-	-		Indan
9.483	1		-	-	-		Indene
11.175	1	PB	4.24321e4	2.35671e-5	1.00000		Naphthalene

Totals : 1.36921e5

Results obtained with enhanced integrator!
2 Warnings or Errors :

Warning : Calibration warnings (see calibration table listing)
Warning : Calibrated compound(s) not found

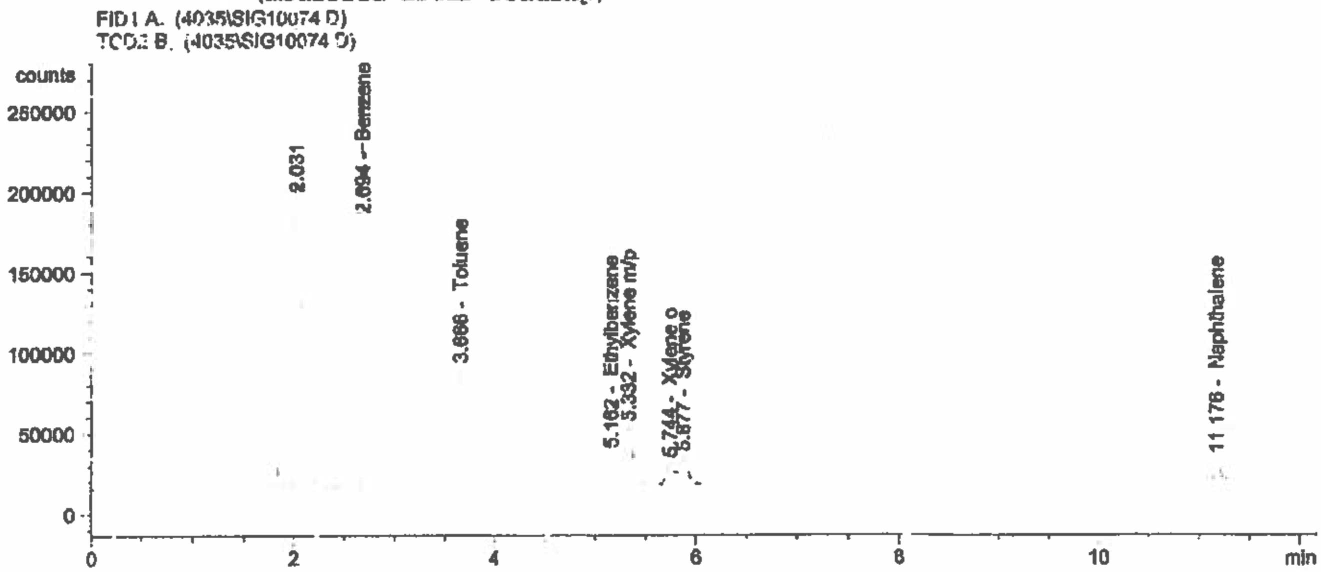
==

*** End of Report ***

Run 2 Spike Outlet B1/2, 0.4 ul injection, run 2, 10171
2MO

===

Injection Date : 10/17/2012 11:43:53 AM
Sample Name : R2 Spike Out 2 Location : Vial 1
Acq. Operator : mo
Acq. Instrument : Instrument 1 Inj Volume : External
Method : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed : 10/17/2012 11:41:33 AM by mo
(modified after loading)



===

External Standard Report (Sample Amount is 0!)

===

Sorted By : Retention Time
Calib. Data Modified : 10/17/2012 11:41:28 AM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,
Signal 2: TCD2 B,

RetTime [min]	Sig	Type	Area counts*s	Amt/Area	Amount [ng/ul]	Grp	Name
2.694	1	BB	5.49284e5	3.60896e-2	1.98234e4		Benzene
3.666	1	PB	2.50607e5	7.98352e-2	2.00072e4		Toluene
5.162	1	BV	1.01293e5	1.93114e-1	1.95612e4		Ethylbenzene
5.332	1	VB	2.15602e5	1.82397e-1	3.93250e4		Xylene m/p
5.744	1	BV	7.49379e4	2.44997e-1	1.83596e4		Xylene o
5.877	1	VB	1.08682e5	1.84201e-1	2.00194e4		Styrene
9.380	1		-	-	-		Indan
9.483	1		-	-	-		Indene
11.176	1	PB	4.23720e4	2.35671e-5	9.98584e-1		Naphthalene

Totals : 1.37097e5

Results obtained with enhanced integrator!
2 Warnings or Errors :

Warning : Calibration warnings (see calibration table listing)
Warning : Calibrated compound(s) not found

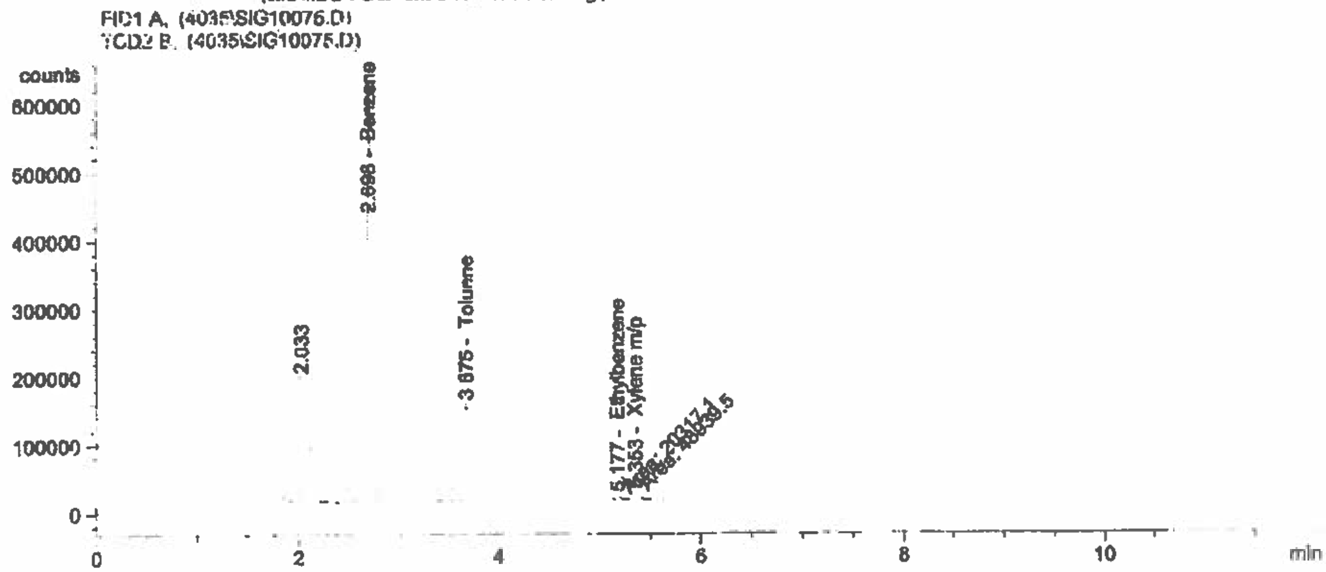
==

*** End of Report ***

Run 2 unspike Outlet F1/2, 0.4 ul injection, run 1, 101
712MO

===

```
Injection Date   : 10/17/2012 12:03:18 PM
Sample Name      : R2 unspike Out 2                Location : Vial 1
Acq. Operator    : mo
Acq. Instrument  : Instrument 1                  Inj Volume : External
Acq. Method      : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed     : 10/17/2012 11:41:33 AM by mo
                   (modified after loading)
Analysis Method  : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed     : 10/17/2012 12:25:41 PM by mo
                   (modified after loading)
```



===

External Standard Report (Sample Amount is 0!)

===

```
Sorted By              :      Retention Time
Calib. Data Modified   :      10/17/2012 11:41:28 AM
Multiplier             :      1.0000
Dilution               :      1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,
Signal 2: TCD2 B,
```

RetTime [min]	Sig	Type	Area counts*s	Amt/Area	Amount [ng/ul]	Grp	Name
2.698	1	BB	1.36911e6	3.60896e-2	4.94107e4		Benzene
3.675	1	BB	4.69381e5	7.98352e-2	3.74731e4		Toluene
5.177	1	MF	2.03171e4	1.93114e-1	3923.52331		Ethylbenzene
5.353	1	FM	4.89395e4	1.82397e-1	8926.41101		Xylene m/p
5.738	1		-	-	-		Xylene o
5.872	1		-	-	-		Styrene
9.380	1		-	-	-		Indan
9.483	1		-	-	-		Indene
11.175	1		-	-	-		Naphthalene

Totals : 9.97338e4

Results obtained with enhanced integrator!
2 Warnings or Errors :

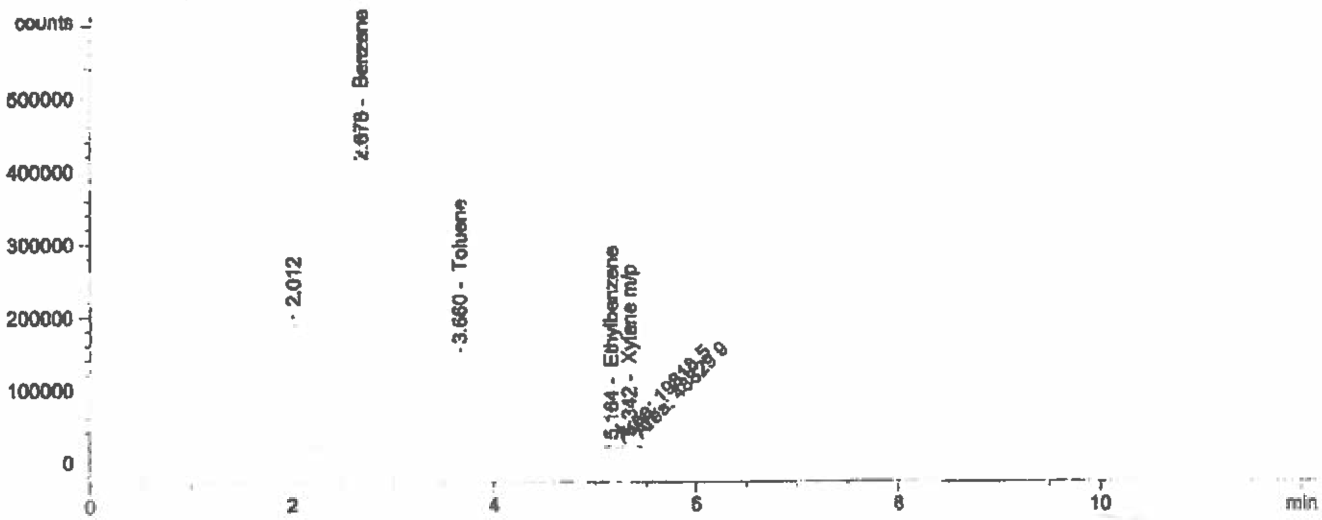
Warning : Calibration warnings (see calibration table listing)
Warning : Calibrated compound(s) not found

===
*** End of Report ***

Run 2 unspike Outlet F1/2, 0.4 ul injection, run 2, 101
712MO

===

Injection Date : 10/17/2012 1:31:18 PM
Sample Name : R2 unspike out 1 Location : Vial 1
Acq. Operator : mo
Acq. Instrument : Instrument 1 Inj Volume : External
Method : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed : 10/17/2012 12:25:41 PM by mo
(modified after loading)



===

External Standard Report (Sample Amount is 0!)

===

Sorted By : Retention Time
Calib. Data Modified : 10/17/2012 11:41:28 AM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,
Signal 2: TCD2 B,

RetTime [min]	Sig	Type	Area counts*s	Amt/Area	Amount [ng/ul]	Grp	Name
2.678	1	BB	1.36019e6	3.60896e-2	4.90886e4		Benzene
3.660	1	BB	4.65539e5	7.98353e-2	3.71664e4		Toluene
5.164	1	MF	1.98185e4	1.93114e-1	3827.23128		Ethylbenzene
5.342	1	FM	4.88299e4	1.82397e-1	8906.41434		Xylene m/p
5.738	1		-	-	-		Xylene o
5.872	1		-	-	-		Styrene
9.380	1		-	-	-		Indan
9.483	1		-	-	-		Indene
11.175	1		-	-	-		Naphthalene

Totals : 9.89886e4

Results obtained with enhanced integrator!
2 Warnings or Errors :

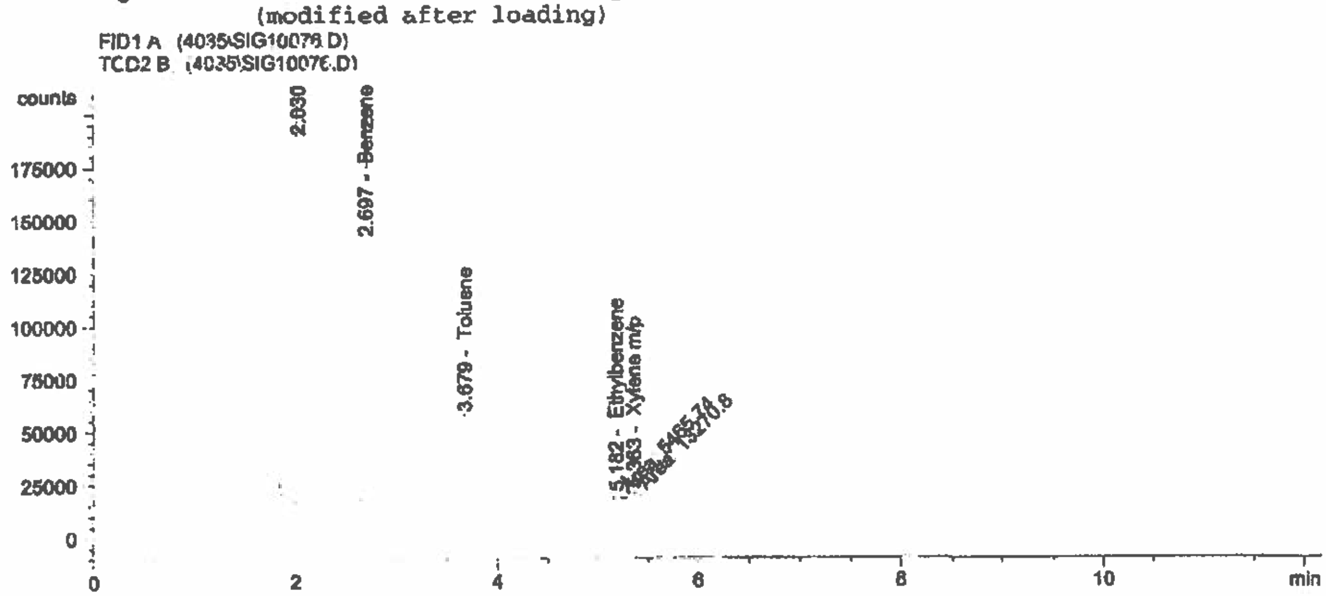
Warning : Calibration warnings (see calibration table listing)
Warning : Calibrated compound(s) not found

==

*** End of Report ***

Run 2 unspike Outlet #1/2, 0.4 ul injection, run 2, 101
712MO

===
Injection Date : 10/17/2012 12:26:50 PM
Sample Name : R2 unspike Out 2   Location : Vial 1
Acq. Operator : mo
Acq. Instrument : Instrument 1   Inj Volume : External
Method : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed : 10/17/2012 12:25:41 PM by mo
(modified after loading)



===
External Standard Report (Sample Amount is 0!)
===

Sorted By : Retention Time
Calib. Data Modified : 10/17/2012 11:41:28 AM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,
Signal 2: TCD2 B,

RetTime [min]	Sig	Type	Area counts*s	Amt/Area	Amount [ng/ul]	Grp	Name
2.697	1	BB	4.14770e5	3.60896e-2	1.49689e4		Benzene
3.679	1	PB	1.41915e5	7.98352e-2	1.13298e4		Toluene
5.182	1	MF	5465.73535	1.93114e-1	1055.51198		Ethylbenzene
5.363	1	FM	1.32708e4	1.82397e-1	2420.55118		Xylene m/p
5.738	1		-	-	-		Xylene o
5.872	1		-	-	-		Styrene
9.380	1		-	-	-		Indan
9.483	1		-	-	-		Indene
11.175	1		-	-	-		Naphthalene

Totals : 2.97748e4

Results obtained with enhanced integrator!
2 Warnings or Errors :

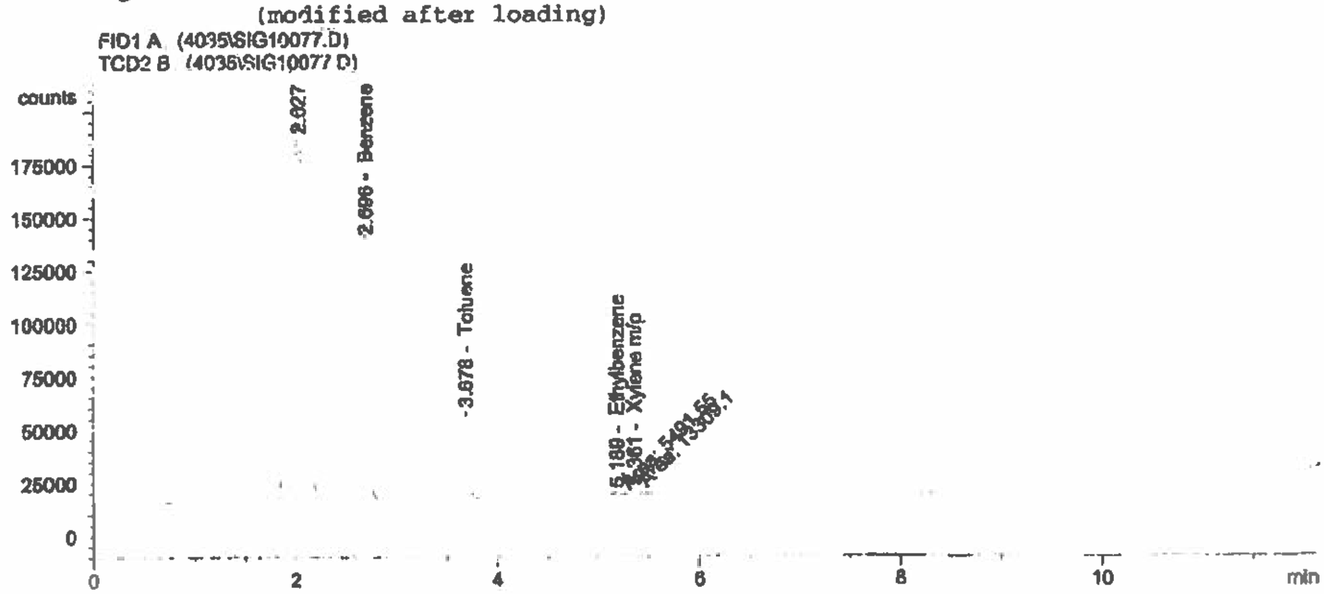
Warning : Calibration warnings (see calibration table listing)
Warning : Calibrated compound(s) not found

==

*** End of Report ***

Run 2 unspike Outlet B1/2, 0.4 ul injection, run 2, 101
712MO

===
Injection Date : 10/17/2012 1:08:54 PM
Sample Name : R2 unspike Out 2 Location : Vial 1
Acq. Operator : mo
Acq. Instrument : Instrument 1 Inj Volume : External
Method : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed : 10/17/2012 12:25:41 PM by mo
(modified after loading)



===
External Standard Report (Sample Amount is 0!)
===

Sorted By : Retention Time
Calib. Data Modified : 10/17/2012 11:41:28 AM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,
Signal 2: TCD2 B,

RetTime [min]	Sig	Type	Area counts*s	Amt/Area	Amount [ng/ul]	Grp	Name
2.696	1	BB	4.13961e5	3.60896e-2	1.49397e4		Benzene
3.678	1	PB	1.41871e5	7.98352e-2	1.13263e4		Toluene
5.189	1	MF	5491.55176	1.93114e-1	1060.49750		Ethylbenzene
5.361	1	FM	1.33091e4	1.82397e-1	2427.54478		Xylene m/p
5.738	1		-	-	-		Xylene o
5.872	1		-	-	-		Styrene
9.380	1		-	-	-		Indan
9.483	1		-	-	-		Indene
11.175	1		-	-	-		Naphthalene

Totals : 2.97540e4

Results obtained with enhanced integrator!
2 Warnings or Errors :

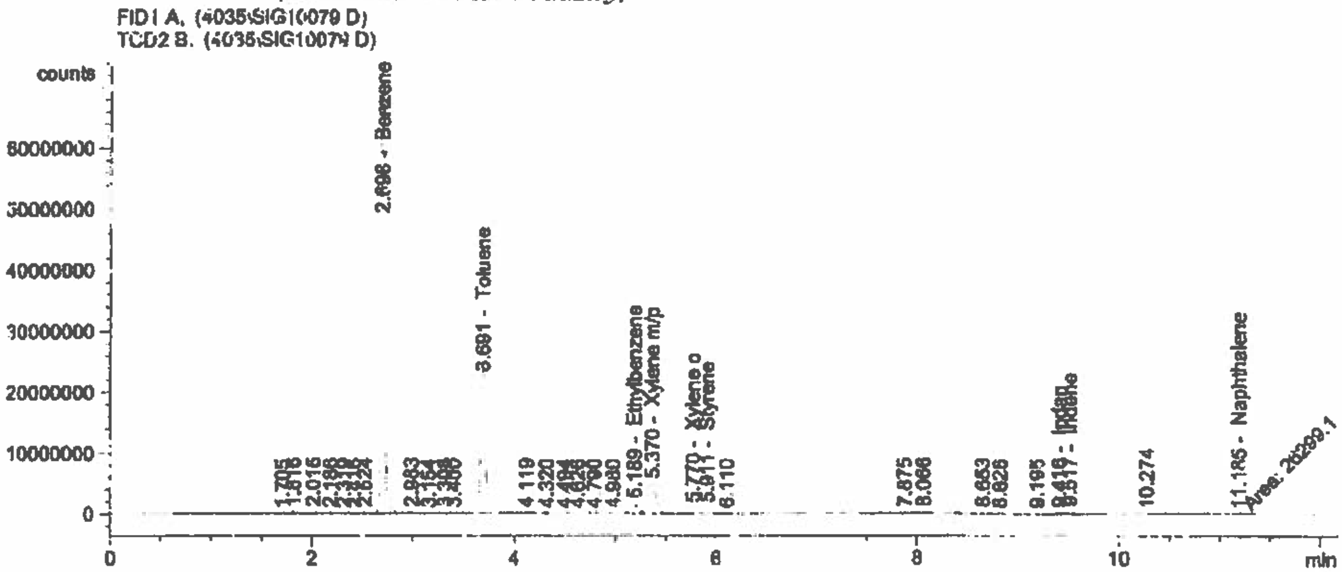
Warning : Calibration warnings (see calibration table listing)
Warning : Calibrated compound(s) not found

===
*** End of Report ***

Run 3 Inlet A F1/2, 0.4 ul injection, run 1, 101712MO

===

Injection Date : 10/17/2012 1:54:01 PM
Sample Name : R3 Inlet A T1 Location : Vial 1
Acq. Operator : mo
Acq. Instrument : Instrument 1 Inj Volume : External
Method : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed : 10/17/2012 12:25:41 PM by mo
(modified after loading)



===

External Standard Report (Sample Amount is 0!)

===

Sorted By : Retention Time
Calib. Data Modified : 10/17/2012 11:41:28 AM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,
Signal 2: TCD2 B,

RetTime [min]	Sig	Type	Area counts*s	Amt/Area	Amount [ng/ul]	Grp	Name
2.698	1	VB S	1.57466e8	3.60896e-2	5.68289e6		Benzene
3.691	1	VV X	7.59420e7	7.98352e-2	6.06284e6		Toluene
5.189	1	VV T	8.06696e6	1.93114e-1	1.55785e6		Ethylbenzene
5.370	1	VV T	2.63759e7	1.82397e-1	4.81088e6		Xylene m/p
5.770	1	VV T	4.93771e6	2.44397e-1	1.20972e6		Xylene o
5.911	1	VV T	5.34505e6	1.84201e-1	9.84566e5		Styrene
9.416	1	VV	7.53118e5	7.26682e-2	5.47278e4		Indan
9.517	1	VB	1.31450e6	2.44455e-6	3.21336		Indene
11.185	1	MM	3.62991e4	2.35671e-5	6.19793e-1		Naphthalene

Totals : 2.03635e7

Results obtained with enhanced integrator!
1 Warnings or Errors :

Warning : Calibration warnings (see calibration table listing)

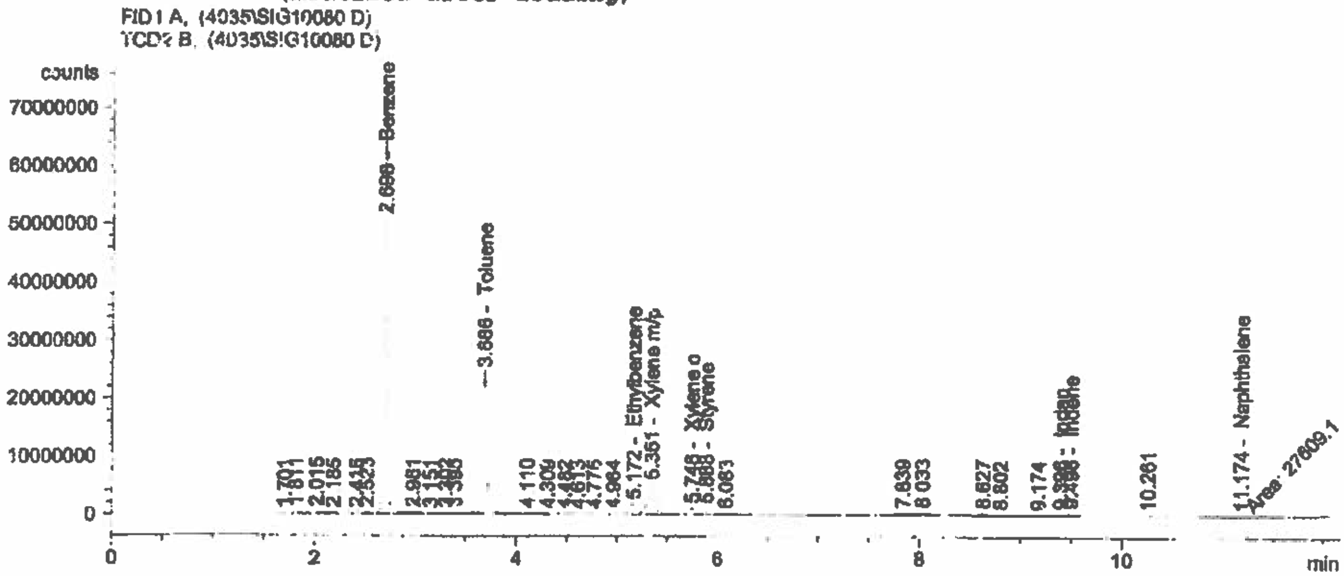
===

*** End of Report ***

Run 3 Inlet A F1/2, 0.4 ul injection, run 2, 101712MO

===

Injection Date : 10/17/2012 2:10:18 PM
Sample Name : R3 Inlet A T1 Location : Vial 1
Acq. Operator : mo
Acq. Instrument : Instrument 1 Inj Volume : External
Method : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed : 10/17/2012 12:25:41 PM by mo
(modified after loading)



===

External Standard Report (Sample Amount is 0!)

===

Sorted By : Retention Time
Calib. Data Modified : 10/17/2012 11:41:28 AM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,
Signal 2: TCD2 B,

RetTime [min]	Sig	Type	Area counts*s	Amt/Area	Amount [ng/ul]	Grp	Name
2.698	1	VB S	1.60885e8	3.60896e-2	5.80628e6		Benzene
3.686	1	VV X	7.84302e7	7.98352e-2	6.26149e6		Toluene
5.172	1	VV T	8.33129e6	1.93114e-1	1.60889e6		Ethylbenzene
5.351	1	VV T	2.71967e7	1.82397e-1	4.96058e6		Xylene m/p
5.748	1	VV T	5.08061e6	2.44997e-1	1.24473e6		Xylene o
5.888	1	VV T	5.49071e6	1.84201e-1	1.01140e6		Styrene
9.396	1	VV	7.76684e5	7.26682e-2	5.64403e4		Indan
9.498	1	VB	1.34800e6	2.44455e-6	3.29525		Indene
11.174	1	MM	2.76091e4	2.35671e-5	6.50665e-1		Naphthalene

Totals : 2.09498e7

Results obtained with enhanced integrator!
1 Warnings or Errors :

Warning : Calibration warnings (see calibration table listing)

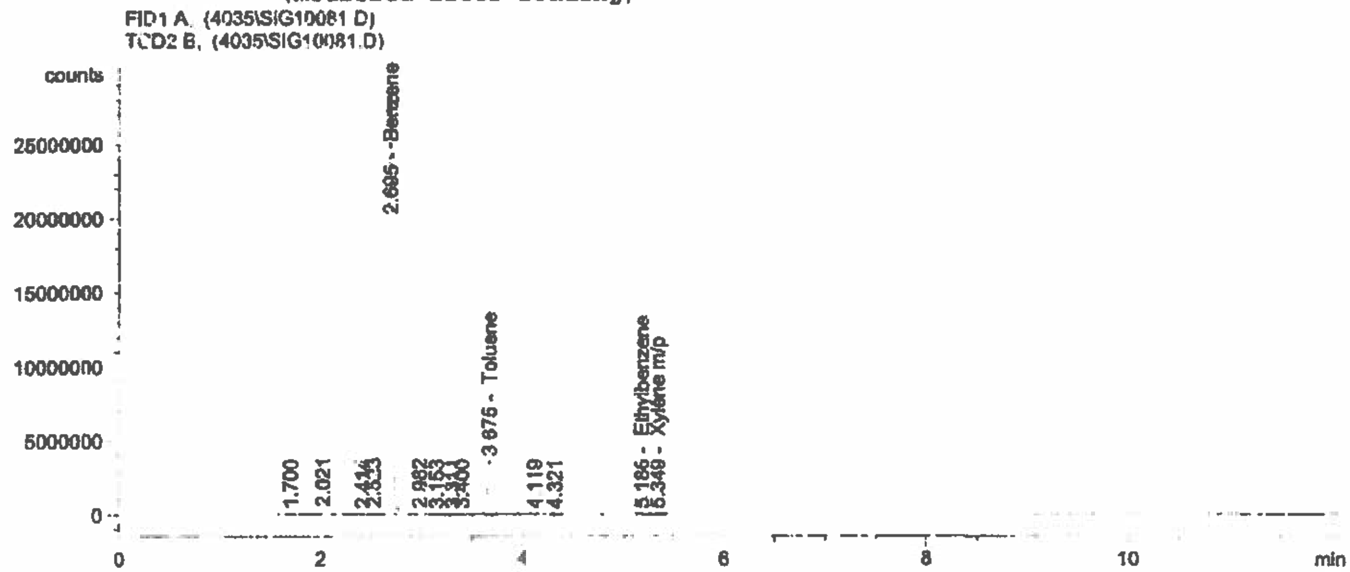
===

*** End of Report ***

Run 3 Inlet A B1/2, 0.4 ul injection, run 1, 101712MO

===

Injection Date : 10/17/2012 2:32:09 PM
Sample Name : R3 Inlet A T2 Location : Vial 1
Acq. Operator : mo
Acq. Instrument : Instrument 1 Inj Volume : External
Method : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed : 10/17/2012 12:25:41 PM by mo
(modified after loading)



===

External Standard Report (Sample Amount is 0!)

===

Sorted By : Retention Time
Calib. Data Modified : 10/17/2012 11:41:28 AM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,
Signal 2: TCD2 B,

RetTime [min]	Sig	Type	Area counts*s	Amt/Area	Amount [ng/ul]	Grp	Name
2.695	1	VV	6.03134e7	3.60896e-2	2.17669e6		Benzene
3.675	1	VB	1.20793e7	7.98352e-2	9.64353e5		Toluene
5.186	1	PV	2.19436e5	1.93114e-1	4.23763e4		Ethylbenzene
5.349	1	VB	1.93907e5	1.82397e-1	3.53681e4		Xylene m/p
5.738	1		-	-	-		Xylene o
5.872	1		-	-	-		Styrene
9.380	1		-	-	-		Indan
9.483	1		-	-	-		Indene
11.175	1		-	-	-		Naphthalene

Totals : 3.21879e6

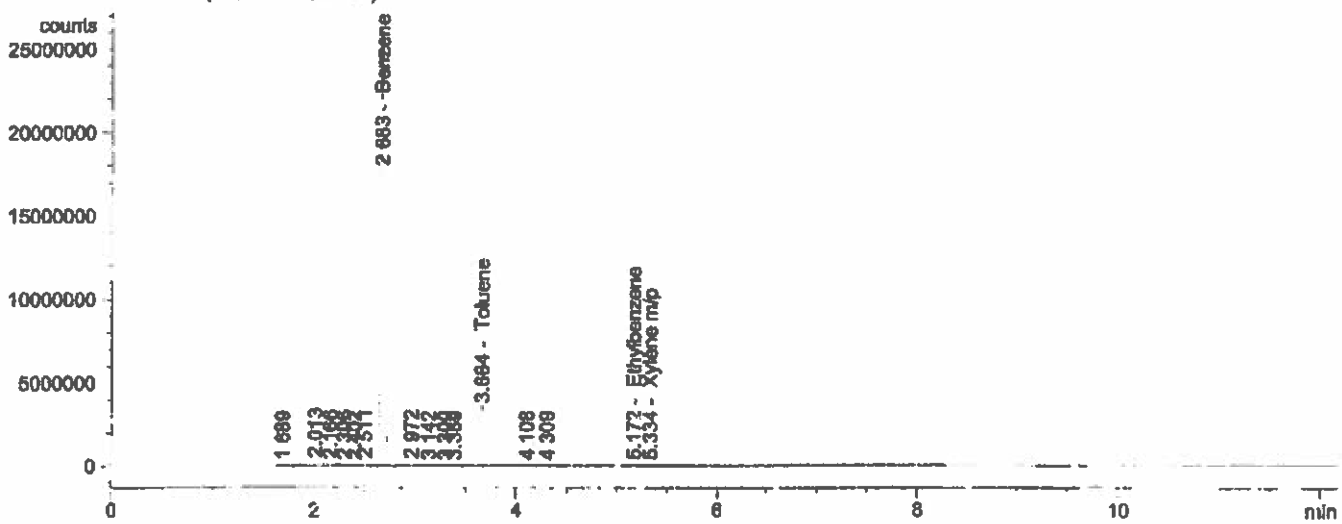
Results obtained with enhanced integrator!
2 Warnings or Errors :

Warning : Calibration warnings (see calibration table listing)
Warning : Calibrated compound(s) not found

===

Run 3 Inlet A B1/2, 0.4 ul injection, run 2, 101712MO

```
=====================================================================
Injection Date  : 10/17/2012 2:51:21 PM
Sample Name     : R3 Inlet A T2                 Location : Vial 1
Acq. Operator   : mo
Acq. Instrument : Instrument 1                Inj Volume : External
Method          : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed    : 10/17/2012 12:25:41 PM by mo
                  (modified after loading)
```




```
=====================================================================
          External Standard Report (Sample Amount is 0!)
=====================================================================

Sorted By              :      Retention Time
Calib. Data Modified   :      10/17/2012 11:41:28 AM
Multiplier             :      1.0000
Dilution               :      1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,
Signal 2: TCD2 B,
```

RetTime [min]	Sig	Type	Area counts*s	Amt/Area	Amount [ng/ul]	Grp	Name
2.683	1	VV	5.95650e7	3.60896e-2	2.14968e6		Benzene
3.664	1	VB	1.20893e7	7.98352e-2	9.65149e5		Toluene
5.172	1	PV	2.20693e5	1.93114e-1	4.26190e4		Ethylbenzene
5.334	1	VB	1.75851e5	1.82397e-1	3.20746e4		Xylene m/p
5.738	1		-	-	-		Xylene o
5.873	1		-	-	-		Styrene
9.380	1		-	-	-		Indan
9.483	1		-	-	-		Indene
11.175	1		-	-	-		Naphthalene

Totals : 3.18952e6

Results obtained with enhanced integrator!
2 Warnings or Errors :

Warning : Calibration warnings (see calibration table listing)
Warning : Calibrated compound(s) not found

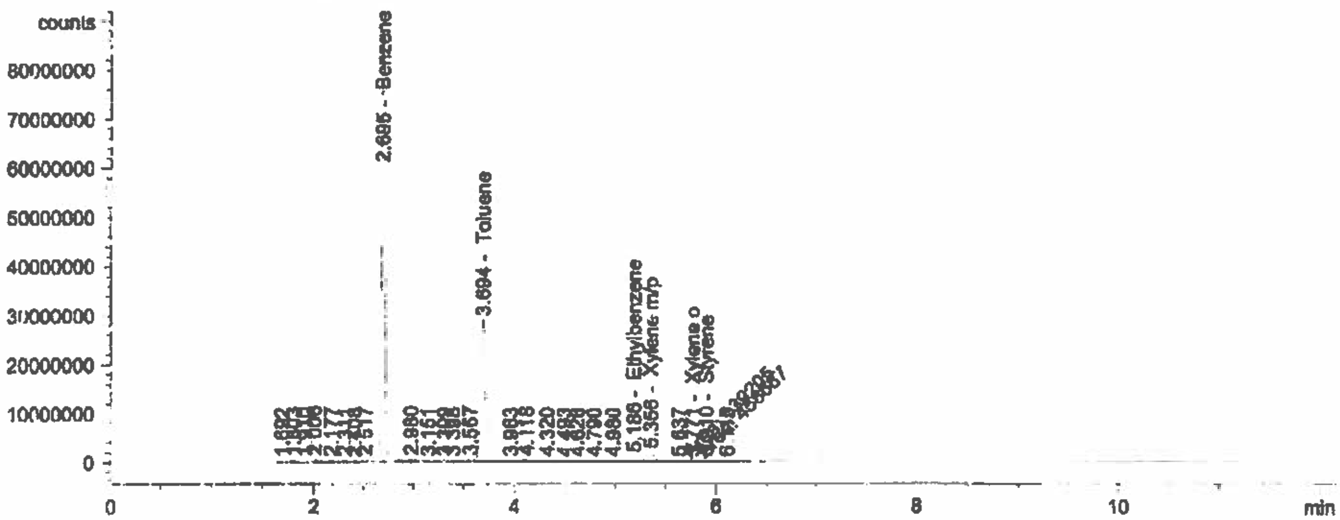
===

Data File C:\HPCHEM\1\DATA\4035\SIG10083.D Sample Name: R3 Inlet B T1

Run 3 Inlet B F1/2, 0.4 ul injection, run 1, 101712MO

===

```
Injection Date   : 10/17/2012 3:17:03 PM
Sample Name      : R3 Inlet B T1                 Location : Vial 1
Acq. Operator    : mo
Acq. Instrument  : Instrument 1               Inj Volume : External
Method           : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed     : 10/17/2012 12:25:41 PM by mo
                   (modified after loading)
```



===

External Standard Report (Sample Amount is 0!)

===

```
Sorted By            :     Retention Time
Calib. Data Modified :     10/17/2012 11:41:28 AM
Multiplier           :     1.0000
Dilution             :     1.0000
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: FID1 A,
Signal 2: TCD2 B,

RetTime [min]	Sig	Type	Area counts*s	Amt/Area	Amount [ng/ul]	Grp	Name
2.695	1	VB S	1.91327e8	3.60896e-2	6.90491e6		Benzene
3.694	1	VV X	9.14587e7	7.98352e-2	7.30162e6		Toluene
5.186	1	VV X	4.65333e6	1.93114e-1	8.98625e5		Ethylbenzene
5.356	1	VV X	9.28079e6	1.82397e-1	1.69279e6		Xylene m/p
5.771	1	FM	4.58687e5	2.44997e-1	1.12377e5		Xylene o
5.910	1	VV X	1.06961e6	1.84201e-1	1.97024e5		Styrene
9.380	1		-	-	-		Indan
9.483	1		-	-	-		Indene
11.175	1		-	-	-		Naphthalene

Totals : 1.71073e7

Results obtained with enhanced integrator!
2 Warnings or Errors :

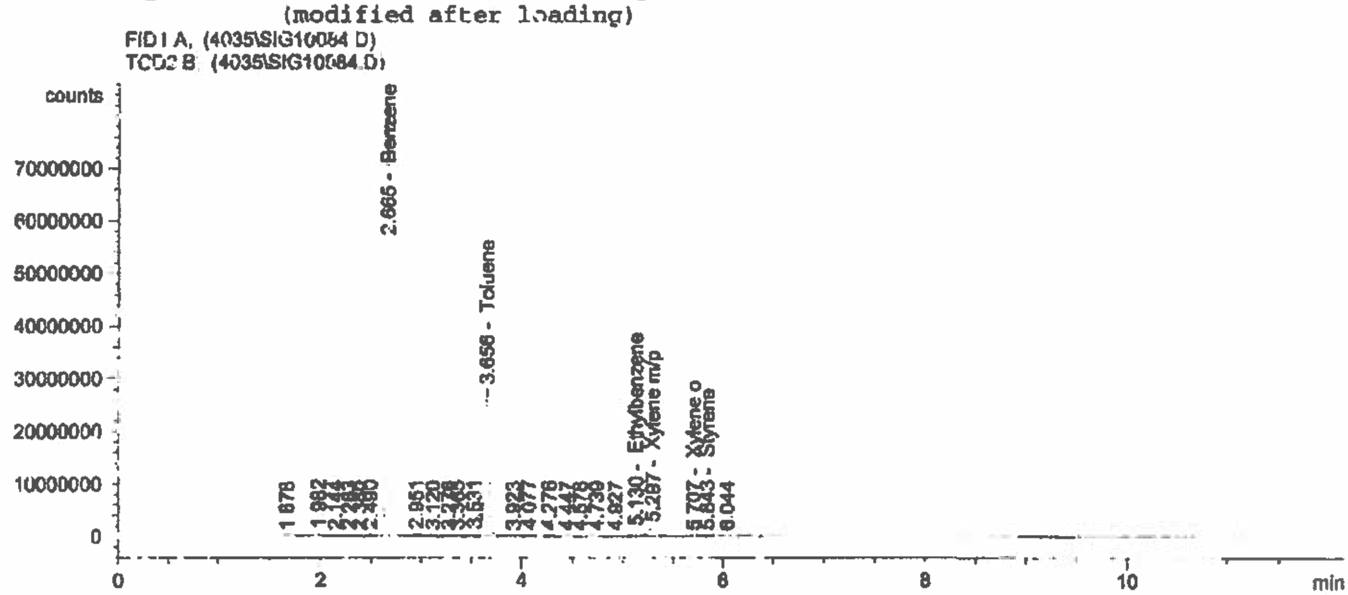
Warning : Calibration warnings (see calibration table listing)
Warning : Calibrated compound(s) not found

===

Run 3 Inlet B F1/2, 0.4 ul injection, run 1, 101712MO

===

Injection Date : 10/17/2012 3:31:57 PM
Sample Name : R3 Inlet B T1 Location : Vial 1
Acq. Operator : mo
Acq. Instrument : Instrument 1 Inj Volume : External
Method : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed : 10/17/2012 12:25:41 PM by mo
(modified after loading)



===

External Standard Report (Sample Amount is 0!)

===

Sorted By : Retention Time
Calib. Data Modified : 10/17/2012 11:41:28 AM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,
Signal 2: TCD2 B,

RetTime [min]	Sig	Type	Area counts*s	Amt/Area	Amount [ng/ul]	Grp	Name
2.665	1	VB S	1.84792e8	3.60896e-2	6.66906e6		Benzene
3.656	1	VV X	8.93090e7	7.98352e-2	7.13000e6		Toluene
5.130	1	VV X	4.59382e6	1.93114e-1	8.87133e5		Ethylbenzene
5.297	1	VV X	9.14557e6	1.82397e-1	1.66812e6		Xylene m/p
5.707	1	VV X	5.76828e5	2.44997e-1	1.41811e5		Xylene o
5.843	1	VV X	1.05728e6	1.84201e-1	1.94753e5		Styrene
9.380	1		-	-	-		Indan
9.483	1		-	-	-		Indene
11.175	1		-	-	-		Naphthalene

Totals : 1.66909e7

Results obtained with enhanced integrator!
2 Warnings or Errors :

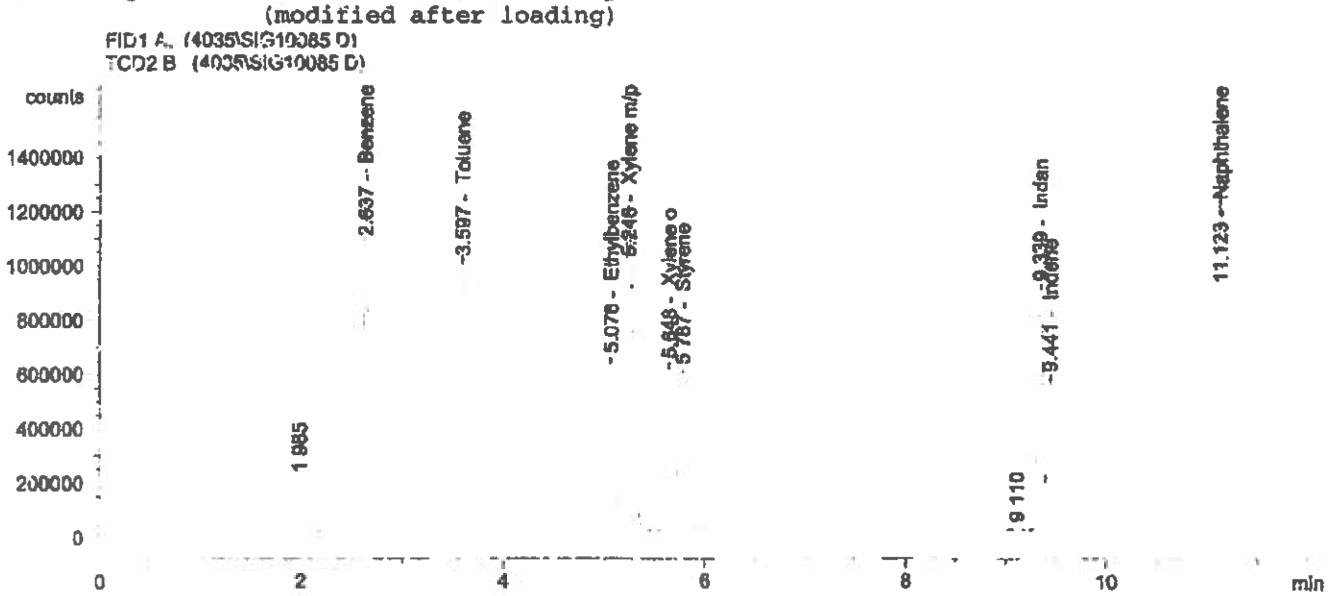
Warning : Calibration warnings (see calibration table listing)
Warning : Calibrated compound(s) not found

===

drift check high, 0.4 ul injection, run 1, 101812MO

===

Injection Date : 10/18/2012 8:33:25 AM
Sample Name : drift high Location : Vial 1
Acq. Operator : mo
Acq. Instrument : Instrument 1 Inj Volume : External
Acq. Method : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed : 10/17/2012 12:25:41 PM by mo
(modified after loading)
Analysis Method : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed : 10/18/2012 8:37:54 AM by mo
(modified after loading)



===

External Standard Report (Sample Amount is 0!)

===

Sorted By : Retention Time
Calib. Data Modified : Thursday, October 18, 2012 8:37:54 AM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,
Signal 2: TCD2 B,

RetTime [min]	Sig	Type	Area counts*s	Amt/Area	Amount [ng/ul]	Grp	Name
2.637	1	PB	3.38444e6	5.90349e-3	1.99800e4		Benzene
3.597	1	BB	3.25046e6	6.14683e-3	1.99800e4		Toluene
5.076	1	BV	3.10314e6	6.43219e-3	1.99600e4		Ethylbenzene
5.248	1	VB	6.48872e6	6.10290e-3	3.96000e4		Xylene m/p
5.648	1	BV	3.22732e6	5.69158e-3	1.83686e4		Xylene o
5.787	1	VB	3.44368e6	5.74966e-3	1.98000e4		Styrene
9.339	1	VV	3.43086e6	5.53798e-3	1.90000e4		Indan
9.441	1	VB	2.17644e6	4.59466e-7	1.00000		Indene
11.123	1	BB	3.79344e6	2.63613e-7	1.00000		Naphthalene

Totals : 1.56691e5

Results obtained with enhanced integrator!
1 Warnings or Errors :

Warning : Calibration warnings (see calibration table listing)

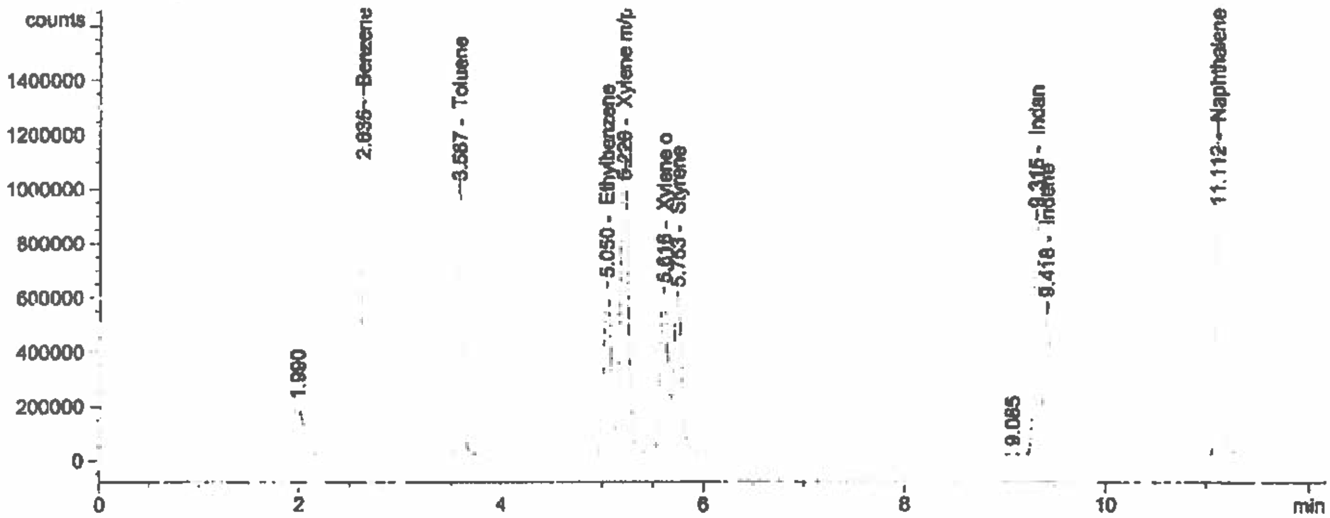
==

*** End of Report ***

drift check high, 0.4 ul injection, run 1, 101812MO

===

Injection Date : 10/18/2012 8:39:28 AM
Sample Name : drift high Location : Vial 1
Acq. Operator : mc
Acq. Instrument : Instrument 1 Inj Volume : External
Method : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed : 10/18/2012 8:38:42 AM by mo
(modified after loading)



===

External Standard Report (Sample Amount is 0!)

===

Sorted By : Retention Time
Calib. Data Modified : 10/18/2012 8:38:39 AM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,
Signal 2: TCD2 B,

RetTime [min]	Sig	Type	Area counts*s	Amt/Area	Amount [ng/ul]	Grp	Name
2.635	1	PB	3.33968e6	5.90349e-3	1.97157e4		Benzene
3.587	1	PB	3.22093e6	6.14683e-3	1.97985e4		Toluene
5.050	1	BV	3.06141e6	6.43219e-3	1.96916e4		Ethylbenzene
5.220	1	VB	6.42034e6	6.10290e-3	3.91827e4		Xylene m/p
5.616	1	BV	3.17836e6	5.69158e-3	1.80899e4		Xylene o
5.753	1	VB	3.41173e6	5.74966e-3	1.96163e4		Styrene
9.315	1	VV	3.38726e6	5.53798e-3	1.87586e4		Indan
9.418	1	VB	2.13378e6	4.59466e-7	9.80398e-1		Indene
11.112	1	BB	3.73126e6	2.63613e-7	9.83609e-1		Naphthalene

Totals : 1.54855e5

Results obtained with enhanced integrator!
1 Warnings or Errors :

Warning : Calibration warnings (see calibration table listing)

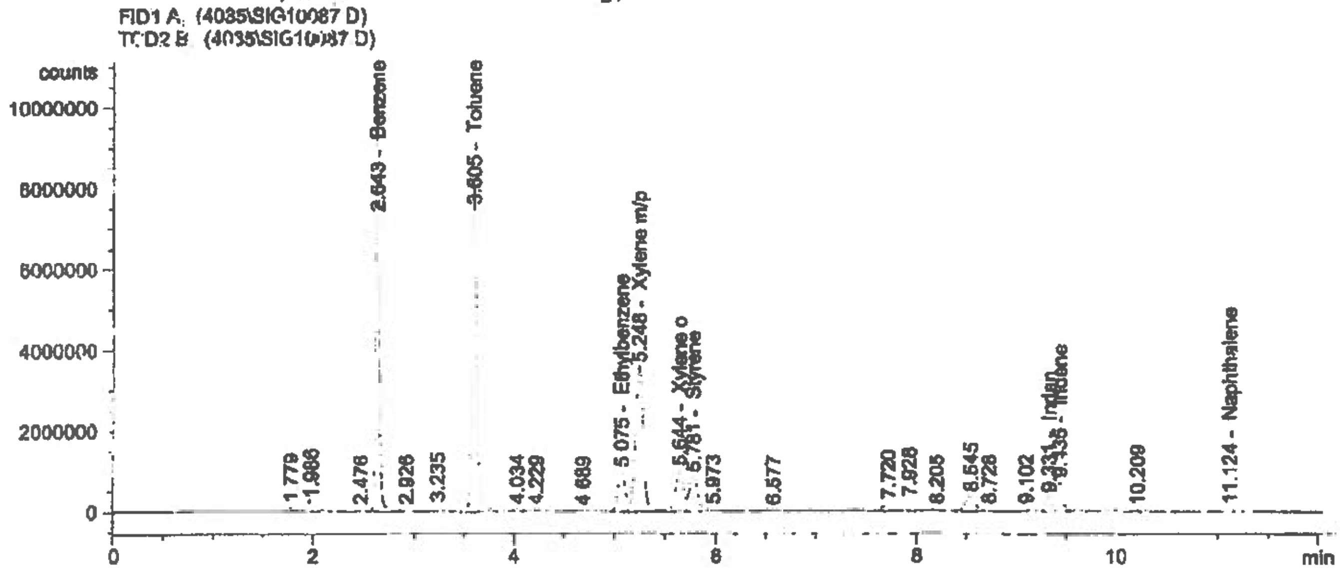
===

*** End of Report ***

Run 3 Inlet B B1/2, 0.4 ul injection, run 1, 101812MO

===

Injection Date : 10/18/2012 8:57:46 AM
Sample Name : R3 Inlet B T2 Location : Vial 1
Acq. Operator : mo
Acq. Instrument : Instrument 1 Inj Volume : External
Method : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed : 10/18/2012 8:38:42 AM by mo
(modified after loading)



===

External Standard Report (Sample Amount is 0!)

===

Sorted By : Retention Time
Calib. Data Modified : 10/18/2012 8:38:39 AM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,
Signal 2: TCD2 B,

RetTime [min]	Sig	Type	Area counts*s	Amt/Area	Amount [ng/ul]	Grp	Name
2.643	1	VB	2.27129e7	5.90349e-3	1.34085e5		Benzene
3.603	1	BB	2.55444e7	6.14683e-3	1.57017e5		Toluene
5.075	1	BV	4.68529e6	6.43219e-3	3.01366e4		Ethylbenzene
5.248	1	VB	1.90006e7	6.10290e-3	1.15959e5		Xylene m/p
5.644	1	BV	5.18252e6	5.69158e-3	2.94967e4		Xylene o
5.781	1	VV	4.78798e6	5.74966e-3	2.75292e4		Styrene
9.331	1	VV	1.17883e6	5.53798e-3	6528.30609		Indan
9.435	1	VB	2.80328e6	4.59466e-7	1.28801		Indene
11.124	1	PB	1.74174e5	2.63613e-7	4.59146e-2		Naphthalene

Totals : 5.00753e5

Results obtained with enhanced integrator!
1 Warnings or Errors :

Warning : Calibration warnings (see calibration table listing)

===

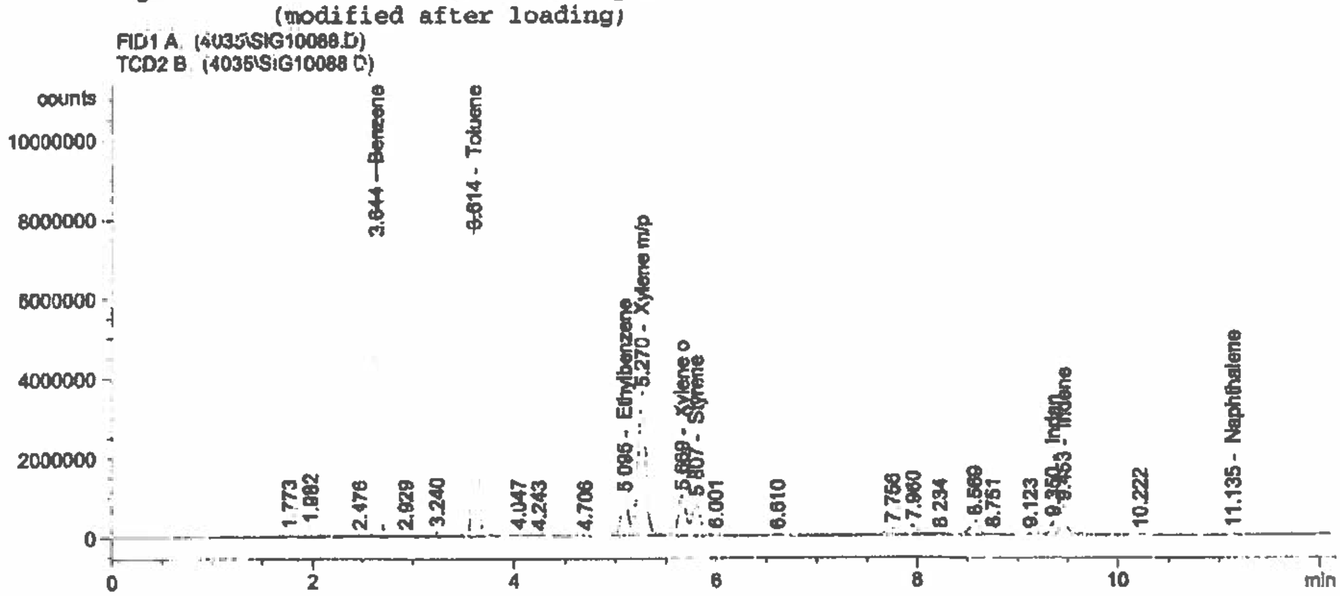
*** End of Report ***

Data File C:\HPCHEM\1\DATA\4035\SIG10088.D   Sample Name: R3 Inlet B T2

Run 3 Inlet B B1/2, 0.4 ul injection, run 2, 101812MO

===

Injection Date : 10/18/2012 9:18:54 AM
Sample Name : R3 Inlet B T2   Location : Vial 1
Acq. Operator : mo
Acq. Instrument : Instrument 1   Inj Volume : External
Acq. Method : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed : 10/18/2012 8:38:42 AM by mo
(modified after loading)
Analysis Method : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed : 10/18/2012 9:32:01 AM by mo
(modified after loading)



===

External Standard Report (Sample Amount is 0!)

===

Sorted By : Retention Time
Calib. Data Modified : Thursday, October 18, 2012 9:32:01 AM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,
Signal 2: TCD2 B,

RetTime [min]	Sig	Type	Area counts*s	Amt/Area	Amount [ng/ul]	Grp	Name
2.644	1	VB	2.31056e7	8.64724e-4	1.99800e4		Benzene
3.614	1	BB	2.60393e7	7.67301e-4	1.99800e4		Toluene
5.095	1	VV	4.73985e6	4.21111e-3	1.99600e4		Ethylbenzene
5.270	1	VB	1.93496e7	2.04656e-3	3.96000e4		Xylene m/p
5.669	1	BV	5.27001e6	3.71916e-3	1.96000e4		Xylene o
5.807	1	VV	4.88365e6	4.05435e-3	1.98000e4		Styrene
9.350	1	VV	1.18893e6	1.59807e-2	1.90000e4		Indan
9.453	1	VB	2.88007e6	3.47214e-7	1.00000		Indene
11.135	1	PB	1.75830e5	5.68730e-6	1.00000		Naphthalene

Totals : 1.57922e5

Results obtained with enhanced integrator!
1 Warnings or Errors :

Warning : Calibration warnings (see calibration table listing)

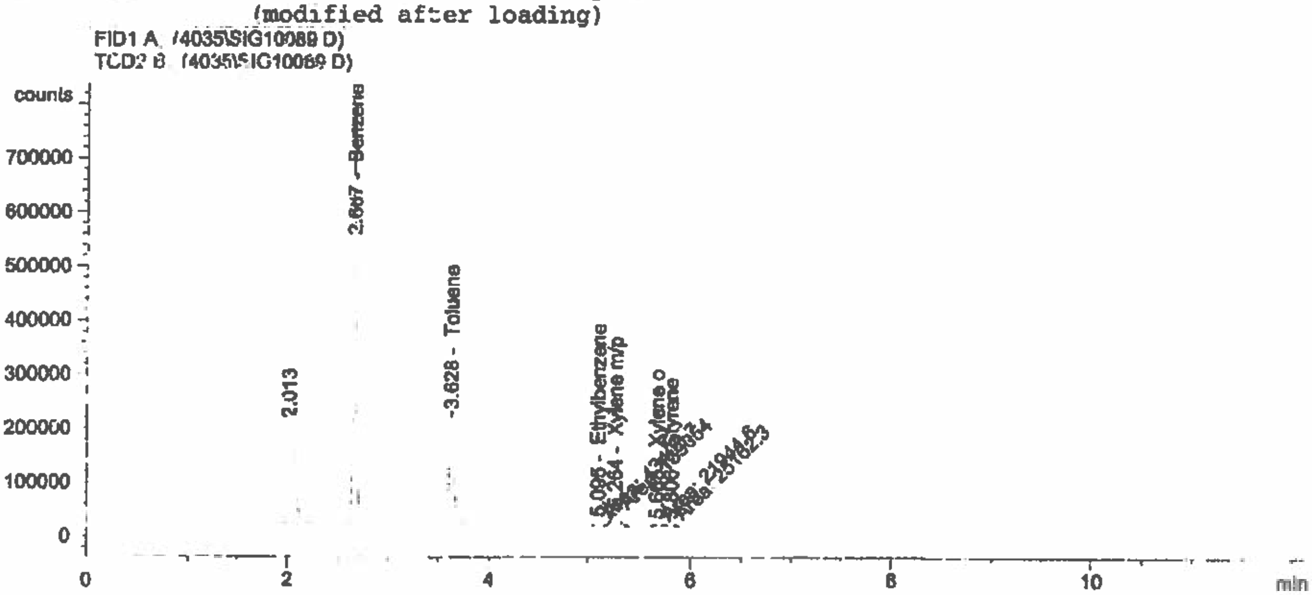
===

*** End of Report ***

Run 3 Outlet spiked F1/2, 0.4 ul injection, run 1, 1018
12MO

===

```
Injection Date   : 10/18/2012 9:34:44 AM
Sample Name      : R3 Outlet sp T1                Location : Vial 1
Acq. Operator    : mo
Acq. Instrument  : Instrument 1                 Inj Volume : External
Method           : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed     : 10/18/2012 9:32:35 AM by mo
                   (modified after loading)
```



===

External Standard Report (Sample Amount is 0!)

===

```
Sorted By             :      Retention Time
Calib. Data Modified  :      10/18/2012 9:32:30 AM
Multiplier            :      1.0000
Dilution              :      1.0000
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: FID1 A,
Signal 2: TCD2 B,

RetTime [min]	Sig	Type	Area counts*s	Amt/Area	Amount [ng/ul]	Grp	Name
2.667	1	BB	1.67994e6	8.64724e-4	1452.66505		Benzene
3.628	1	BB	6.78791e5	7.67301e-4	520.83705		Toluene
5.095	1	MF	4.34037e4	4.21111e-3	182.77740		Ethylbenzene
5.264	1	FM	1.39054e5	2.04656e-3	284.58184		Xylene m/p
5.668	1	MF	2.19446e4	3.71916e-3	81.61560		Xylene o
5.806	1	FM	2.51623e4	4.05435e-3	102.01680		Styrene
9.350	1		-	-	-		Indan
9.453	1		-	-	-		Indene
11.135	1		-	-	-		Naphthalene
Totals :					2624.51374		

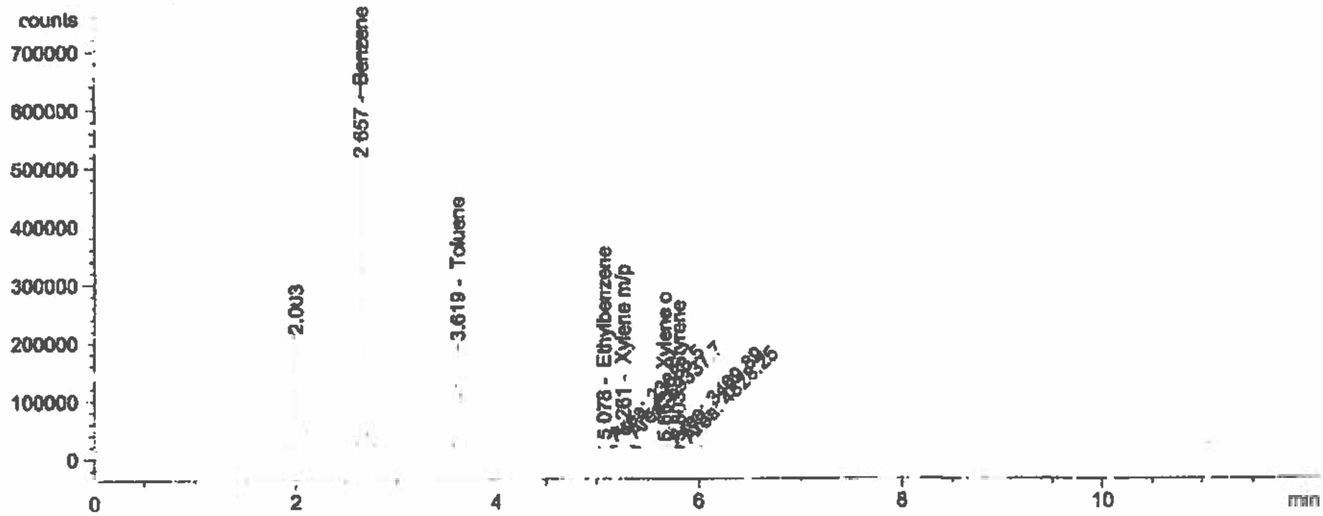
Results obtained with enhanced integrator!
2 Warnings or Errors :

Warning : Calibration warnings (see calibration table listing)
Warning : Calibrated compound(s) not found

==
*** End of Report ***

Run 3 Outlet spiked F1/2, 0.4 ul injection, run 2, 1018
12MO

===
Injection Date : 10/18/2012 9:50:54 AM
Sample Name : R3 Outlet sp T1 Location : Vial 1
Acq. Operator : mo
Acq. Instrument : Instrument 1 Inj Volume : External
Method : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed : 10/18/2012 9:32:35 AM by mo
(modified after loading)



===
External Standard Report (Sample Amount is 0!)
===

Sorted By : Retention Time
Calib. Data Modified : 10/18/2012 9:32:30 AM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,
Signal 2: TCD2 B,

RetTime [min]	Sig	Type	Area counts*s	Amt/Area	Amount [ng/ul]	Grp	Name
2.657	1	BB	1.57676e6	8.64724e-4	1365.19290		Benzene
3.619	1	BB	5.66733e5	7.67301e-4	434.85454		Toluene
5.078	1	MF	2.38885e4	4.21111e-3	100.59703		Ethylbenzene
5.261	1	FM	5.93377e4	2.04656e-3	121.43792		Xylene m/p
5.663	1	MF	3469.88940	3.71916e-3	12.90507		Xylene o
5.803	1	FM	4828.24609	4.05435e-3	19.57538		Styrene
9.350	1		-	-	-		Indan
9.453	1		-	-	-		Indene
11.135	1		-	-	-		Naphthalene

Totals : 2054.56285

Results obtained with enhanced integrator!
2 Warnings or Errors :

Warning : Calibration warnings (see calibration table listing)
Warning : Calibrated compound(s) not found

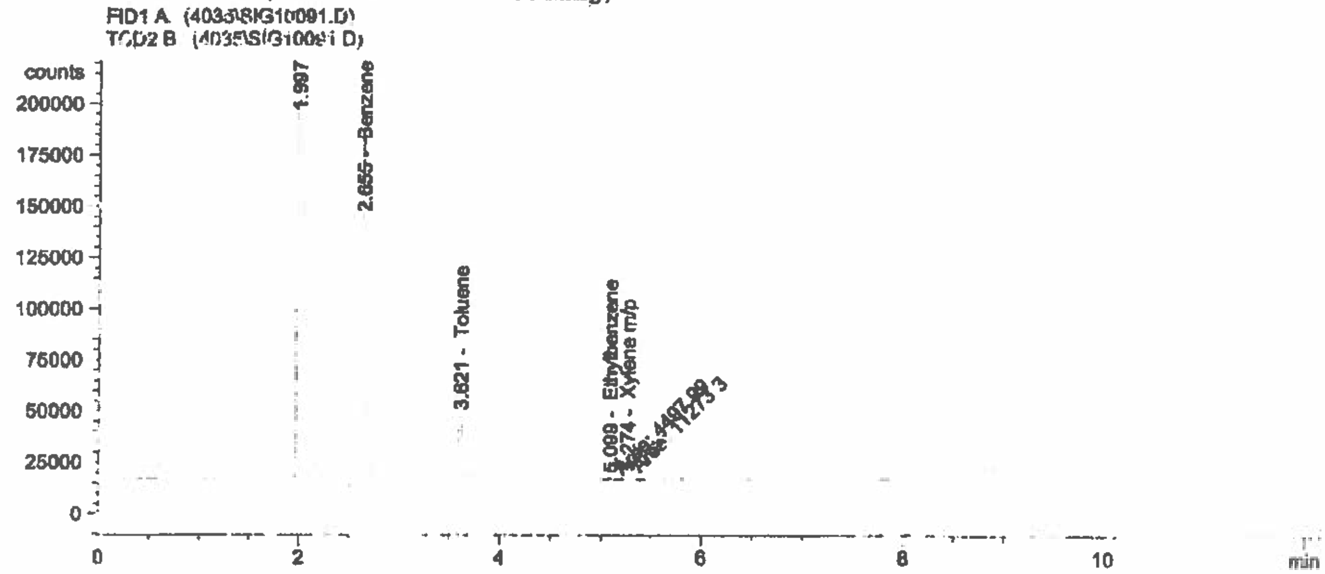
===

*** End of Report ***

Data File C:\HPCHEM\1\DATA\4035\SIG10091.D Sample Name: R3 Outlet sp T2

Run 3 Outlet spiked B1/2, 0.4 ul injection, run 1, 1018
12MO

===
Injection Date : 10/18/2012 10:08:14 AM
Sample Name : R3 Outlet sp T2 Location : Vial 1
Acq. Operator : mo
Acq. Instrument : Instrument 1 Inj Volume : External
Method : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed : 10/18/2012 9:32:35 AM by mo
(modified after loading)



===
External Standard Report (Sample Amount is 0!)
===

Sorted By : Retention Time
Calib. Data Modified : 10/18/2012 9:32:30 AM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,
Signal 2: TCD2 B,

RetTime [min]	Sig	Type	Area counts*s	Amt/Area	Amount [ng/ul]	Grp	Name
2.655	1	BB	3.87432e5	8.64724e-4	335.02146		Benzene
3.621	1	BB	1.04244e5	7.67301e-4	79.98656		Toluene
5.099	1	MF	4497.98779	4.21111e-3	18.94150		Ethylbenzene
5.274	1	FM	1.12733e4	2.04656e-3	23.07137		Xylene m/p
5.669	1		-	-	-		Xylene o
5.807	1		-	-	-		Styrene
9.350	1		-	-	-		Indan
9.453	1		-	-	-		Indene
11.135	1		-	-	-		Naphthalene

Totals : 457.02090

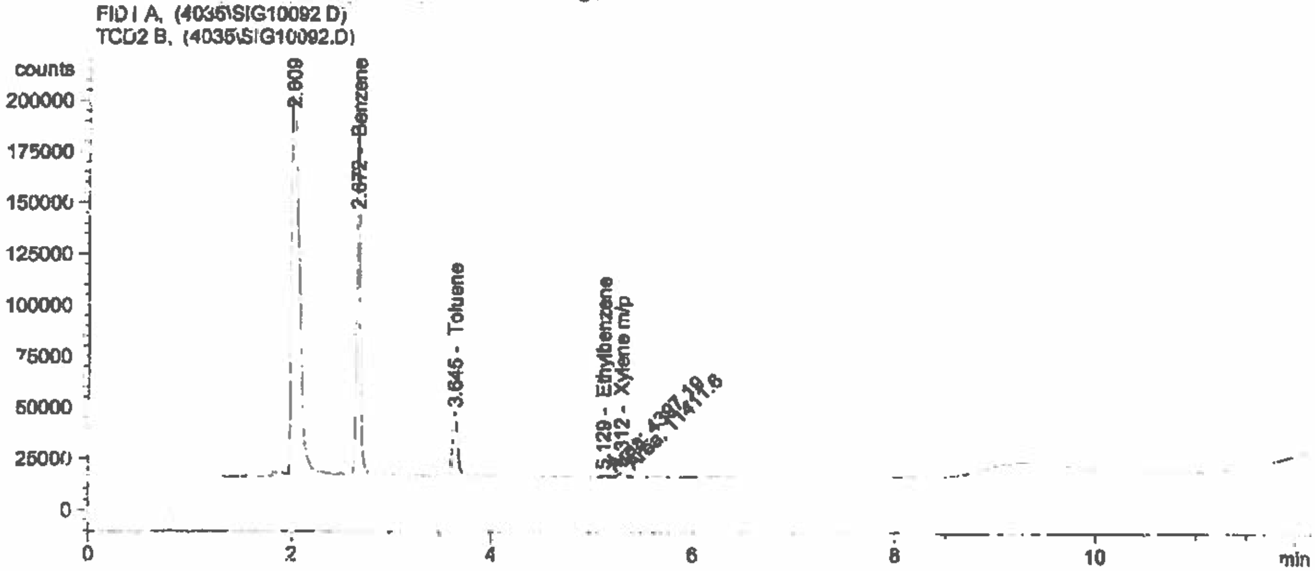
Results obtained with enhanced integrator!
2 Warnings or Errors :

Warning : Calibration warnings (see calibration table listing)
Warning : Calibrated compound(s) not found

==
*** End of Report ***

Run 3 Outlet spiked E1/2, 0.4 ul injection, run 2, 1018
12MO

===
Injection Date : 10/18/2012 10:25:35 AM
Sample Name : R3 Outlet sp T2 Location : Vial 1
Acq. Operator : mo
Acq. Instrument : Instrument 1 Inj Volume : External
Method : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed : 10/18/2012 9:32:35 AM by mo
(modified after loading)



===
External Standard Report (Sample Amount is 0!)
===

Sorted By : Retention Time
Calib. Data Modified : 10/18/2012 9:32:30 AM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,
Signal 2: TCD2 B,

RetTime [min]	Sig	Type	Area counts*s	Amt/Area	Amount [ng/ul]	Grp	Name
2.672	1	BB	3.86367e5	8.64724e-4	334.10069		Benzene
3.645	1	BB	1.03560e5	7.67301e-4	79.46189		Toluene
5.129	1	MF	4397.18896	4.21111e-3	18.51703		Ethylbenzene
5.313	1	FM	1.14116e4	2.04636e-3	23.35438		Xylene m/p
5.669	1		-	-	-		Xylene o
5.807	1		-	-	-		Styrene
9.350	1		-	-	-		Indan
9.453	1		-	-	-		Indene
11.135	1		-	-	-		Naphthalene

Totals : 455.43399

Results obtained with enhanced integrator!
2 Warnings or Errors :

Warning : Calibration warnings (see calibration table listing)
Warning : Calibrated compound(s) not found

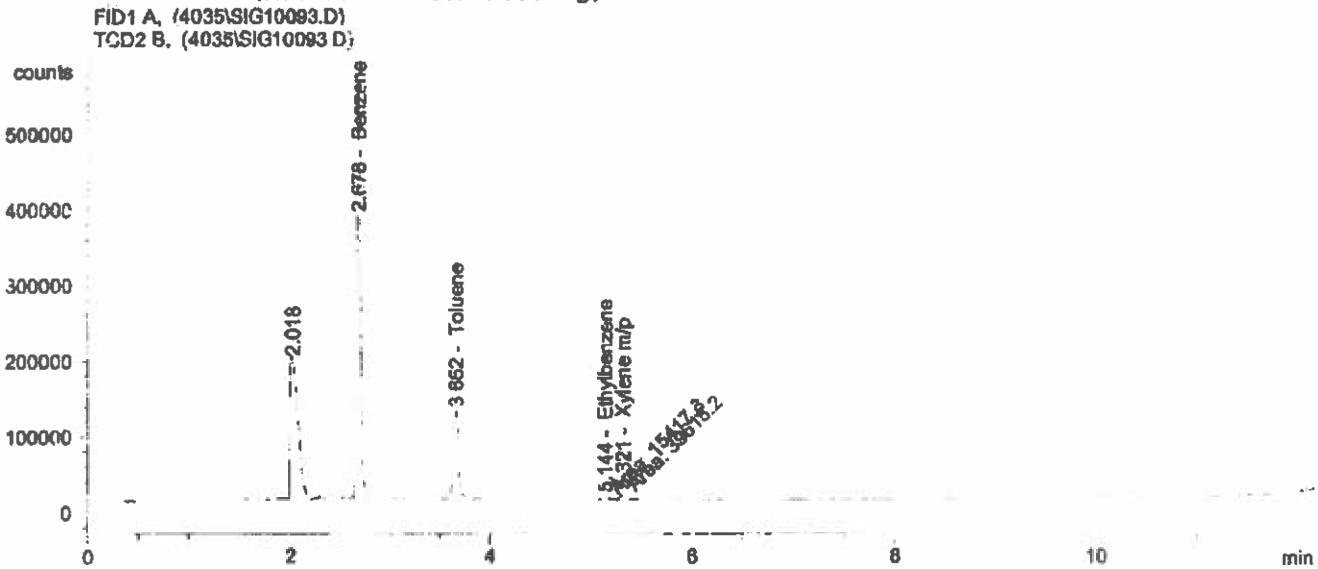
==

*** End of Report ***

Run 3 Outlet unspiked F1/2, 0.4 ul injection, run 1, 10
1812MO

===

Injection Date : 10/18/2012 10:43:35 AM
Sample Name : R3 Outlet uns T1 Location : Vial 1
Acq. Operator : mo
Acq. Instrument : Instrument 1 Inj Volume : External
Method : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed : 10/18/2012 9:32:35 AM by mo
(modified after loading)



===

External Standard Report (Sample Amount is 0!)

===

Sorted By : Retention Time
Calib. Data Modified : 10/18/2012 9:32:30 AM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,
Signal 2: TCD2 B,

RetTime [min]	Sig	Type	Area counts*s	Amt/Area	Amount [ng/ul]	Grp	Name
2.678	1	BB	1.25827e6	8.64724e-4	1088.05905		Benzene
3.652	1	PB	3.89677e5	7.67301e-4	298.99957		Toluene
5.144	1	MF	1.54178e4	4.21111e-3	64.92605		Ethylbenzene
5.321	1	FM	3.96152e4	2.04656e-3	81.07472		Xylene m/p
5.669	1		-	-	-		Xylene o
5.807	1		-	-	-		Styrene
9.350	1		-	-	-		Indan
9.453	1		-	-	-		Indene
11.135	1		-	-	-		Naphthalene

Totals : 1533.05940

Results obtained with enhanced integrator!
2 Warnings or Errors :

Warning : Calibration warnings (see calibration table listing)
Warning : Calibrated compound(s) not found

==

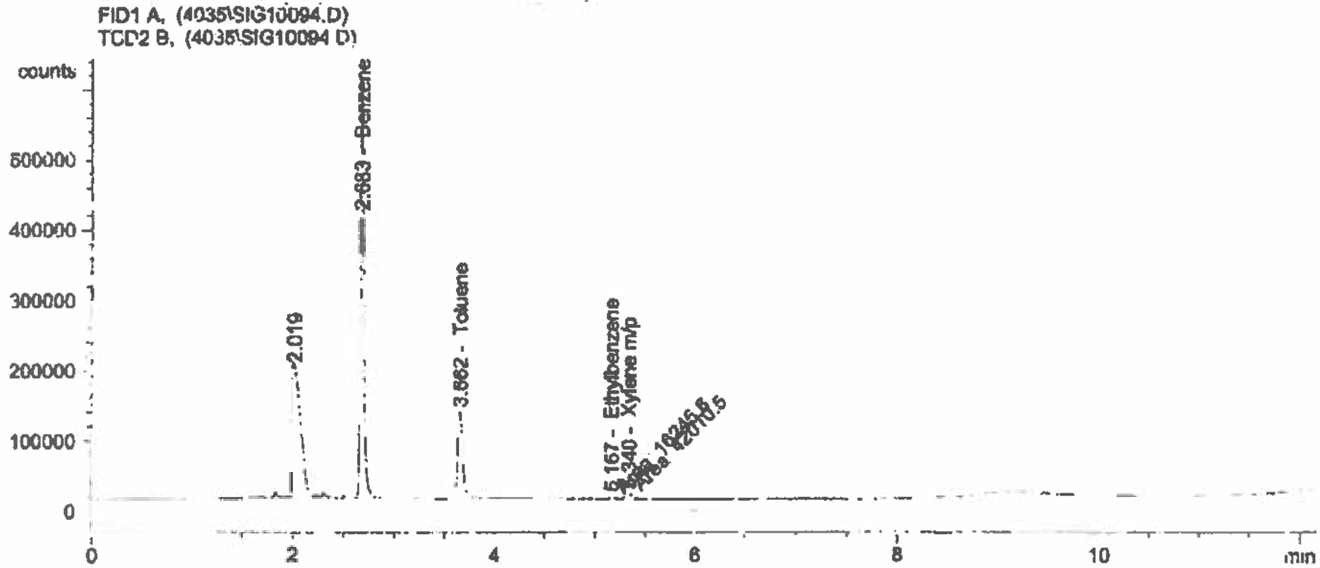
*** End of Report ***

Data File C:\HPCHEM\1\DATA\4035\SIG10094.D Sample Name: R3 Outlet uns T1

Run 3 Outlet unspiked F1/2, 0.4 ul injection, run 2, 10
1812MO

===

Injection Date	: 10/18/2012 11:10:50 AM		
Sample Name	: R3 Outlet uns T1	Location	: Vial 1
Acq. Operator	: mo		
Acq. Instrument	: Instrument 1	Inj Volume	: External
Method	: C:\HPCHEM\1\METHODS\KOPPERS.M		
Last changed	: 10/18/2012 9:32:35 AM by mo (modified after loading)		



===

External Standard Report (Sample Amount is 0!)

===

Sorted By	:	Retention Time
Calib. Data Modified	:	10/18/2012 9:32:20 AM
Multiplier	:	1.0000
Dilution	:	1.0000

Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,
Signal 2: TCD2 B,

RetTime [min]	Sig	Type	Area counts*s	Amt/Area	Amount [ng/ul]	Grp	Name
2.683	1	BB	1.32336e6	8.64724e-4	1144.34482		Benzene
3.662	1	BB	4.09056e5	7.67301e-4	313.86854		Toluene
5.167	1	MF	1.62456e4	4.21111e-3	68.41201		Ethylbenzene
5.340	1	FM	4.20105e4	2.04656e-3	85.97679		Xylene m/p
5.669	1		-	-	-		Xylene o
5.807	1		-	-	-		Styrene
9.350	1		-	-	-		Indan
9.453	1		-	-	-		Indene
11.135	1		-	-	-		Naphthalene

Totals : 1612.60216

Results obtained with enhanced integrator!
2 Warnings or Errors :

Warning : Calibration warnings (see calibration table listing)
Warning : Calibrated compound(s) not found

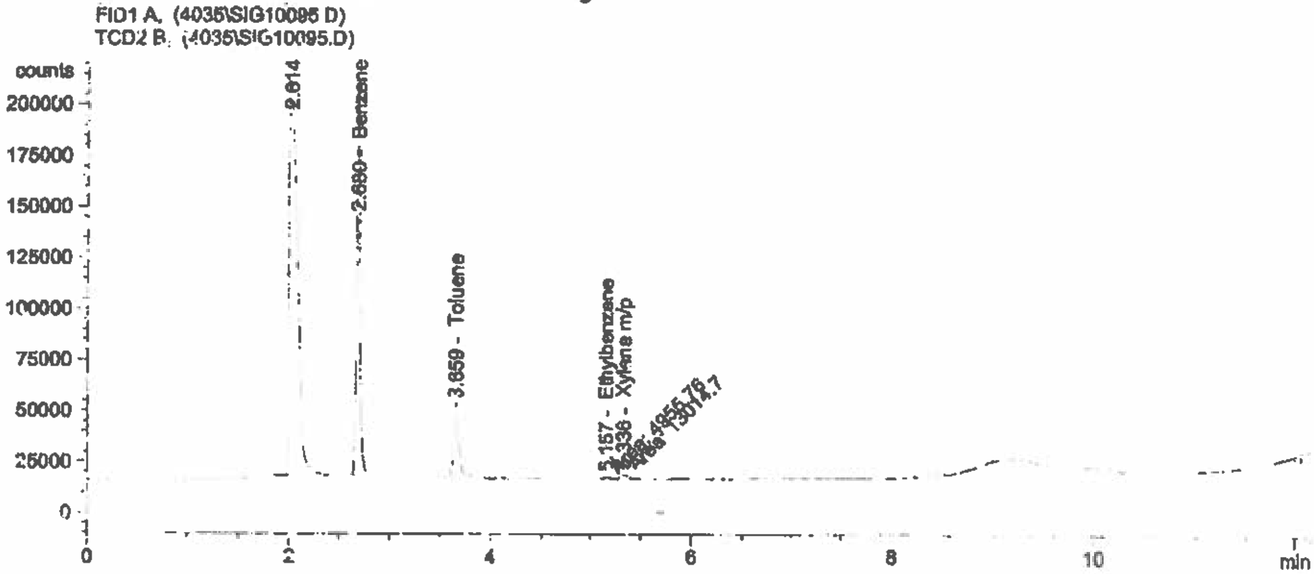
==

*** End of Report ***

Data File C:\HPCHEM\1\DATA\4035\SIG10095.D Sample Name: R3 Outlet uns T1

Run 3 Outlet unspiked F1/2, 0.4 ul injection, run 1, 10
1812MO

===
Injection Date : 10/18/2012 11:44:35 AM
Sample Name : R3 Outlet uns T1 Location : Vial 1
Acq. Operator : mo
Acq. Instrument : Instrument 1 Inj Volume : External
Method : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed : 10/18/2012 9:32:35 AM by mo
(modified after loading)



===
External Standard Report (Sample Amount is 0!)
===

Sorted By : Retention Time
Calib. Data Modified : 10/18/2012 9:32:30 AM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,
Signal 2: TCD2 B,

RetTime [min]	Sig	Type	Area counts*s	Amt/Area	Amount [ng/ul]	Grp	Name
2.680	1	BB	4.31145e5	8.64724e-4	372.82175		Benzene
3.659	1	BB	1.21167e5	7.67301e-4	92.97134		Toluene
5.157	1	MF	4955.76123	4.21111e-3	20.86924		Ethylbenzene
5.336	1	FM	1.30147e4	2.04636e-3	26.63531		Xylene m/p
5.669	1		-	-	-		Xylene o
5.807	1		-	-	-		Styrene
9.350	1		-	-	-		Indan
9.453	1		-	-	-		Indene
11.135	1		-	-	-		Naphthalene

Totals : 513.29763

Results obtained with enhanced integrator!
2 Warnings or Errors :

Warning : Calibration warnings (see calibration table listing)
Warning : Calibrated compound(s) not found

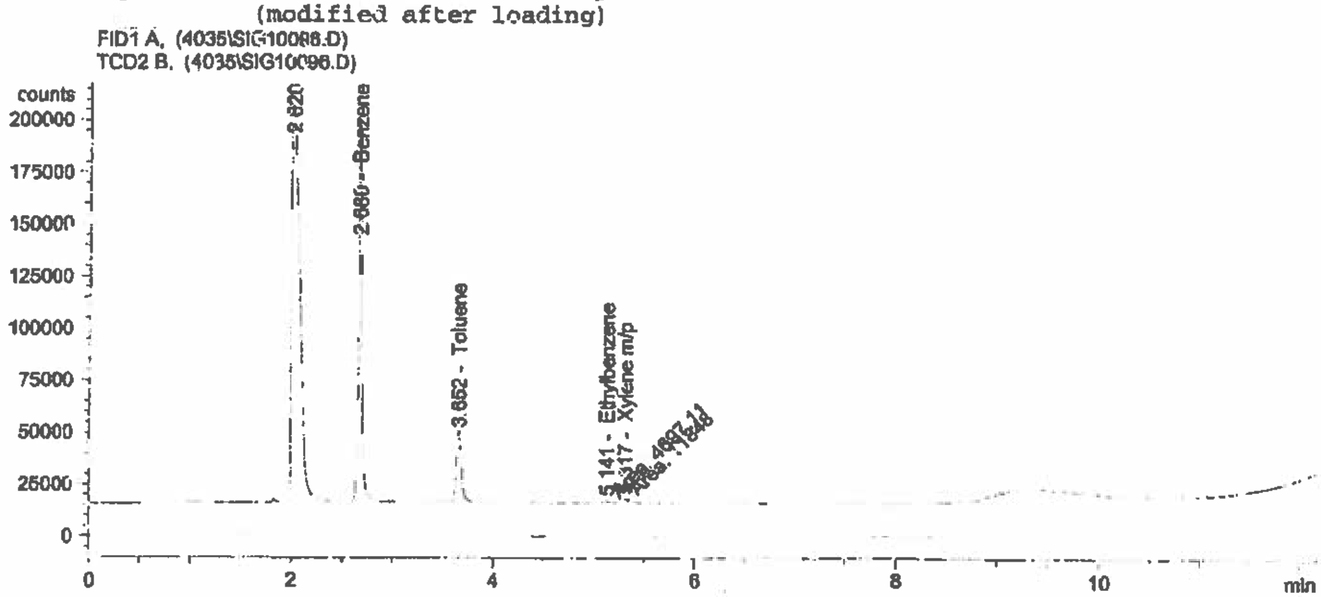
==

*** End of Report ***

Run 3 Outlet unspiked B1/2, 0.4 ul injection, run 2, 10
1812MO

===

```
Injection Date  : 10/18/2012 12:02:35 PM
Sample Name     : R3 Outlet uns T2            Location : Vial 1
Acq. Operator   : mo
Acq. Instrument : Instrument 1              Inj Volume : External
Method          : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed    : 10/18/2012 9:32:35 AM by mo
                  (modified after loading)
```



===

External Standard Report (Sample Amount is 0!)

===

```
Sorted By             :      Retention Time
Calib. Data Modified  :      10/18/2012 9:32:30 AM
Multiplier            :      1.0000
Dilution              :      1.0000
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: FID1 A,
Signal 2: TCD2 B,

RetTime [min]	Sig	Type	Area counts*s	Amt/Area	Amount [ng/ul]	Grp	Name
2.680	1	BB	4.03182e5	8.64724e-4	348.64130		Benzene
3.652	1	PB	1.15793e5	7.67301e-4	88.84794		Toluene
5.141	1	MF	4697.10889	4.21111e-3	19.78002		Ethylbenzene
5.317	1	FM	1.18480e4	2.04656e-3	24.24762		Xylene m/p
5.669	1		-	-	-		Xylene o
5.807	1		-	-	-		Styrene
9.350	1		-	-	-		Indan
9.453	1		-	-	-		Indene
11.135	1		-	-	-		Naphthalene

Totals : 481.51689

Results obtained with enhanced integrator!
2 Warnings or Errors :

Warning : Calibration warnings (see calibration table listing)
Warning : Calibrated compound(s) not found

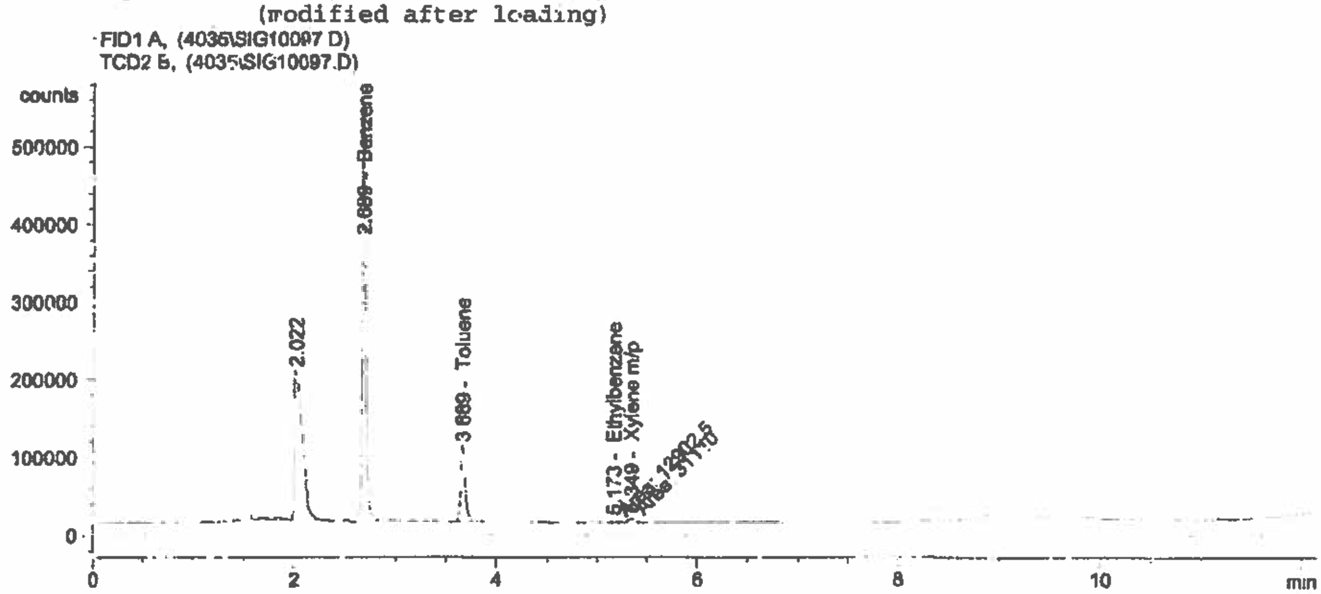
==

*** End of Report ***

Run 4 Outlet spiked F1/2, 0.4 ul injection, run 1, 1018
12MO

===

Injection Date : 10/18/2012 12:47:29 PM
Sample Name : R4 Outlet spi T1 Location : Vial 1
Acq. Operator : mo
Acq. Instrument : Instrument 1 Inj Volume : External
Method : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed : 10/18/2012 9:32:35 AM by mo
(modified after loading)



===

External Standard Report (Sample Amount is 0!)

===

Sorted By : Retention Time
Calib. Data Modified : 10/18/2012 9:32:30 AM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,
Signal 2: TCD2 B,

RetTime [min]	Sig	Type	Area counts*s	Amt/Area	Amount [ng/ul]	Grp	Name
2.689	1	BB	1.19480e6	8.64724e-4	1033.17284		Benzene
3.669	1	PB	3.23439e5	7.67301e-4	248.17514		Toluene
5.173	1	MF	1.29025e4	4.21111e-3	54.33388		Ethylbenzene
5.349	1	FM	3.11100e4	2.04656e-3	63.66835		Xylene m/p
5.669	1		-	-	-		Xylene o
5.807	1		-	-	-		Styrene
9.350	1		-	-	-		Indan
9.453	1		-	-	-		Indene
11.135	1		-	-	-		Naphthalene

Totals : 1399.35021

Results obtained with enhanced integrator!
2 Warnings or Errors :

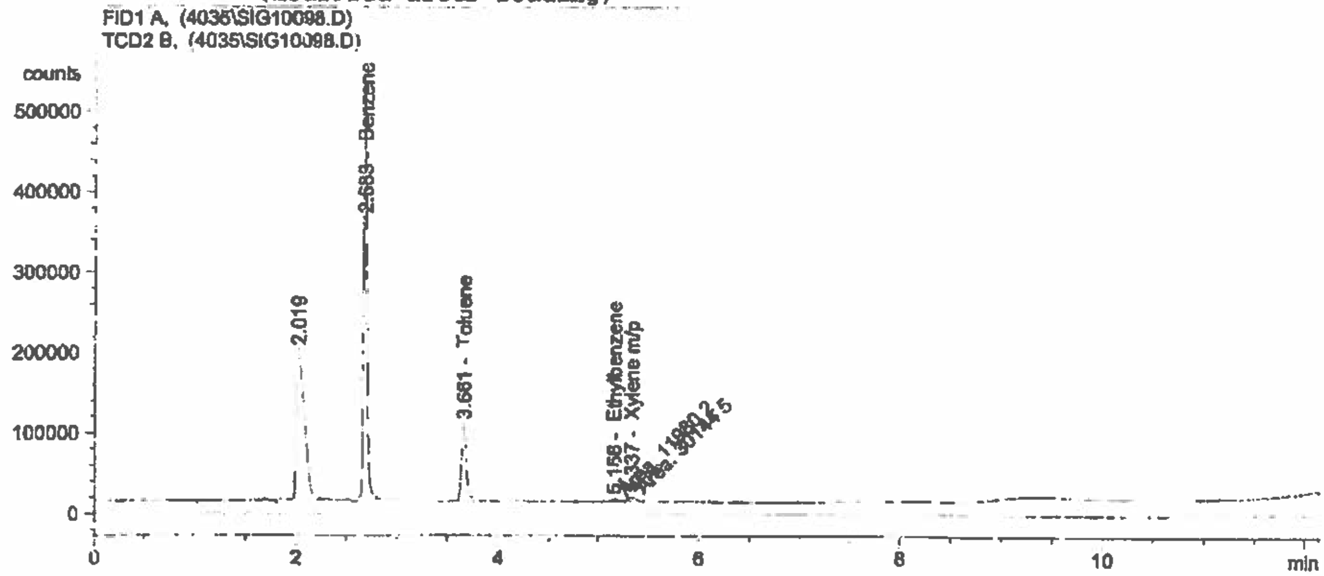
Warning : Calibration warnings (see calibration table listing)
Warning : Calibrated compound(s) not found

===
*** End of Report ***

Data File C:\HPCHEM\1\DATA\4035\SIG10098.D Sample Name: R4 Outlet spi T1

Run 4 Outlet spiked F1/2, 0.4 ul injection, run 2, 1018
12MO

===
Injection Date : 10/18/2012 1:07:10 PM
Sample Name : R4 Outlet spi T1 Location : Vial 1
Acq. Operator : mo
Acq. Instrument : Instrument 1 Inj Volume : External
Method : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed : 10/18/2012 9:32:35 AM by mo
(modified after loading)



===
External Standard Report (Sample Amount is 0!)
===

Sorted By : Retention Time
Calib. Data Modified : 10/18/2012 9:32:30 AM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,
Signal 2: TCD2 B,

RetTime [min]	Sig	Type	Area counts*s	Amt/Area	Amount [ng/ul]	Grp	Name
2.683	1	BB	1.18789e6	8.64724e-4	1027.19630		Benzene
3.661	1	BB	3.16782e5	7.67301e-4	243.06669		Toluene
5.158	1	MF	1.19802e4	4.21111e-3	50.45001		Ethylbenzene
5.337	1	FM	3.01445e4	2.04656e-3	61.69233		Xylene m/p
5.669	1		-	-	-		Xylene o
5.807	1		-	-	-		Styrene
9.350	1		-	-	-		Indan
9.453	1		-	-	-		Indene
11.135	1		-	-	-		Naphthalene

Totals : 1382.40533

Results obtained with enhanced integrator!
2 Warnings or Errors :

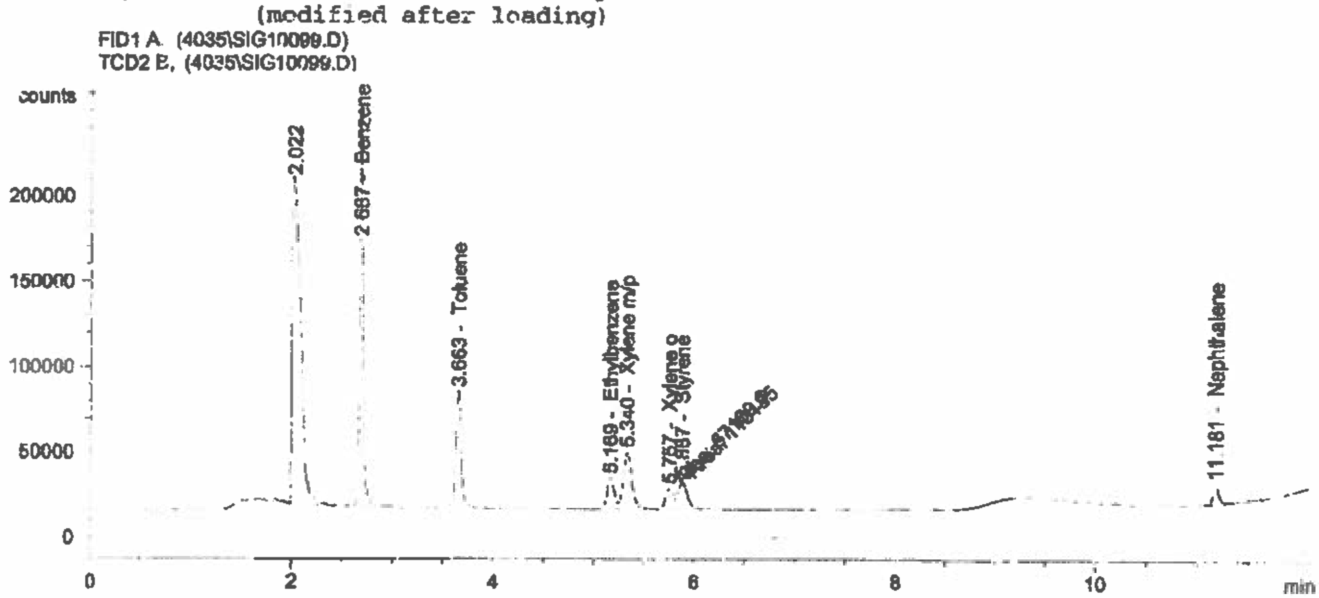
Warning : Calibration warnings (see calibration table listing)
Warning : Calibrated compound(s) not found

==

*** End of Report ***

Run 4 Outlet spiked B1/2, 0.4 ul injection, run 1, 1018
12MO

===
Injection Date : 10/18/2012 1:25:35 PM
Sample Name : R4 Outlet spi T2 Location : Vial 1
Acq. Operator : mo
Acq. Instrument : Instrument 1 Inj Volume : External
Acq. Method : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed : 10/18/2012 9:32:35 AM by mo
(modified after loading)
Analysis Method : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed : 10/18/2012 1:56:21 PM by mo
(modified after loading)



===
External Standard Report (Sample Amount is 0!)
===

Sorted By : Retention Time
Calib. Data Modified : 10/18/2012 1:56:18 PM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,
Signal 2: TCD2 B,

RetTime [min]	Sig	Type	Area counts*s	Amt/Area	Amount [ng/ul]	Grp	Name
2.687	1	BB	5.23062e5	3.91619e-2	2.04841e4		Benzene
3.663	1	BB	2.29749e5	9.01140e-2	2.07036e4		Toluene
5.169	1	PV	9.19621e4	4.21111e-3	387.26225		Ethylbenzene
5.340	1	VB	2.02977e5	1.98933e-1	4.03786e4		Xylene m/p
5.757	1	MF	6.71696e4	3.05154e-1	2.04971e4		Xylene o
5.887	1	FM	1.10185e5	1.82624e-1	2.01224e4		Styrene
9.350	1		-	-	-		Indan
9.453	1		-	-	-		Indene
11.181	1	PB	4.04193e4	5.68730e-6	2.29877e-1		Naphthalene

Totals : 1.22573e5

Results obtained with enhanced integrator!
2 Warnings or Errors :

Warning : Calibration warnings (see calibration table listing)
Warning : Calibrated compound(s) not found

==

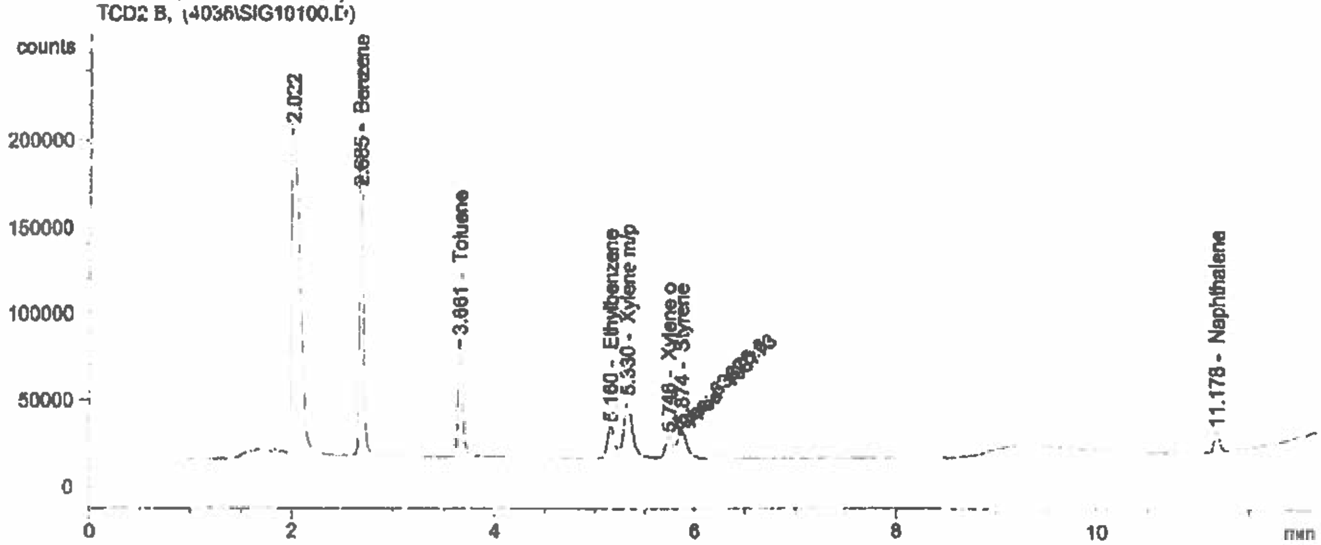
*** End of Report ***

Run 4 Outlet spiked B1/2, 0.4 ul injection, run 2, 1018
12MO

===

Injection Date : 10/18/2012 1:42:34 PM
Sample Name : R4 Outlet spi T2 Location : Vial 1
Acq. Operator : mo
Acq. Instrument : Instrument 1 Inj Volume : External
Acq. Method : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed : 10/18/2012 9:32:35 AM by mo
(modified after loading)
Analysis Method : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed : 10/18/2012 1:56:21 PM by mo
(modified after loading)

FID1 A, (4035\SIG10100.D)
TCD2 B, (4035\SIG10100.D)



===

External Standard Report (Sample Amount is 0!)

===

Sorted By : Retention Time
Calib. Data Modified : 10/18/2012 1:56:18 PM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,
Signal 2: TCD2 B,

RetTime [min]	Sig	Type	Area counts*s	Amt/Area	Amount [ng/ul]	Grp	Name
2.685	1	BB	5.10190e5	3.91619e-2	1.99800e4		Benzene
3.651	1	BB	2.21719e5	9.01140e-2	1.99800e4		Toluene
5.160	1	BV	9.01262e4	4.21111e-3	379.53089		Ethylbenzene
5.330	1	VB	1.99062e5	1.98933e-1	3.96000e4		Xylene m/p
5.746	1	MF	6.38756e4	3.05154e-1	1.94919e4		Xylene o
5.874	1	FM	1.08773e5	1.82624e-1	1.98647e4		Styrene
9.350	1		-	-	-		Indan
9.453	1		-	-	-		Indene
11.178	1	PB	3.99101e4	5.68730e-6	2.26981e-1		Naphthalene

Totals : 1.19296e5

Results obtained with enhanced integrator!
2 Warnings or Errors :

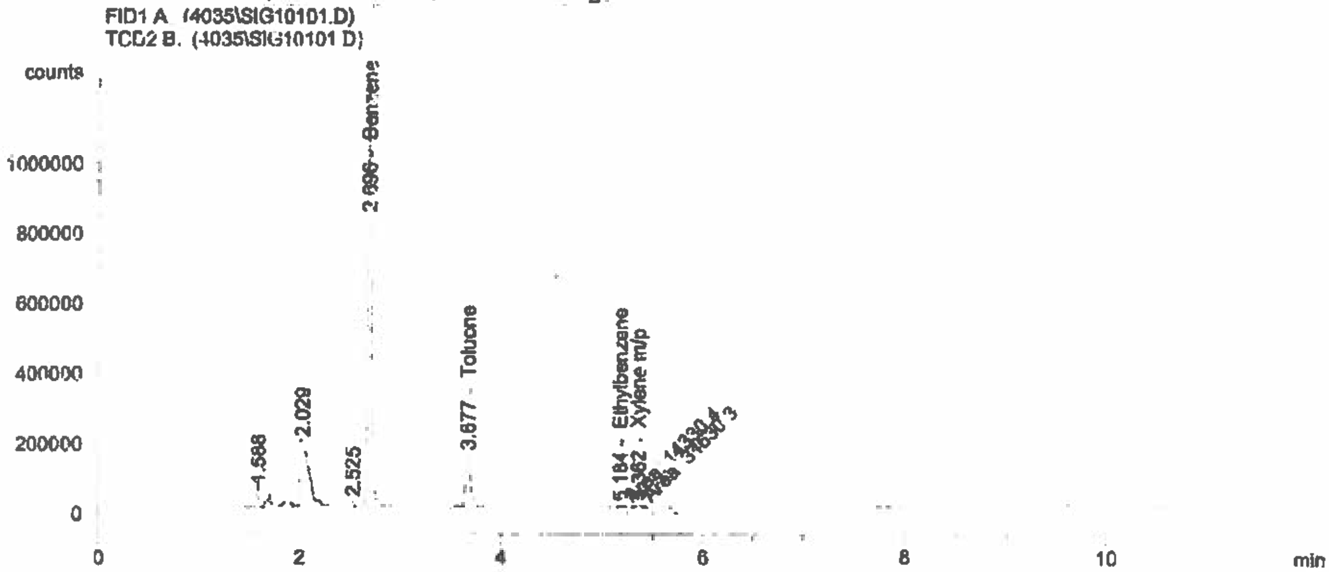
Warning : Calibration warnings (see calibration table listing)
Warning : Calibrated compound(s) not found

==

*** End of Report ***

Run 4 Outlet unspiked F1/2, 0.4 ul injection, run 1, 10
1812MO

===
Injection Date : 10/18/2012 2:16:25 PM
Sample Name : R4 Outlet uns T1 Location : Vial 1
Acq. Operator : mo
Acq. Instrument : Instrument 1 Inj Volume : External
Method : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed : 10/18/2012 1:56:21 PM by mo
(modified after loading)



===
External Standard Report (Sample Amount is 0!)
===

Sorted By : Retention Time
Calib. Data Modified : 10/18/2012 1:56:18 PM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,
Signal 2: TCD2 B,

RetTime [min]	Sig	Type	Area counts*s	Amt/Area	Amount [ng/ul]	Grp	Name
2.696	1	VB	2.70234e6	3.91619e-2	1.05829e5		Benzene
3.677	1	BB	4.93107e5	9.01140e-2	4.44359e4		Toluene
5.184	1	MF	1.43304e4	4.21111e-3	60.34699		Ethylbenzene
5.362	1	FM	3.46303e4	1.98933e-1	6889.10312		Xylene m/p
5.746	1		-	-	-		Xylene o
5.874	1		-	-	-		Styrene
9.350	1		-	-	-		Indan
9.453	1		-	-	-		Indene
11.135	1		-	-	-		Naphthalene

Totals : 1.57214e5

Results obtained with enhanced integrator!
2 Warnings or Errors :

Warning : Calibration warnings (see calibration table listing)
Warning : Calibrated compound(s) not found

==

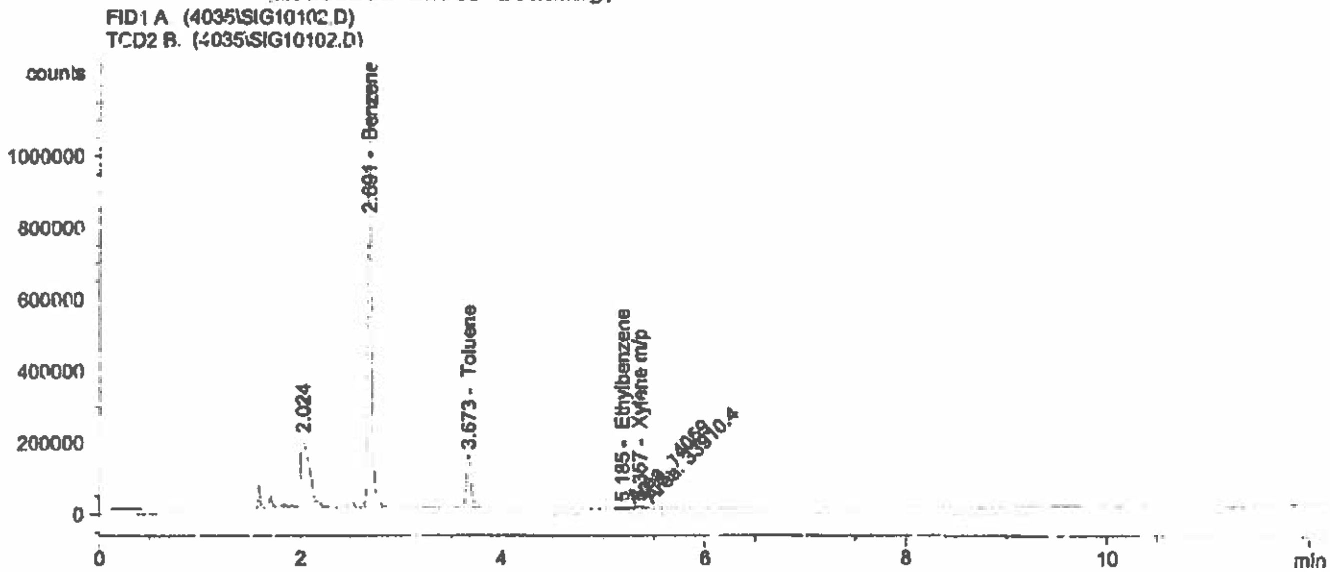
*** End of Report ***

Data File C:\HPCHEM\1\DATA\4035\SIG10102.D Sample Name: R4 Outlet uns T2

Run 4 Outlet unspiked B1/2, 0.4 ul injection, run 2, 10
1812MO

===

Injection Date : 10/18/2012 2:36:33 PM
Sample Name : R4 Outlet uns T2 Location : Vial 1
Acq. Operator : mo
Acq. Instrument : Instrument 1 Inj Volume : External
Method : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed : 10/18/2012 1:56:21 PM by mo
(modified after loading)



===

External Standard Report (Sample Amount is 0!)

===

Sorted By : Retention Time
Calib. Data Modified : 10/18/2012 1:56:18 PM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,
Signal 2: TCD2 B,

RetTime [min]	Sig	Type	Area counts*s	Amt/Area	Amount [ng/ul]	Grp	Name
2.691	1	BB	2.69896e6	3.91619e-2	1.05696e5		Benzene
3.673	1	BB	4.95002e5	9.01140e-2	4.46067e4		Toluene
5.185	1	MF	1.40590e4	4.21111e-3	59.20381		Ethylbenzene
5.357	1	FM	3.39104e4	1.98933e-1	6745.87712		Xylene m/p
5.746	1		-	-	-		Xylene o
5.874	1		-	-	-		Styrene
9.350	1		-	-	-		Indan
9.453	1		-	-	-		Indene
11.135	1		-	-	-		Naphthalene

Totals : 1.57108e5

Results obtained with enhanced integrator!
2 Warnings or Errors :

Warning : Calibration warnings (see calibration table listing)
Warning : Calibrated compound(s) not found

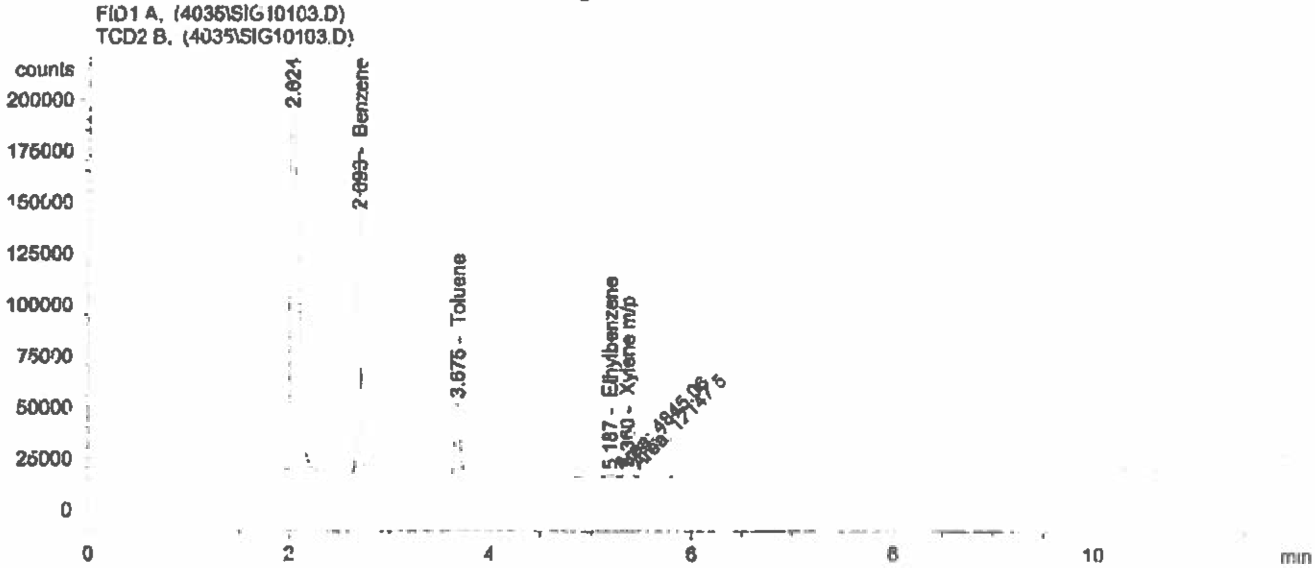
==

*** End of Report ***

Run 4 Outlet unspiked B1/2, 0.4 ul injection, run 1, 10
1812MO

===

Injection Date : 10/18/2012 2:56:25 PM
Sample Name : R4 Outlet uns T1 Location : Vial 1
Acq. Operator : mo
Acq. Instrument : Instrument 1 Inj Volume : External
Method : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed : 10/18/2012 1:56:21 PM by mo
(modified after loading)



===

External Standard Report (Sample Amount is 0!)

===

Sorted By : Retention Time
Calib. Data Modified : 10/18/2012 1:56:18 PM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,
Signal 2: TCD2 B,

RetTime [min]	Sig	Type	Area counts*s	Amt/Area	Amount [ng/ul]	Grp	Name
2.693	1	BB	3.50536e5	3.91619e-2	1.37277e4		Benzene
3.675	1	BB	1.19629e5	9.01140e-2	1.07802e4		Toluene
5.187	1	MF	4845.05566	4.21111e-3	20.40304		Ethylbenzene
5.360	1	FM	1.21475e4	1.98933e-1	2416.53035		Xylene m/p
5.746	1		-	-	-		Xylene o
5.874	1		-	-	-		Styrene
9.350	1		-	-	-		Indan
9.453	1		-	-	-		Indene
11.135	1		-	-	-		Naphthalene

Totals : 2.69448e4

Results obtained with enhanced integrator!
2 Warnings or Errors :

Warning : Calibration warnings (see calibration table listing)
Warning : Calibrated compound(s) not found

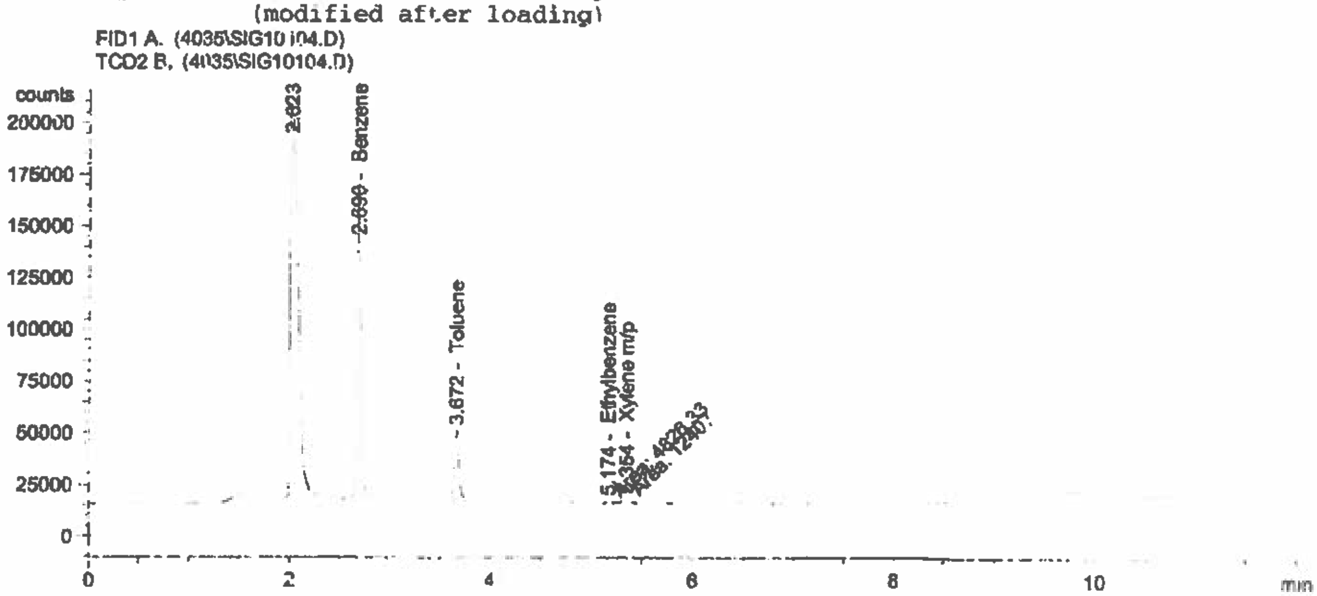
==

*** End of Report ***

Run 4 Outlet unspiked B1/2, 0.4 ul injection, run 2, 10
1812MO

===

Injection Date : 10/18/2012 3:14:55 PM
Sample Name : R4 Outlet uns T2 Location : Vial 1
Acq. Operator : mo
Acq. Instrument : Instrument 1 Inj Volume : External
Method : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed : 10/18/2012 1:56:21 PM by mo
(modified after loading)



===

External Standard Report (Sample Amount is 0!)

===

Sorted by : Retention Time
Calib. Data Modified : 10/18/2012 1:56:18 PM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,
Signal 2: TCD2 B,

RetTime [min]	Sig	Type	Area counts*s	Amt/Area	Amount [ng/ul]	Grp	Name
2.690	1	BB	3.43591e5	3.91619e-2	1.34557e4		Benzene
3.672	1	BB	1.15965e5	9.01140e-2	1.04501e4		Toluene
5.174	1	MF	4826.33301	4.21111e-3	20.32420		Ethylbenzene
5.354	1	FM	1.24070e4	1.98932e-1	2468.15353		Xylene m/p
5.746	1		-	-	-		Xylene o
5.874	1		-	-	-		Styrene
9.350	1		-	-	-		Indan
9.453	1		-	-	-		Indene
11.135	1		-	-	-		Naphthalene

Totals : 2.63943e4

Results obtained with enhanced integrator!
2 Warnings or Errors :

Warning : Calibration warnings (see calibration table listing)
Warning : Calibrated compound(s) not found

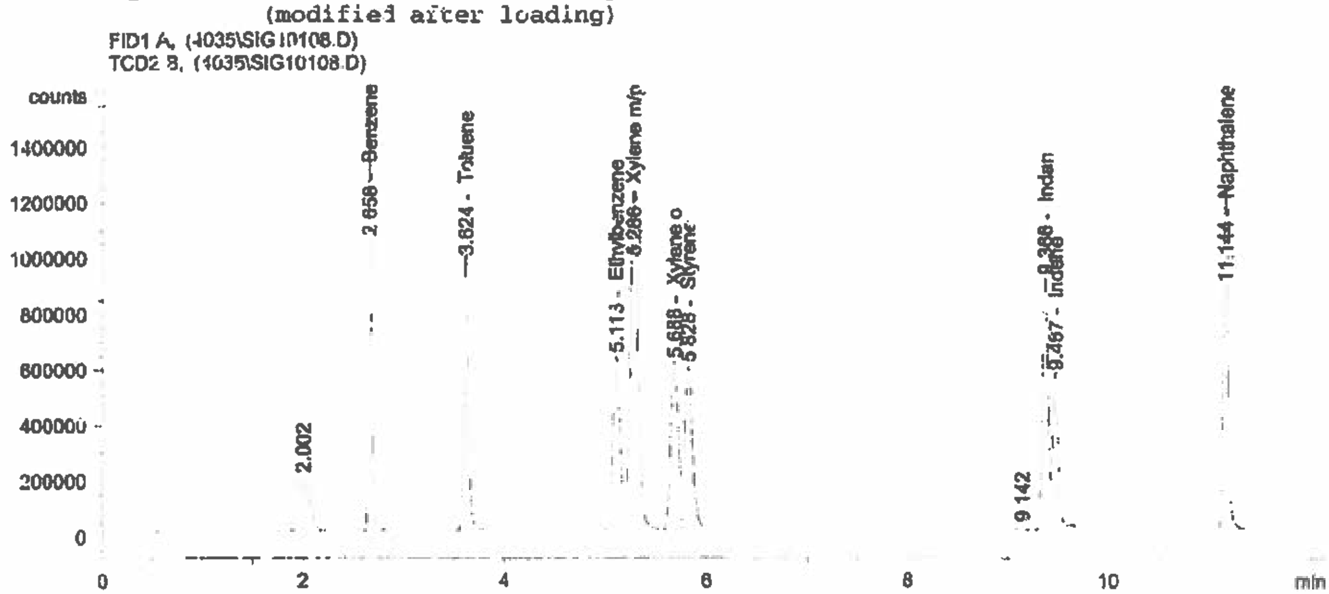
==

*** End of Report ***

Drift check high, 0.4 ul injection, run 1, 101912MO

===

Injection Date : 10/19/2012 8:23:56 AM
Sample Name : Drift check high Location : Vial 1
Acq. Operator : mo
Acq. Instrument : Instrument 1 Inj Volume : External
Method : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed : 10/18/2012 4:29:39 PM by mo
(modified after loading)



===

External Standard Report (Sample Amount is 0!)

===

Sorted By : Retention Time
Calib. Data Modified : 10/18/2012 1:56:18 PM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,
Signal 2: TCD2 B,

RetTime [min]	Sig	Type	Area counts*s	Amt/Area	Amount [ng/ul]	Grp	Name
2.658	1	PB	3.31998e6	3.91619e-2	1.30017e5		Benzene
3.624	1	BB	3.18542e6	9.01140e-2	2.87051e5		Toluene
5.113	1	BV	3.02164e6	4.21111e-3	1.27245e4		Ethylbenzene
5.286	1	VB	6.65980e6	1.98933e-1	1.32485e6		Xylene m/p
5.688	1	BV	3.13945e6	3.05154e-1	9.58016e5		Xylene o
5.828	1	VB	3.42317e6	1.82624e-1	6.25154e5		Styrene
9.366	1	VV	3.35496e6	1.59807e-2	5.36148e4		Indan
9.467	1	VB	2.15720e6	3.47214e-7	7.49010e-1		Indene
11.144	1	BB	3.70555e6	5.69730e-6	21.07456		Naphthalene

Totals : 3.39145e6

Results obtained with enhanced integrator!
1 Warnings or Errors :

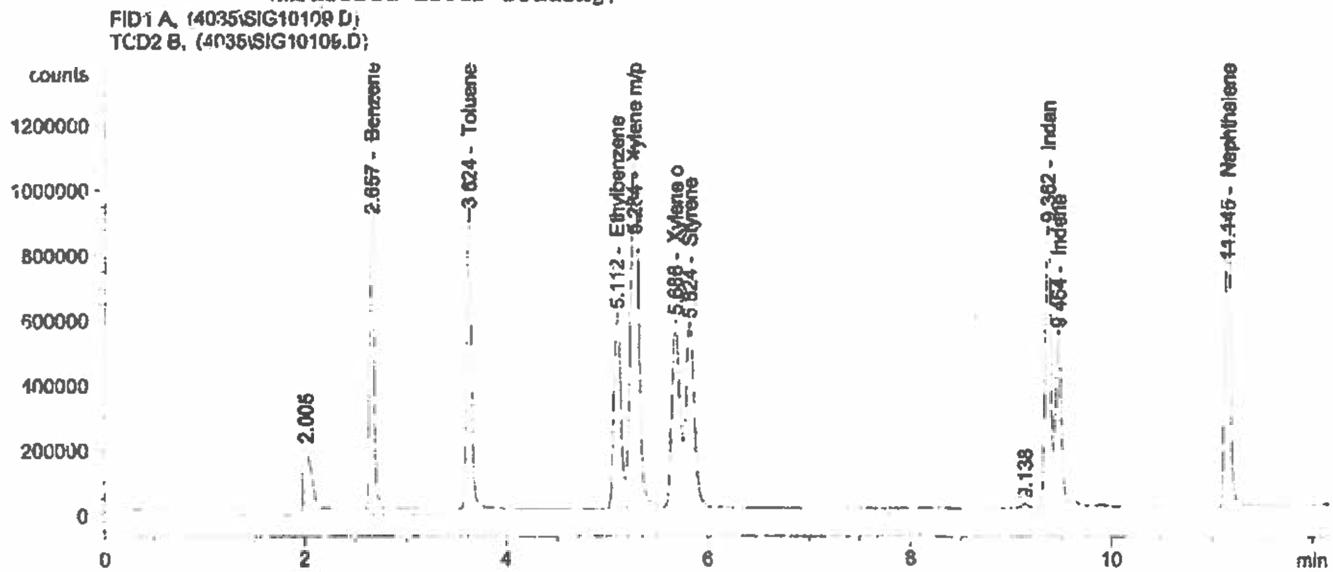
Warning : Calibration warnings (see calibration table listing)

===
*** End of Report ***

Drift check high, 0.4 ul injection, run 1, 101913MO

===

Injection Date : 10/19/2012 8:48:15 AM
Sample Name : Drift check high Location : Vial 1
Acq. Operator : mo
Acq. Instrument : Instrument 1 Inj Volume : External
Method : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed : 10/18/2012 4:29:29 PM by mo
(modified after loading)



===

External Standard Report (Sample Amount is 0!)

===

Sorted By : Retention Time
Calib. Data Modified : 10/18/2012 1:56:18 PM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,
Signal 2: TCD2 B,

RetTime [min]	Sig	Type	Area counts*s	Amt/Area	Amount [ng/ul]	Grp	Name
2.657	1	PB	3.23335e6	3.91619e-2	1.26624e5		Benzene
3.624	1	BP	3.10605e6	9.01140e-2	2.79899e5		Toluene
5.112	1	BV	2.92861e6	4.21111e-3	1.23327e4		Ethylbenzene
5.284	1	VB	6.26966e6	1.98933e-1	1.24724e6		Xylene m/p
5.686	1	BV	3.01160e6	3.05154e-1	9.19004e5		Xylene o
5.824	1	VB	3.38597e6	1.83624e-1	6.18361e5		Styrene
9.362	1	VV	3.27961e6	1.59807e-2	5.24105e4		Indan
9.464	1	VB	2.11132e6	3.47214e-7	7.33080e-1		Indene
11.145	1	BB	3.55573e6	5.68730e-6	20.22249		Naphthalene

Totals : 3.25589e6

Results obtained with enhanced integrator!
1 Warnings or Errors :

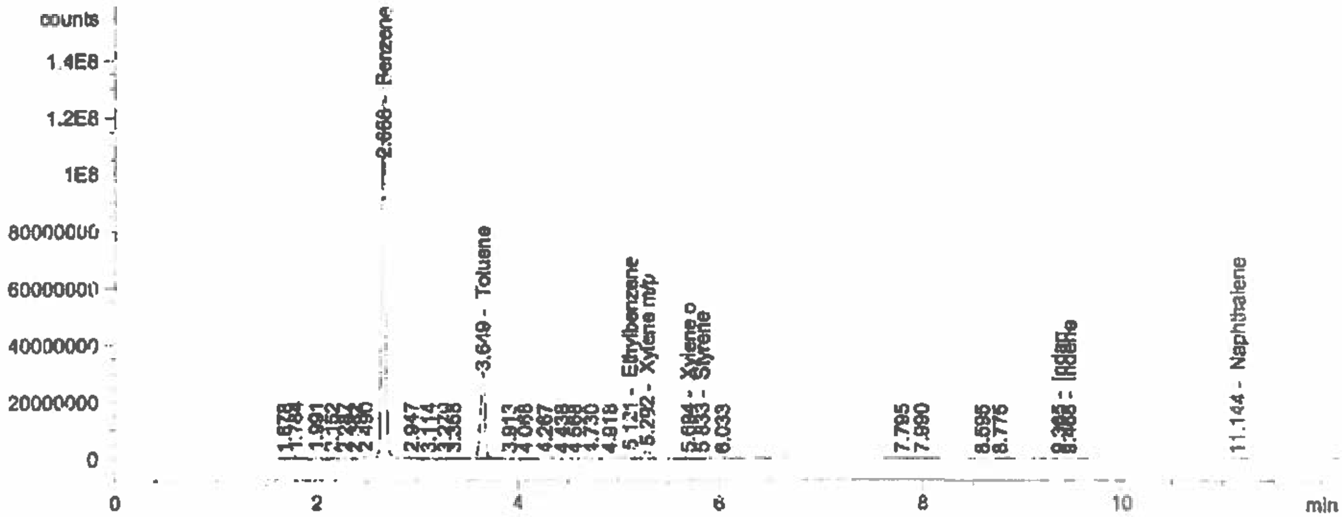
Warning : Calibration warnings (see calibration table listing)

===
*** End of Report ***

Run 4 Inlet A T1, 0.4 ul injection, run 1. 101912MO

===

Injection Date : 10/19/2012 9:38:34 AM
Sample Name : R4 Inlet A T1 Location : Vial 1
Acq. Operator : mo
Acq. Instrument : Instrument 1 Inj Volume : External
Method : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed : 10/18/2012 4:29:39 PM by mo
(modified after loading)



===

External Standard Report (Sample Amount is 0!)

===

Sorted By : Retention Time
Calib. Data Modified : 10/18/2012 1:56:18 PM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,
Signal 2: TCD2 B,

RetTime [min]	Sig	Type	Area counts*s	Amt/Area	Amount [ng/ul]	Grp	Name
2.668	1	VB S	3.64703e8	3.91619e-2	1.42823e7		Benzene
3.649	1	VV X	9.82210e7	9.01140e-2	8.85105e6		Toluene
5.121	1	VV X	5.94682e6	4.21111e-3	2.50427e4		Ethylbenzene
5.292	1	VV X	1.46677e7	1.98933e-1	2.91788e6		Xylene m/p
5.694	1	VV X	2.14254e6	3.05154e-1	6.53806e5		Xylene o
5.833	1	VV X	2.63219e6	1.82624e-1	4.80703e5		Styrene
9.365	1	PV	4.61694e5	1.59807e-2	7378.21614		Indan
9.468	1	VB	7.59075e5	3.47214e-7	2.63561e-1		Indene
11.144	1	PB	1.71541e5	5.68730e-6	9.75605e-1		Naphthalene

Totals : 2.72184e7

Results obtained with enhanced integrator!
1 Warnings or Errors :

Warning : Calibration warnings (see calibration table listing)

===

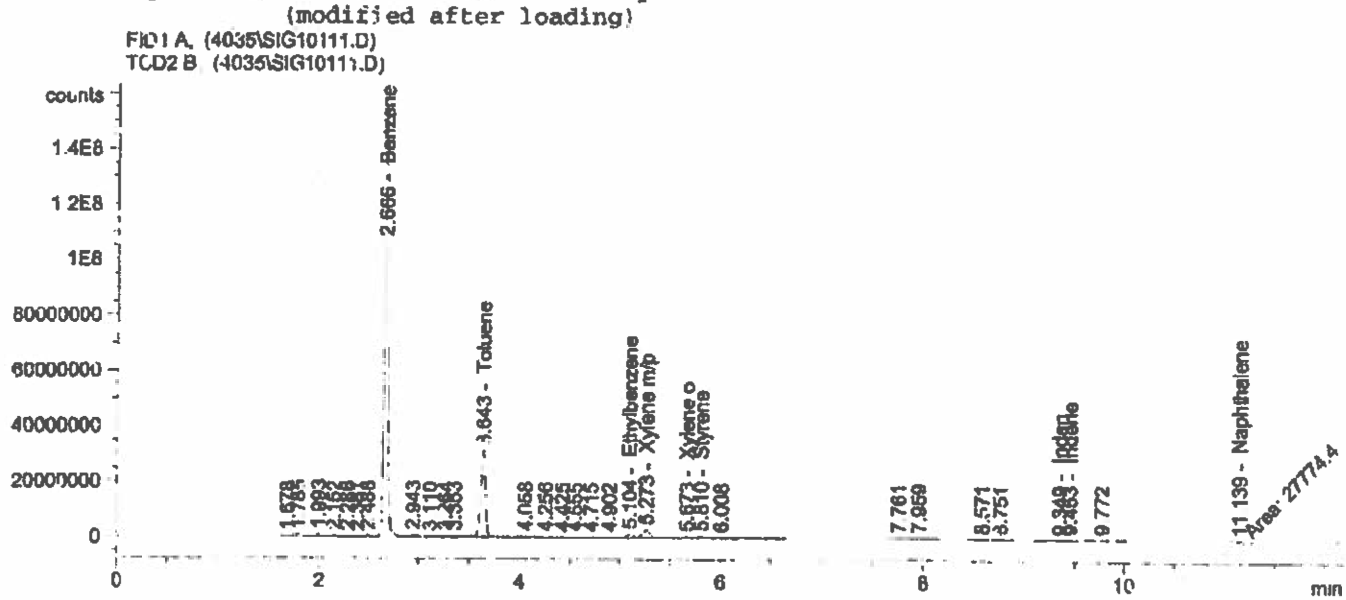
*** End of Report ***

Data File C:\HPCHEM\1\DATA\4035\SIG10111.D Sample Name: R4 Inlet A T1

Run 4 Inlet A T1, 0.4 ul injection, run 2, 101912MO

===

```
Injection Date   : 10/19/2012 9:55:41 AM
Sample Name      : R4 Inlet A T1                  Location : Vial 1
Acq. Operator    : mo
Acq. Instrument  : Instrument 1                   Inj Volume : External
Acq. Method      : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed     : 10/19/2012 9:57:50 AM by mo
                   (modified after loading)
Analysis Method  : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed     : 10/19/2012 10:19:34 AM by mo
                   (modified after loading)
```



===

External Standard Report (Sample Amount is 0!)

===

```
Sorted By              :      Retention Time
Calib. Data Modified   :      10/19/2012 10:19:55 AM
Multiplier             :      1.0000
Dilution               :      1.0000
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: FID1 A,
Signal 2: TCD2 B,

RetTime [min]	Sig	Type	Area counts*s	Amt/Area	Amount [ng/ul]	Grp	Name
2.666	1	VB S	3.71119e8	5.47843e-5	2.03315e4		Benzene
3.643	1	VV X	1.00866e8	2.03419e-4	2.05180e4		Toluene
5.104	1	VV X	5.99195e6	3.35641e-3	2.01115e4		Ethylbenzene
5.273	1	VV X	1.48183e7	2.69981e-3	4.00066e4		Xylene m/p
5.673	1	VV X	2.06108e6	9.14802e-3	1.88548e4		Xylene o
5.810	1	VV X	2.56034e6	7.52224e-3	1.92595e4		Styrene
9.349	1	BV	4.21199e5	4.11528e-2	1.73335e4		Indan
9.453	1	VB	7.36369e5	1.31739e-6	9.70086e-1		Indene
11.139	1	MM	2.77744e4	5.82951e-6	1.61911e-1		Naphthalene

Totals : 1.56416e5

Results obtained with enhanced integrator!
1 Warnings or Errors :

Warning : Calibration warnings (see calibration table listing)

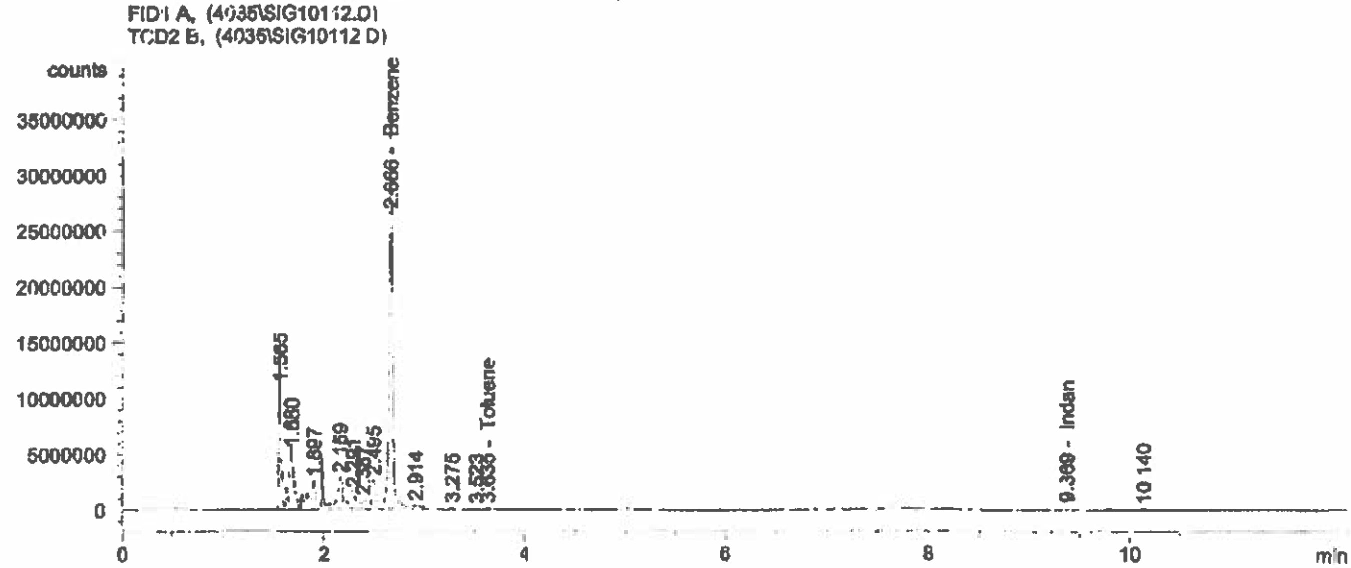
==

*** End of Report ***

Run 4 Inlet A T2, 0.4 ul injection, run 1, 101912MO

===

Injection Date : 10/19/2012 10:18:14 AM
Sample Name : R4 Inlet A T2 Location : Vial 1
Acq. Operator : mo
Acq. Instrument : Instrument 1 Inj Volume : External
Method : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed : 10/19/2012 10:19:34 AM by mo
(modified after loading)



===

External Standard Report (Sample Amount is 0!)

===

Sorted By : Retention Time
Calib. Data Modified : 10/19/2012 10:19:55 AM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,
Signal 2: TCD2 B,

RetTime [min]	Sig	Type	Area counts*s	Amt/Area	Amount [ng/ul]	Grp	Name
2.666	1	VV	8.94395e7	5.47843e-5	4903.16633		Benzene
3.635	1	VB	5.00761e5	2.03419e-4	101.86428		Toluene
5.121	1		-	-	-		Ethylbenzene
5.292	1		-	-	-		Xylene m/p
5.694	1		-	-	-		Xylene o
5.833	1		-	-	-		Styrene
9.369	1	BP	7.71325e5	4.11528e-2	3.17422e4		Indan
9.468	1		-	-	-		Indene
11.144	1		-	-	-		Naphthalene

Totals : 3.67472e4

Results obtained with enhanced integrator!
2 Warnings or Errors :

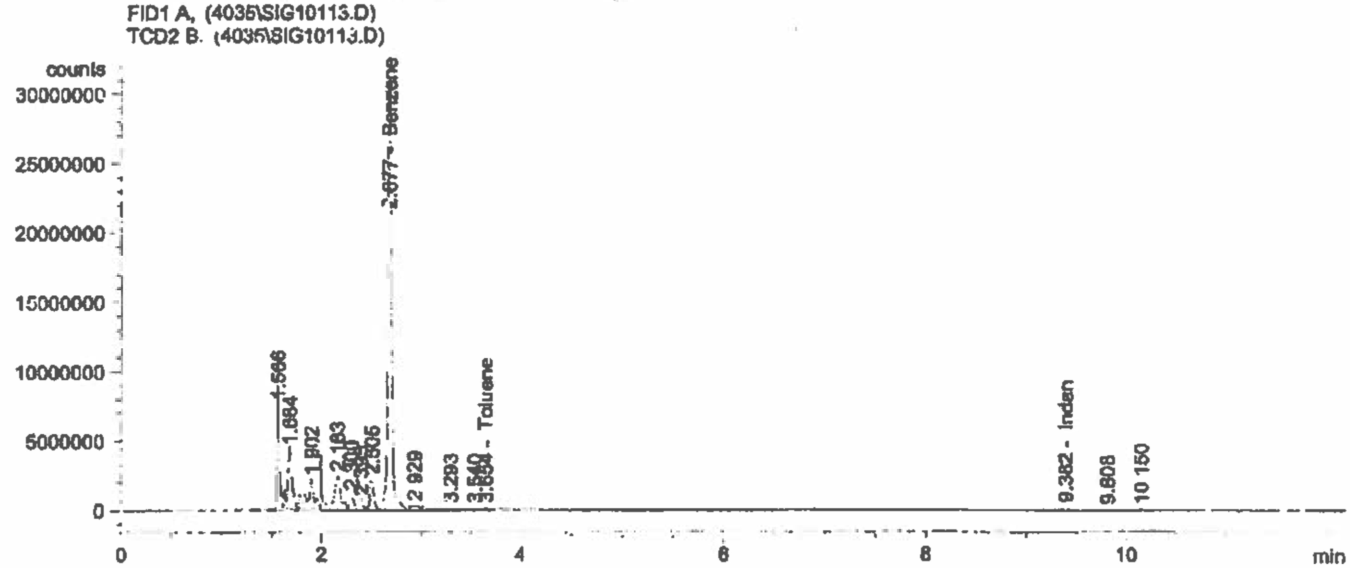
Warning : Calibration warnings (see calibration table listing)
Warning : Calibrated compound(s) not found

===

Run 4 Inlet A T2, 0.4 ul injection, run 1, 101912MO

===

```
Injection Date   : 10/19/2012 10:33:29 AM
Sample Name      : R4 Inlet A T2                    Location : Vial 1
Acq. Operator    : mo
Acq. Instrument  : Instrument 1                 Inj Volume : External
Method           : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed     : 10/19/2012 10:19:34 AM by mo
                   (modified after loading)
```



===

External Standard Report (Sample Amount is 0!)

===

```
Sorted By             :     Retention Time
Calib. Data Modified  :     10/19/2012 10:19:55 AM
Multiplier            :     1.0000
Dilution              :     1.0000
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: FID1 A,
Signal 2: TCD2 B,

RetTime [min]	Sig	Type	Area counts*s	Amt/Area	Amount [ng/ul]	Grp	Name
2.677	1	VV	7.84367e7	5.47843e-5	4297.09618		Benzene
3.654	1	VB	4.50971e5	2.03419e-4	91.73602		Toluene
5.121	1		-	-	-		Ethylbenzene
5.293	1		-	-	-		Xylene m/p
5.694	1		-	-	-		Xylene o
5.833	1		-	-	-		Styrene
9.382	1	BP	6.94464e5	4.11528e-2	2.85791e4		Indan
9.468	1		-	-	-		Indene
11.144	1		-	-	-		Naphthalene

Totals : 3.29680e4

Results obtained with enhanced integrator!
2 Warnings or Errors :

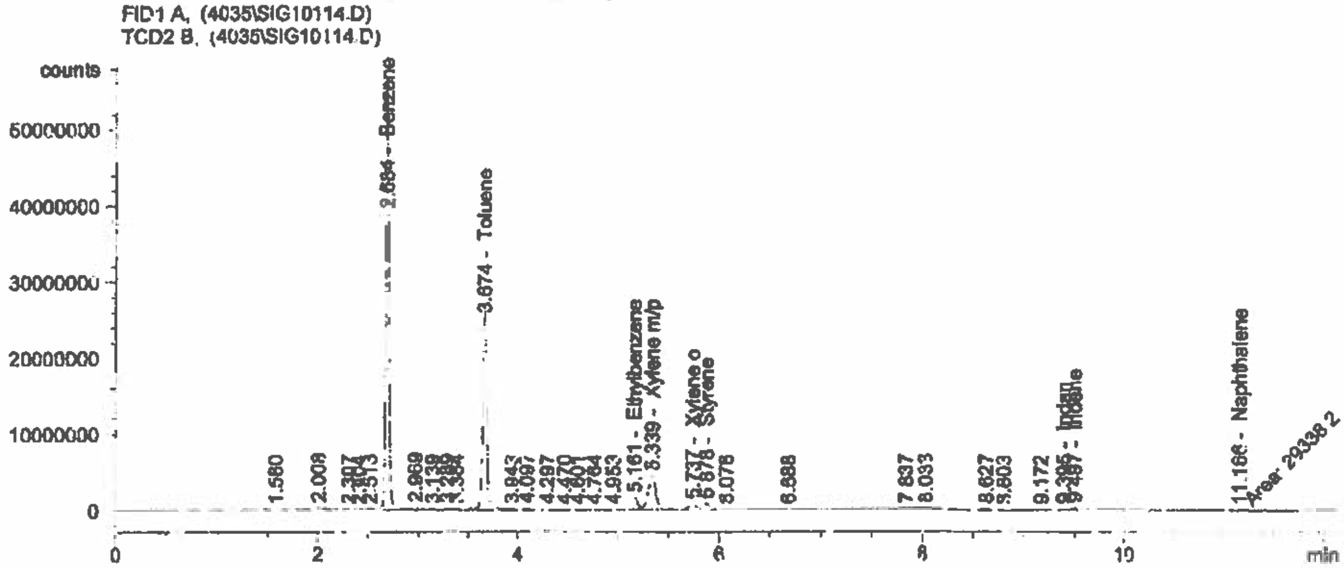
Warning : Calibration warnings (see calibration table listing)
Warning : Calibrated compound(s) not found

===

Run 4 Inlet B T1, 0.4 ul injection, run 1, 101912MO

===

Injection Date : 10/19/2012 10:50:32 AM
Sample Name : R4 Inlet B T1   Location : Vial 1
Acq. Operator : mo
Acq. Instrument : Instrument 1   Inj Volume : External
Method : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed : 10/19/2012 10:19:34 AM by mo
(modified after loading)



===

External Standard Report (Sample Amount is 0!)

===

Sorted By : Retention Time
Calib. Data Modified : 10/19/2012 10:19:55 AM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,
Signal 2: TCD2 B,

RetTime [min]	Sig	Type	Area counts*s	Amt/Area	Amount [ng/ul]	Grp	Name
2.684	1	VV	1.19751e8	5.47843e-5	6560.49248		Benzene
3.674	1	VV	8.34954e7	2.03419e-4	1.69845e4		Toluene
5.161	1	VV	7.72883e6	3.35641e-3	2.59411e4		Ethylbenzene
5.339	1	VV	2.38022e7	2.69981e-3	6.42614e4		Xylene m/p
5.737	1	VV	3.89391e6	9.14802e-3	3.56125e4		Xylene o
5.878	1	VV	4.32779e6	7.52224e-3	3.25547e4		Styrene
9.395	1	VV	5.78363e5	4.11528e-2	2.38012e4		Indan
9.497	1	VB	1.06917e6	1.31739e-6	1.40852		Indene
11.166	1	MF	2.93382e4	5.82951e-6	1.71037e-1		Naphthalene

Totals : 2.05718e5

Results obtained with enhanced integrator!
1 Warnings or Errors :

Warning : Calibration warnings (see calibration table listing)

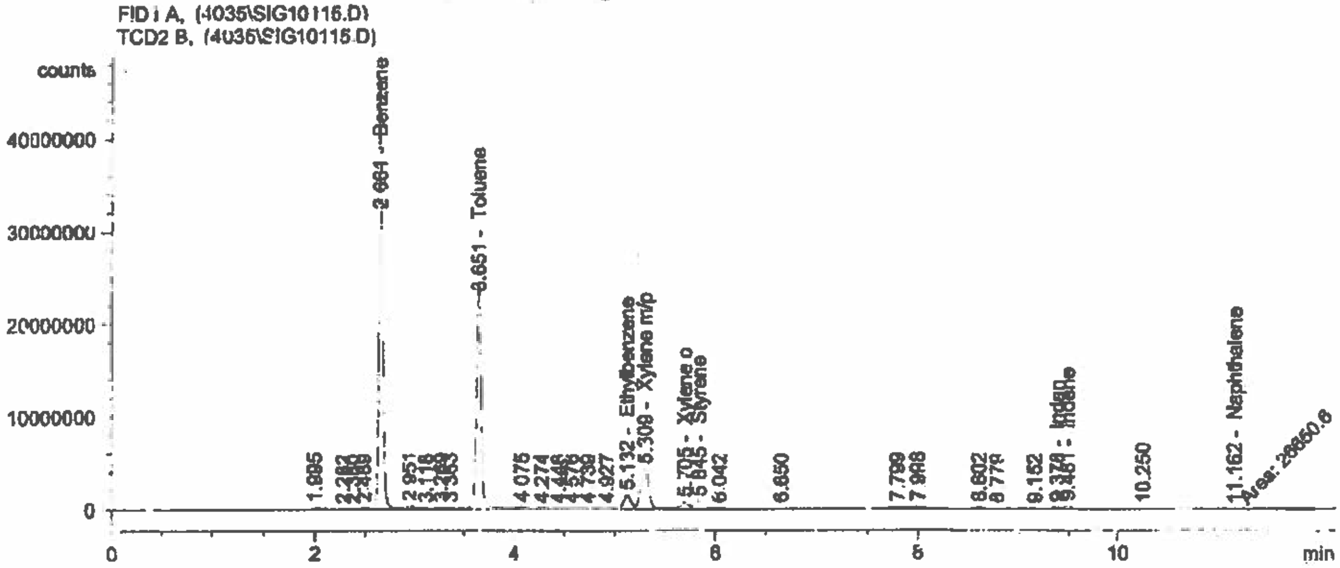
===

*** End of Report ***

Run 4 Inlet B T1, 0.4 ul injection, run 2, 101912MO

===

Injection Date : 10/19/2012 11:05:34 AM
Sample Name : R4 Inlet B T1 Location : Vial 1
Acq. Operator : mo
Acq. Instrument : Instrument 1 Inj Volume : External
Method : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed : 10/19/2012 10:19:34 AM by mo
(modified after loading)



===

External Standard Report (Sample Amount is 0!)

===

Sorted By : Retention Time
Calib. Data Modified : 10/19/2012 10:19:55 AM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,
Signal 2: TCD2 B,

RetTime [min]	Sig	Type	Area counts*s	Amt/Area	Amount [ng/ul]	Grp	Name
2.661	1	VV	1.12639e8	5.47843e-5	6170.82381		Benzene
3.651	1	VV	8.08326e7	2.03419e-4	1.64429e4		Toluene
5.133	1	VV	7.51619e6	3.35641e-3	2.52275e4		Ethylbenzene
5.309	1	VV	2.32317e7	2.69981e-3	6.27212e4		Xylene m/p
5.706	1	VV	3.80000e6	9.14802e-3	3.47625e4		Xylene o
5.845	1	VV	4.24503e6	7.52224e-3	3.19322e4		Styrene
9.378	1	VV	5.58896e5	4.11528e-2	2.30001e4		Indan
9.481	1	VB	1.04025e6	1.31739e-6	1.37042		Indene
11.162	1	MF	2.66506e4	5.82951e-6	1.55360e-1		Naphthalene

Totals : 2.00259e5

Results obtained with enhanced integrator!
1 Warnings or Errors :

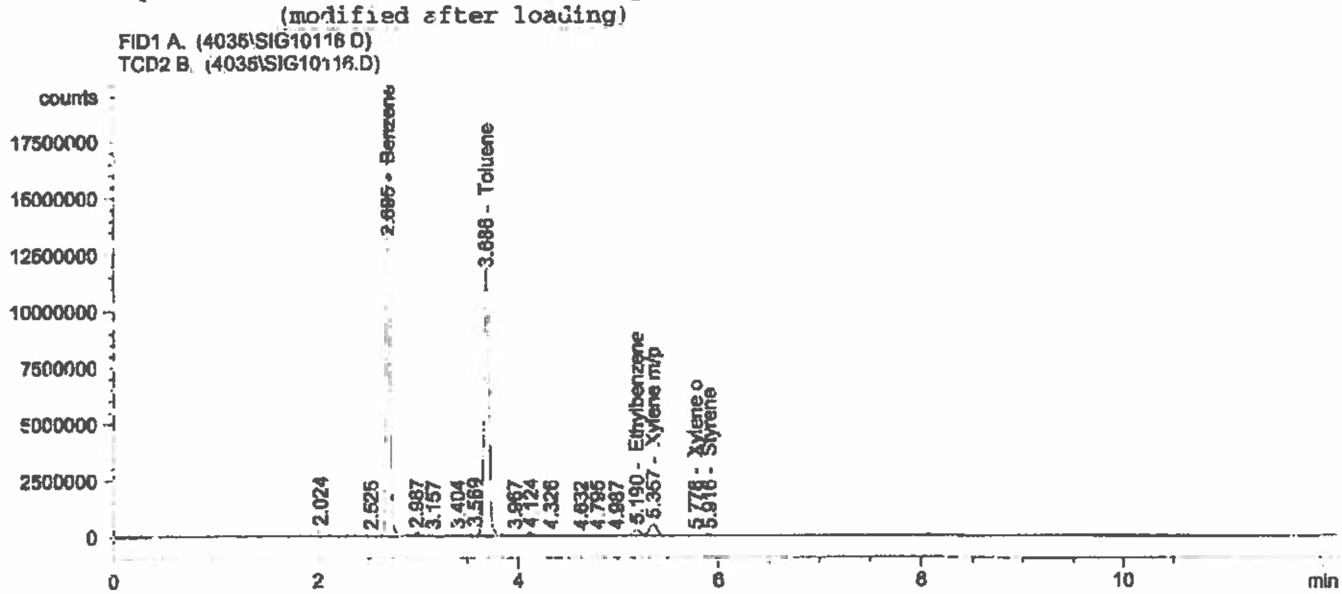
Warning : Calibration warnings (see calibration table listing)

===

*** End of Report ***

Run 4 Inlet B T2, 0.4 ul injection, run 1, 101912MO

===
Injection Date : 10/19/2012 11:28:22 AM
Sample Name : R4 Inlet B T2   Location : Vial 1
Acq. Operator : mo
Acq. Instrument : Instrument 1   Inj Volume : External
Acq. Method : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed : 10/19/2012 10:19:34 AM by mo
(modified after loading)
Analysis Method : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed : 10/19/2012 11:45:09 AM by mo
(modified after loading)



===
External Standard Report (Sample Amount is 0!)
===

Sorted By : Retention Time
Calib. Data Modified : 10/19/2012 11:45:05 AM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,
Signal 2: TCD2 B,

RetTime [min]	Sig	Type	Area counts*s	Amt/Area	Amount [ng/ul]	Grp	Name
2.695	1	VV	4.35118e7	4.59186e-4	1.99800e4		Benzene
3.686	1	VB	3.83183e7	5.21422e-4	1.99800e4		Toluene
5.190	1	VV	1.32436e6	1.50714e-2	1.99600e4		Ethylbenzene
5.357	1	VB	2.91636e6	1.35786e-2	3.96000e4		Xylene m/p
5.778	1	BV	2.30662e5	1.08443e-1	2.50136e4		Xylene o
5.916	1	VB	4.55574e5	5.02267e-2	2.28820e4		Styrene
9.365	1		-	-	-		Indan
9.468	1		-	-	-		Indene
11.144	1		-	-	-		Naphthalene

Totals : 1.47416e5

Results obtained with enhanced integrator!
2 Warnings or Errors :

Warning : Calibration warnings (see calibration table listing)

Warning : Calibrated compound(s) not found

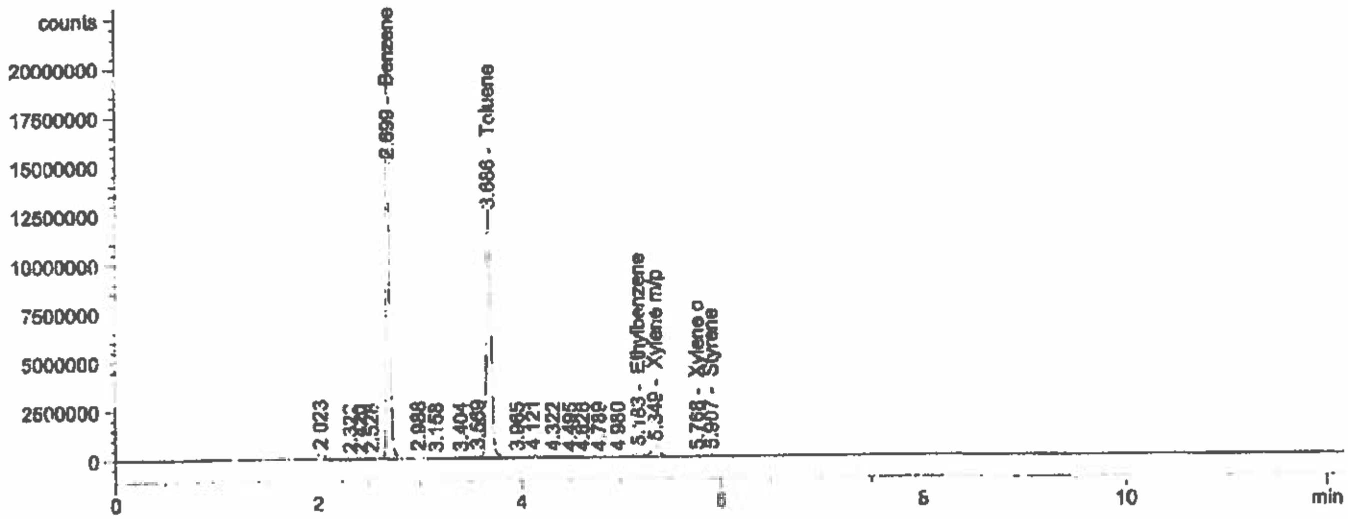
==

*** End of Report ***

Run 4 Inlet B T2, 0.4 ul injection, run 2, 101912MO

===

Injection Date : 10/19/2012 11:46:28 AM
Sample Name : R4 Inlet B T2 Location : Vial 1
Acq. Operator : mo
Acq. Instrument : Instrument 1 Inj Volume : External
Method : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed : 10/19/2012 11:45:09 AM by mo
(modified after loading)



===
External Standard Report (Sample Amount is 0!)
===

Sorted By : Retention Time
Calib. Data Modified : 10/19/2012 11:45:05 AM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,
Signal 2: TCD2 B,

RetTime [min]	Sig	Type	Area counts*s	Amt/Area	Amount [ng/ul]	Grp	Name
2.699	1	VV	4.55147e7	4.59186e-4	2.08997e4		Benzene
3.686	1	VB	3.96431e7	5.21422e-4	2.06708e4		Toluene
5.183	1	VV	1.32581e6	1.50714e-2	1.99819e4		Ethylbenzene
5.349	1	VB	2.90270e6	1.35786e-2	3.94146e4		Xylene m/p
5.768	1	BV	1.69959e5	1.08443e-1	1.84308e4		Xylene o
5.907	1	VB	3.55947e5	5.02267e-2	1.78780e4		Styrene
9.365	1		-	-	-		Indan
9.468	1		-	-	-		Indene
11.144	1		-	-	-		Naphthalene

Totals : 1.37276e5

Results obtained with enhanced integrator!
2 Warnings or Errors :

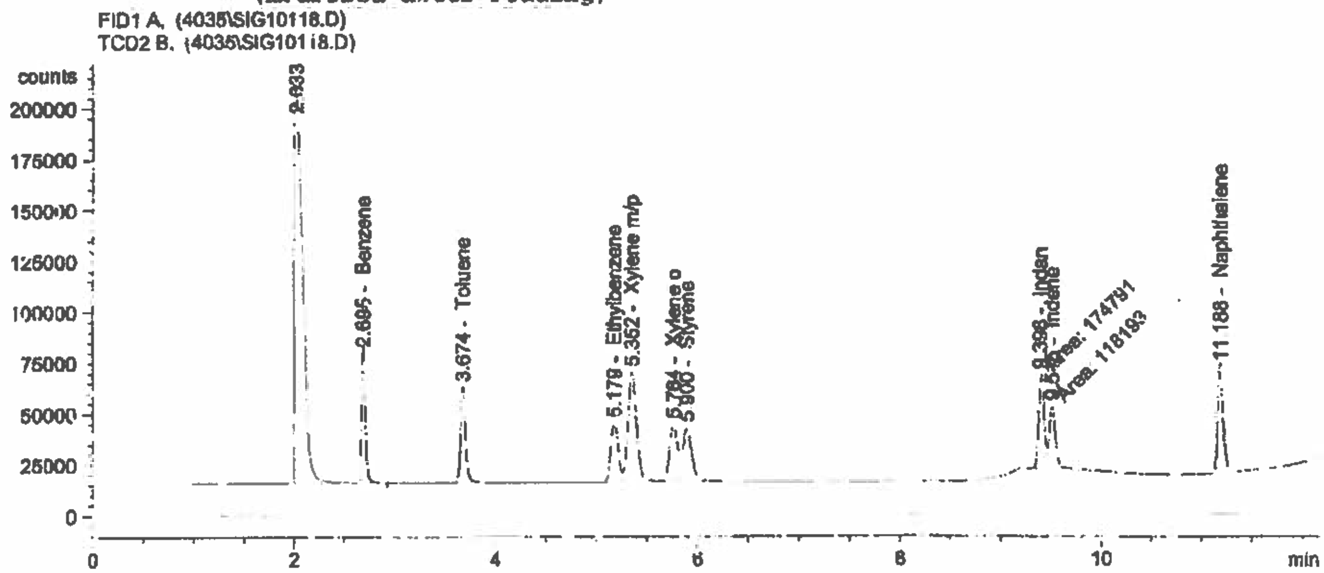
Warning : Calibration warnings (see calibration table listing)
Warning : Calibrated compound(s) not found

===

Low Cal (MDL), 0.4 ul injection, run 1, 101912MO

===

Injection Date : 10/19/2012 1:22:58 PM	
Sample Name : Low Cal (MDL)	Location : Vial 1
Acq. Operator : mo	
Acq. Instrument : Instrument 1	Inj Volume : External
Acq. Method : C:\HPCHEM\1\METHODS\KOPPERS.M	
Last changed : 10/19/2012 1:35:10 PM by mo (modified after loading)	
Analysis Method : C:\HPCHEM\1\METHODS\KOPPERS.M	
Last changed : 10/19/2012 1:42:14 PM by mo (modified after loading)	



===

External Standard Report (Sample Amount is 0!)

===

Sorted By : Retention Time
Calib. Data Modified : 10/19/2012 11:45:05 AM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,
Signal 2: TCD2 B,

RetTime [min]	Sig	Type	Area counts*s	Amt/Area	Amount [ng/ul]	Grp	Name
2.695	1	FB	1.64615e5	4.59186e-4	75.58903		Benzene
3.674	1	BB	1.60110e5	5.21422e-4	83.48507		Toluene
5.179	1	BV	1.46299e5	1.50714e-2	2204.91798		Ethylbenzene
5.352	1	VB	3.14472e5	1.35786e-2	4270.09198		Xylene m/p
5.764	1	BV	1.56356e5	1.08443e-1	1.69556e4		Xylene o
5.900	1	VB	1.67542e5	5.02267e-2	8415.08633		Styrene
9.398	1	MF	1.74791e5	4.11528e-2	7193.12152		Indan
9.515	1	FM	1.18193e5	1.31739e-6	1.55707e-1		Indene
11.188	1	PB	1.84439e5	5.82951e-6	1.07519		Naphthalene

Totals : 3.91991e4

Results obtained with enhanced integrator!
1 Warnings or Errors :

Warning : Calibration warnings (see calibration table listing)

==

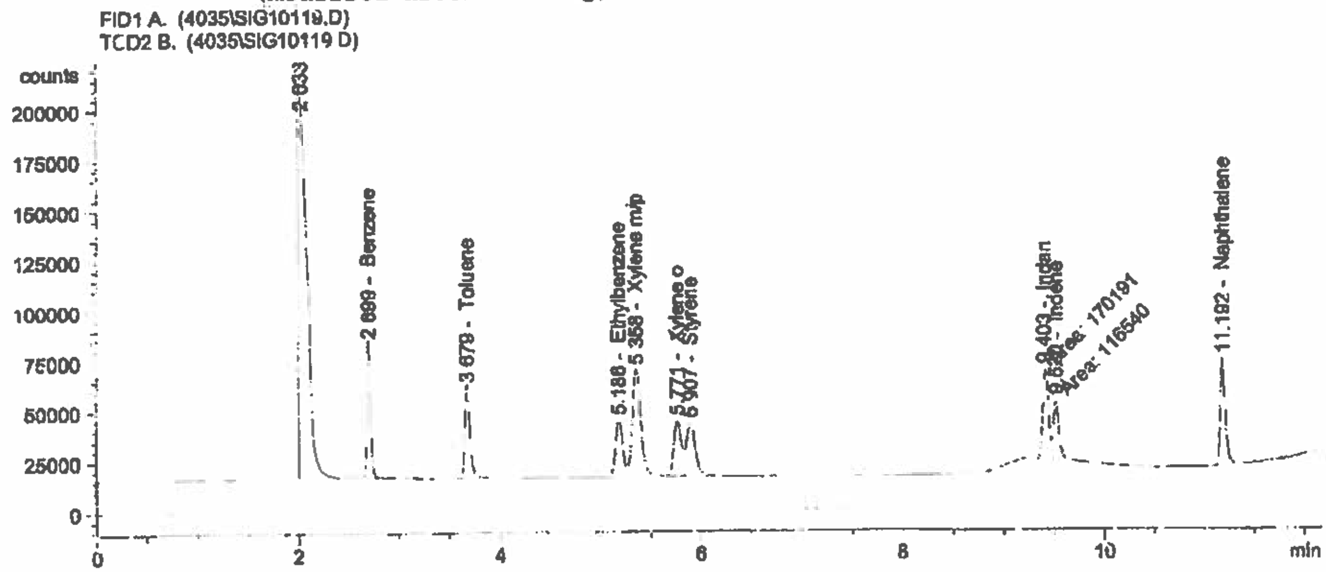
*** End of Report ***

Data File C:\HPCHEM\1\DATA\4035\SIG10119.D Sample Name: Low Cal (MDL)

Low Cal (MDL), 0.4 ul injection, run 2, 101912MO

===

Injection Date : 10/19/2012 1:41:25 PM
Sample Name : Low Cal (MDL) Location : Vial 1
Acq. Operator : mo
Acq. Instrument : Instrument 1 Inj Volume : External
Method : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed : 10/19/2012 1:42:14 PM by mo
(modified after loading)



===

External Standard Report (Sample Amount is 0!)

===

Sorted By : Retention Time
Calib. Data Modified : 10/19/2012 11:45:05 AM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,
Signal 2: TCD2 B,

RetTime [min]	Sig	Type	Area counts*s	Amt/Area	Amount [ng/ul]	Grp	Name
2.699	1	PB	1.63292e5	4.59186e-4	74.98137		Benzene
3.679	1	PB	1.58054e5	5.21422e-4	82.41272		Toluene
5.186	1	PV	1.43911e5	1.50714e-2	2168.94043		Ethylbenzene
5.358	1	VB	3.12182e5	1.35786e-2	4238.98682		Xylene m/p
5.771	1	BV	1.52335e5	1.08443e-1	1.65196e4		Xylene o
5.907	1	VB	1.66985e5	5.02267e-2	8387.08886		Styrene
9.403	1	MF	1.70191e5	4.11528e-2	7003.83222		Indan
9.520	1	FM	1.16540e5	1.31739e-6	1.53529e-1		Indene
11.192	1	PB	1.79118e5	5.82951e-6	1.04417		Naphthalene

Totals : 3.84771e4

Results obtained with enhanced integrator!
1 Warnings or Errors :

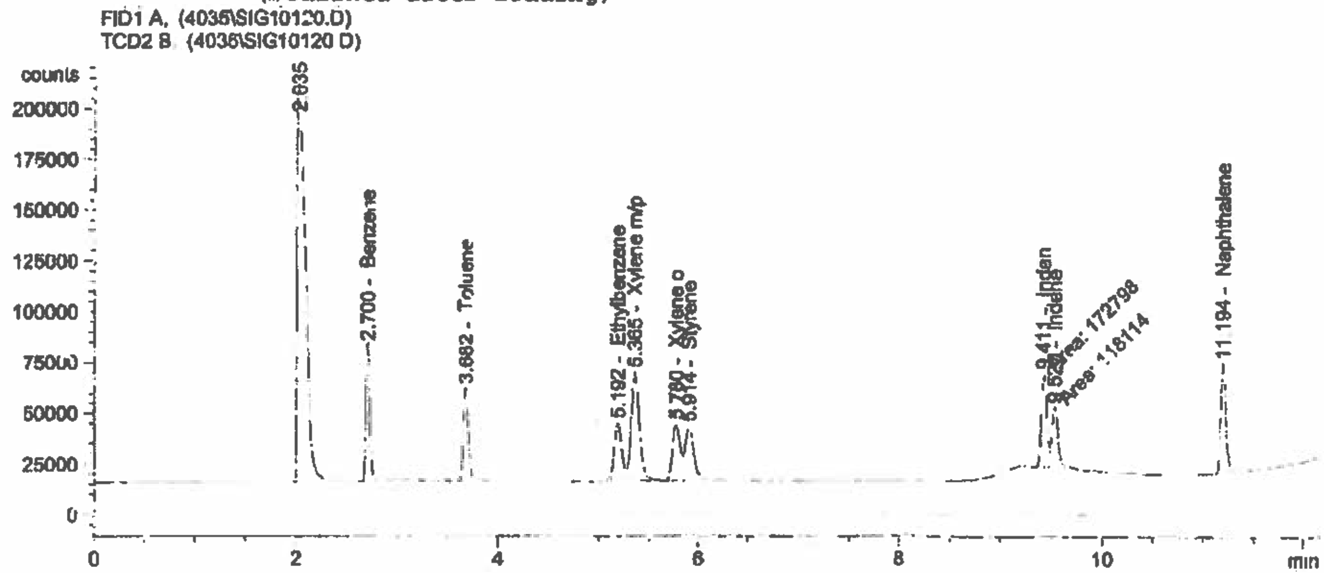
Warning : Calibration warnings (see calibration table listing)

===
*** End of Report ***

Low Cal (MDL), 0.4 ul injection, run 3, 101912MO

===

Injection Date : 10/19/2012 2:00:07 PM
Sample Name : Low Cal (MDL) Location : Vial 1
Acq. Operator : mo
Acq. Instrument : Instrument 1 Inj Volume : External
Method : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed : 10/19/2012 1:42:14 PM by mo
(modified after loading)



===

External Standard Report (Sample Amount is 0!)

===

Sorted By : Retention Time
Calib. Data Modified : 10/19/2012 11:45:05 AM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,
Signal 2: TCD2 B,

RetTime [min]	Sig	Type	Area counts*s	Amt/Area	Amount [ng/ul]	Grp	Name
2.700	1	PB	1.63434e5	4.59186e-4	75.04658		Benzene
3.682	1	PB	1.57929e5	5.21422e-4	82.34753		Toluene
5.192	1	BV	1.43841e5	1.50714e-2	2167.89085		Ethylbenzene
5.365	1	VB	3.12469e5	1.35786e-2	4242.89406		Xylene m/p
5.780	1	BV	1.51275e5	1.08443e-1	1.64047e4		Xylene o
5.914	1	VB	1.67922e5	5.02267e-2	8434.19367		Styrene
9.411	1	MF	1.72798e5	4.11528e-2	7111.11174		Indan
9.520	1	FM	1.18114e5	1.31739e-6	1.55602e-1		Indene
11.194	1	PB	1.80006e5	5.82951e-6	1.04935		Naphthalene

Totals : 3.85194e4

Results obtained with enhanced integrator!
1 Warnings or Errors :

Warning : Calibration warnings (see calibration table listing)

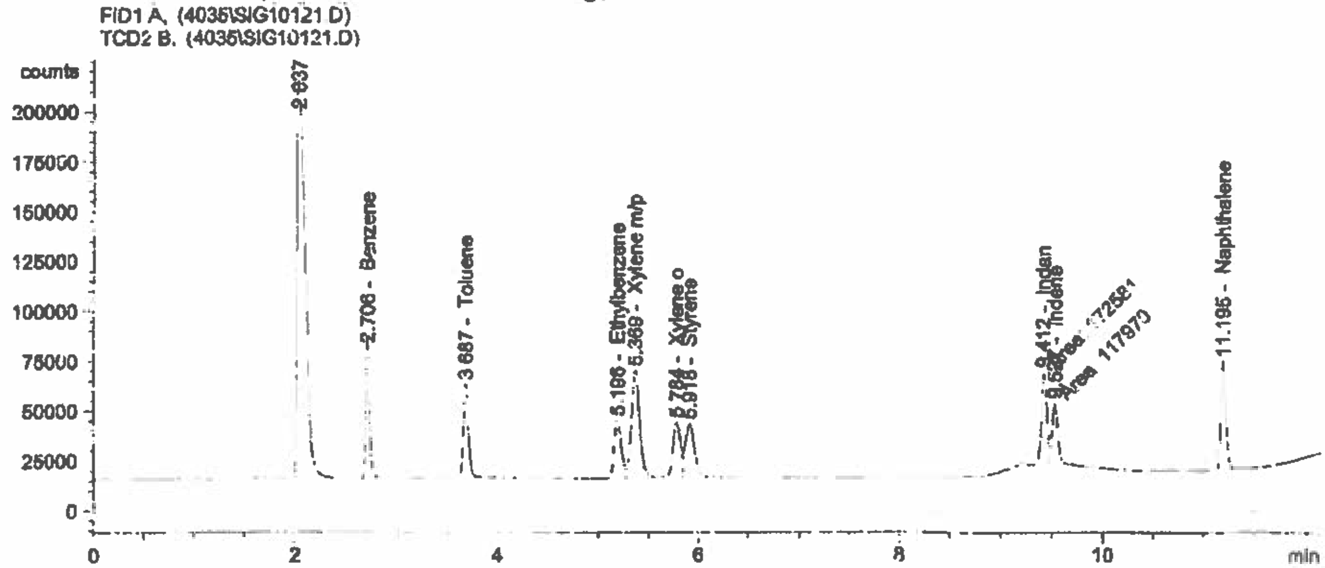
===

*** End of Report ***

Low Cal (MDL), 0.4 ul injection, run 4, 101912MO

===

Injection Date : 10/19/2012 2:18:05 PM
Sample Name : Low Cal (MDL) Location : Vial 1
Acq. Operator : mo
Acq. Instrument : Instrument 1 Inj Volume : External
Method : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed : 10/19/2012 1:42:14 PM by mo
(modified after loading)



===

External Standard Report (Sample Amount is 0!)

===

Sorted By : Retention Time
Calib. Data Modified : 10/19/2012 11:45:05 AM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,
Signal 2: TCD2 B,

RetTime [min]	Sig	Type	Area counts*s	Amt/Area	Amount [ng/ul]	Grp	Name
2.706	1	PB	1.64093e5	4.59186e-4	75.34921		Benzene
3.687	1	BB	1.55655e5	5.21422e-4	81.16216		Toluene
5.196	1	BV	1.44068e5	1.50714e-2	2171.30805		Ethylbenzene
5.369	1	VB	3.15196e5	1.35786e-2	4279.91099		Xylene m/p
5.784	1	BV	1.50359e5	1.08443e-1	1.63053e4		Xylene o
5.918	1	VB	1.70633e5	5.02267e-2	8570.35359		Styrene
9.412	1	MF	1.72581e5	4.11528e-2	7102.19316		Indan
9.527	1	FM	1.17970e5	1.31739e-6	1.55413e-1		Indene
11.195	1	PB	1.82026e5	5.82951e-6	1.06112		Naphthalene

Totals : 3.85868e4

Results obtained with enhanced integrator!
1 Warnings or Errors :

Warning : Calibration warnings (see calibration table listing)

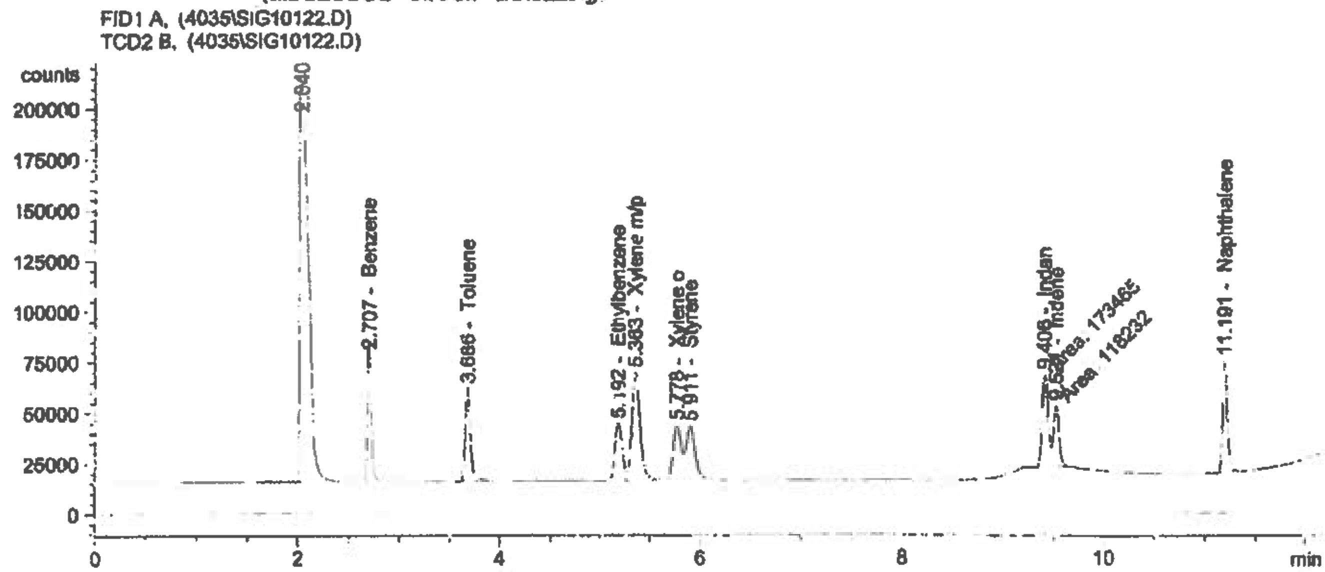
===

*** End of Report ***

Low Cal (MDL), 0.4 ul injection, run 4, 101912MO

===

Injection Date : 10/19/2012 2:34:42 PM
Sample Name : Low Cal (MDL)   Location : Vial 1
Acq. Operator : mo
Acq. Instrument : Instrument 1   Inj Volume : External
Method : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed : 10/19/2012 1:42:14 PM by mo
(modified after loading)



===

External Standard Report (Sample Amount is 0!)

===

Sorted By : Retention Time
Calib. Data Modified : 10/19/2012 11:45:05 AM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,
Signal 2: TCD2 B,

RetTime [min]	Sig	Type	Area counts*s	Amt/Area	Amount [ng/ul]	Grp	Name
2.707	1	PB	1.62337e5	4.59186e-4	75.00198		Benzene
3.686	1	BB	1.54989e5	5.21422e-4	80.81466		Toluene
5.192	1	BV	1.42735e5	1.50714e-2	2151.21081		Ethylbenzene
5.363	1	VB	3.13620e5	1.35786e-2	4258.51750		Xylene m/p
5.778	1	BV	1.48495e5	1.08443e-1	1.61032e4		Xylene o
5.911	1	VB	1.70001e5	5.02267e-2	8538.59854		Styrene
9.406	1	MF	1.73465e5	4.11528e-2	7138.57029		Indan
9.521	1	FM	1.18232e5	1.31739e-6	1.55758e-1		Indene
11.191	1	PB	1.80589e5	5.82951e-6	1.05275		Naphthalene

Totals : 3.83471e4

Results obtained with enhanced integrator!
1 Warnings or Errors :

Warning : Calibration warnings (see calibration table listing)

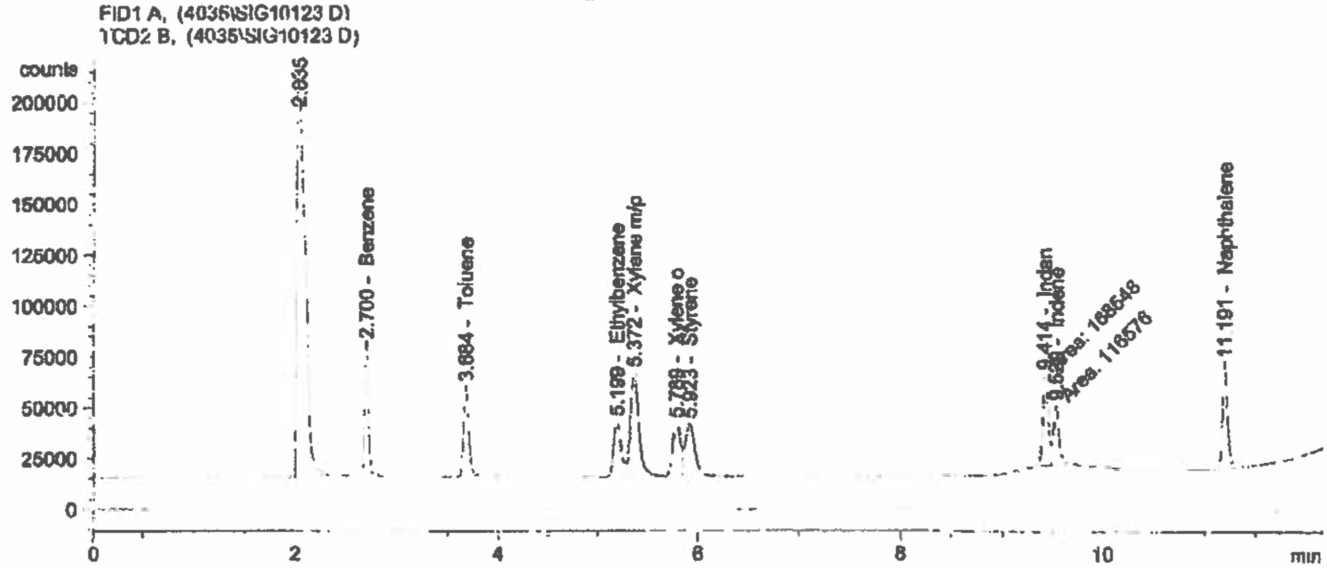
===

*** End of Report ***

Low Cal (MDL), 0.4 ul injection, run 6, 101912MO

===

Injection Date : 10/19/2012 3:01:24 PM
Sample Name : Low Cal (MDL) Location : Vial 1
Acq. Operator : mo
Acq. Instrument : Instrument 1 Inj Volume : External
Method : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed : 10/19/2012 1:42:14 PM by mo
(modified after loading)



===

External Standard Report (Sample Amount is 0!)

===

Sorted By : Retention Time
Calib. Data Modified : 10/19/2012 11:45:05 AM
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A,
Signal 2: TCD2 B,

RetTime [min]	Sig	Type	Area counts*s	Amt/Area	Amount [ng/ul]	Grp	Name
2.700	1	PB	1.59437e5	4.59186e-4	73.21099		Benzene
3.684	1	BB	1.50604e5	5.21432e-4	78.52851		Toluene
5.199	1	FV	1.39203e5	1.50714e-2	2097.98759		Ethylbenzene
5.372	1	VB	3.05432e5	1.35786e-2	4147.33600		Xylene m/p
5.789	1	BV	1.43959e5	1.08443e-1	1.56113e4		Xylene o
5.923	1	VB	1.65730e5	5.02267e-2	8324.05276		Styrene
9.414	1	MF	1.68548e5	4.11528e-2	6936.21819		Indan
9.529	1	FM	1.16576e5	1.31739e-6	1.53576e-1		Indene
11.191	1	PB	1.76985e5	5.82951e-6	1.03173		Naphthalene

Totals : 3.72698e4

Results obtained with enhanced integrator!
1 Warnings or Errors :

Warning : Calibration warnings (see calibration table listing)

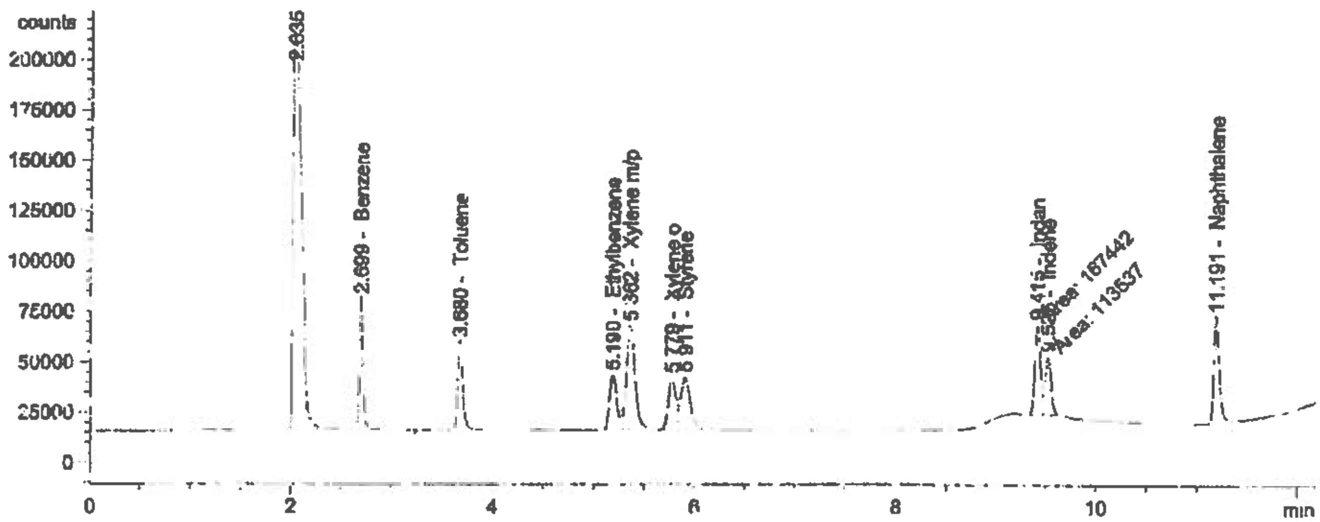
===

*** End of Report ***

Low Cal (MDL), 0.4 ul injection, run 7, 101912MO

===

```
Injection Date  : 10/19/2012 3:51:34 PM
Sample Name     : Low Cal (MDL)                  Location : Vial 1
Acq. Operator   : mo
Acq. Instrument : Instrument 1                 Inj Volume : External
Method          : C:\HPCHEM\1\METHODS\KOPPERS.M
Last changed    : 10/19/2012 3:45:29 PM by mo
                  (modified after loading)
```



===

External Standard Report (Sample Amount is 0!)

===

```
Sorted By              :      Retention Time
Calib. Data Modified   :      10/19/2012 11:45:05 AM
Multiplier             :      1.0000
Dilution               :      1.0000
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: FID1 A,
Signal 2: TCD2 B,

RetTime [min]	Sig	Type	Area counts*s	Amt/Area	Amount [ng/ul]	Grp	Name
2.699	1	PB	1.62926e5	4.59156e-4	74.81345		Benzene
3.690	1	PB	1.55915e5	5.21422e-4	81.29754		Toluene
5.190	1	BV	1.38623e5	1.50714e-2	2089.23628		Ethylbenzene
5.362	1	VB	3.10210e5	1.35786e-2	4212.21960		Xylene m/p
5.779	1	BV	1.39953e5	1.08443e-1	1.51769e4		Xylene o
5.911	1	VB	1.71491e5	5.02267e-2	8613.42536		Styrene
9.415	1	MF	1.67442e5	4.11528e-2	6890.68585		Indan
9.525	1	FM	1.13537e5	1.31739e-6	1.49573e-1		Indene
11.191	1	PB	1.79255e5	5.82951e-6	1.04497		Naphthalene

Totals : 3.71397e4

Results obtained with enhanced integrator!
1 Warnings or Errors :

Warning : Calibration warnings (see calibration table listing)

===

*** End of Report ***

Chain of Custody

Includes the following:

- **Field Chain of Custody**

AIRTECH Environmental Services Inc.

AIRTECH ENVIRONMENTAL SERVICES INC.
Chain of Custody

Project Number	4035	Location	Tube Furnace Inlet/Outlet
Client	Kopper's Inc.	Date	9/14/12
Plant	Cicero, IL	Completed By	Airtech

Page 1 of 1

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ID No.	Run No.	Date	Sample Description	Benzene	Toluene	Xylene	Styrene	Indan	Indene	Naphthalene	Number of Containers	Notes
Kop-Inlet-R4-M18	4	9/14/12	Three SKC Charcoal tubes Train A	X	X	X	X	X	X	X	1	
Kop-Inlet-R4-M18	4		Four SKC Charcoal tubes Train B	X	X	X	X	X	X	X	1	
Kop-Inlet-R2-M18	2		Four SKC Charcoal tubes Train A	X	X	X	X	X	X	X	1	
Kop-Inlet-R2-M18	2		Four SKC Charcoal tubes Train B	X	X	X	X	X	X	X	1	
Kop-Inlet-R3-M18	3		Four SKC Charcoal tubes Train A	X	X	X	X	X	X	X	1	
Kop-Inlet-R3-M18	3		Four SKC Charcoal tubes Train B	X	X	X	X	X	X	X	1	
Kop-Outlet-R4-M18	4		Four SKC Charcoal tubes Un-spiked	X	X	X	X	X	X	X	1	
Kop-Outlet-R4-M18	4		Four SKC Charcoal tubes spiked	X	X	X	X	X	X	X	1	
Kop-Outlet-R2-M18	2		Four SKC Charcoal tubes Un-spiked	X	X	X	X	X	X	X	1	
Kop-Outlet-R2-M18	2		Four SKC Charcoal tubes spiked	X	X	X	X	X	X	X	1	
Kop-Outlet-R3-M18	3		Four SKC Charcoal tubes Un-spiked	X	X	X	X	X	X	X	1	
Kop-Outlet-R3-M18	3		Four SKC Charcoal tubes spiked	X	X	X	X	X	X	X	1	
Kop-Tunnel-R1-M18	1		"	✓	✓	✓	✓	✓	✓	✓	1	
Kop-Tunnel-R1-M18	1		"	✓	✓	✓	✓	✓	✓	✓	1	

Relinquished By		Relinquished By		Carrier	Van
(signature)	[signature]	(signature)	[signature]	Laboratory	
(printed)	Eric Ales	(printed)	J. Mc[illegible]	Contact	
Date/Time	9/13/12 1200	Date/Time	9/14/12	Address	
Accepted By		Accepted By			
(signature)	[signature]	(signature)		Phone	
(printed)	J. Mc[illegible]	(printed)		Fax	
Date/Time	9/14/12	Date/Time		Date/Time	

AIRTECH Environmental Services Inc

Airtech Environmental Services Inc.
601A Country Club Drive
Bensenville, IL 60106
Phone (630) 860-4740, Fax (630) 860 4745

Calibration Data

Airtech Environmental Services, Inc.
Meter Box Full Test Calibration

Date: 2/15/2012

Operator: J burton

Meter Box ID M-10				Meter Box ΔH@		1.803		Meter Box Y_d			1.0046	Barometric Pressure (in. Hg.)			29.50
Time	Orifice Data				Meter Box Data								Results		
θ (min)	K'	Vacuum	T_{amb}	V_{cr}	$V_{initial}$	V_{final}	V_d	ΔH	T_i	T_o	T_{avg}	V_{mstd}	Q	Y_d	ΔH@
5.0	0.3445	20.0	75	2.197	997.00	999.22	2.22	0.63	68	66	67	2.196	0.439	1.0006	1.804
5.0	0.3445	20.0	75	2.197	999.22	1001.42	2.20	0.63	68	66	67.0	2.176	0.439	1.0097	1.837
5.0	0.3445	20.0	75	2.197	1001.42	1003.64	2.22	0.63	73	71	72.0	2.175	0.439	1.0101	1.822
5.0	0.4436	18.0	76	2.826	4.90	7.77	2.87	1.05	70	68	69.0	2.831	0.565	0.9984	1.806
5.0	0.4436	18.0	76	2.826	7.77	10.64	2.87	1.05	71	68	69.5	2.828	0.565	0.9994	1.808
5.0	0.4436	18.0	76	2.826	10.64	13.51	2.87	1.05	73	69	71.0	2.820	0.565	1.0022	1.813
5.0	0.5885	17.0	78	3.742	14.50	18.30	3.80	1.8	75	71	73.0	3.727	0.748	1.0042	1.780
5.0	0.5885	17.0	78	3.742	18.30	22.11	3.81	1.8	76	71	73.5	3.733	0.748	1.0026	1.772
5.0	0.5885	17.0	78	3.742	22.11	25.92	3.81	1.8	77	72	74.5	3.726	0.748	1.0044	1.776
5.0	0.7954	15.0	80	5.049	26.80	31.93	5.13	3.3	79	73	76.0	5.021	1.010	1.0054	1.800
5.0	0.7954	15.0	80	5.049	31.93	37.05	5.12	3.3	80	74	77.0	5.002	1.010	1.0093	1.811
5.0	0.7954	15.0	80	5.049	37.05	42.18	5.13	3.3	81	75	78.0	5.003	1.010	1.0092	1.807
													Average	1.0046	1.803

Nomenclature	
K'	Critical Orifice Coefficient
T_{amb}	Ambient Temperature (°F)
V_{cr}	Volume Through Orifice (scf)
V_d	Gas Meter Volume (ft³)
ΔH	Orifice Pressure Differential (in. H_2O)
T_i	Meter Inlet Temperature (°F)
T_o	Meter Outlet Temperauture (°F)
T_{avg}	Average Meter Box Temperature (°F)
V_{mstd}	Volume Metered Standardized (scf)
Q	Flow Rate (scfm)
Y_d	Meter Correction Factor (dimensionless)
ΔH@	ΔH yielding 0.75 scfm

Vacuum Guage (in. Hg.)		Thermometers (°F)			
Standard	Vacuum Gauge	Standard	Ch. No 1	Ch. No 2	Ch. No 3
5	5.0	32	32	33	33
10	10.0	50	50	51	51
15	15.0	100	100	102	102
20	20.0	150	150	152	152
25	25.0	212	212	213	214
		250	250	252	252
		300	300	302	302
		350	350	352	352
		400	400	402	402
		500	500	502	501
		600	600	602	601

Equations

$$V_{cr} = \frac{K' \cdot P_b \cdot \theta}{(T_{amb} + 460)^{0.5}}$$

$$V_{mstd} = \frac{17.64 * V_d * (P_b + (\Delta H / 13.6))}{(T_{avg} + 460)}$$

$$Q = V_{cr} / \theta$$

$$Y_d = V_{cr} / V_{mstd}$$

$$\Delta H@ = \frac{.0319 * \Delta H * (T_{amb} + 460) * \theta^2}{P_b * Y_d^2 * V_d^2}$$

Airtech Environmental Services
Meter Post Calibration

Average Field Sample Rate (cfm)	1.000	Date	9/14/2012
Highest Field Vacuum (inches Hg)	3	Client	Koppers
Critical Orifice ID	BB-55	Project No.	4035
Orifice Flow Rate (cfm)	0.570	Meter ID	M-10

	Run 1	Run 2	Run 3
Initial Volume (ft^3)	959.50	962.35	965.20
Final Volume (ft^3)	962.35	965.20	968.06
Volume Metered (ft^3)	2.85	2.85	2.86
DGM Inlet Temperature (°F)	75	77	78
DGM Outlet Temperature (°F)	73	74	75
Average DGM Temperature (°F)	74.0	75.5	76.5
Ambient Temperature (°F)	73	73	73
Elapsed Time (min.)	5	5	5
ΔH (inches H_2O)	1.10	1.10	1.10
Barometric Pressure (inches Hg)	29.5	29.5	29.5
Pump Vacuum (inches Hg)	20	20	20
K'	0.4407	0.4407	0.4407
Vcr (ft^3)	2.816	2.816	2.816
Vmstd (ft^3)	2.785	2.777	2.782
Post Test Yc	1.0110	1.0139	1.0122
Full Test Yd	1.0046	1.0046	1.0046
% Difference	-0.64	-0.92	-0.76
	Average % Difference		-0.77

Airtech Environmental Services, Inc.
30B Meter Box Full Test Calibration

Date: 4/18/2012 Operator: j burton

Meter Box	M-11						Meter Box Y_d			0.9883	Barometric Pressure (in. Hg.)			29.50
Time	**Orifice Data**				**Meter Box Data**							**Results**		
θ (min)	K'	Vacuum	T_{amb}	V_{cr}	$V_{initial}$	V_{final}	V_d	LPM			T_m	V_{mstd}	Q	Y_d	ΔH@
10.0	0.0419	16.0	65	15.276	8796.000	8811.600	15.60	1.15			77.0	15.161	1.528	1.0076	0.281
10.0	0.0419	16.0	64	15.290	8811.600	8827.350	15.75	1.15			77.0	15.306	1.529	0.9990	0.276
10.0	0.0419	16.0	65	15.276	8827.350	8643.100	15.75	1.15			77.5	15.292	1.528	0.9989	0.276
10.0	0.0292	18.0	65	10.646	8846.000	8857.190	11.19	0.75			78.5	10.834	1.065	0.9826	0.357
10.0	0.0292	18.0	65	10.646	8857.190	8868.370	11.18	0.75			79.0	10.814	1.065	0.9844	0.358
10.0	0.0292	18.0	65	10.646	8868.370	8879.520	11.15	0.75			79.0	10.785	1.065	0.9871	0.360
10.0	0.0198	19.0	64	7.226	8883.000	8890.630	7.63	0.30			80.0	7.358	0.723	0.9820	0.308
10.0	0.0198	19.0	64	7.226	8890.630	8898.270	7.64	0.30			80.0	7.368	0.723	0.9807	0.307
10.0	0.0198	19.0	65	7.219	8898.270	8905.830	7.56	0.30			80.0	7.291	0.722	0.9901	0.314
10.0	0.0125	21.0	65	4.557	8909.000	8913.800	4.80	0.10			80.0	4.627	0.456	0.9850	0.259
10.0	0.0125	21.0	64	4.562	8913.800	8918.620	4.82	0.10			80.0	4.646	0.456	0.9818	0.257
10.0	0.0125	21.0	64	4.562	8918.620	8923.450	4.83	0.10			80.5	4.651	0.456	0.9807	0.256
													Average	0.9883	0.315

Nomenclature	
K'	Critical Orifice Coefficient
T_{amb}	Ambient Temperature (°F)
V_{cr}	Volume Through Orifice (L)
V_d	Gas Meter Volume (L)
ΔH	Orifice Pressure Differential (in. H_2O)
T_i	Meter Inlet Temperature (°F)
T_o	Meter Outlet Temperauture (°F)
T_{avg}	Average Meter Box Temperature (°F)
V_{mstd}	Volume Metered Standardized (L)
Q	Flow Rate (scfm)
Y_d	Meter Correction Factor (dimensionless)
ΔH@	ΔH yielding 0.75 scfm

Vacuum Guage (in. Hg.)		Thermometers (°F)			
Standard	Vacuum Gauge	Standard	Ch No 1	Ch No 2	Ch No 3
5	5.0	32	33	1	33
10	10.0	50	51	11	51
15	15.0	100	102	39	101
20	20.0	150	152	67	151
25	25.0	212	214	101	213
		250	252	123	251
		300	302	151	301
		350	352	179	351
		400	402	206	400
		500	502	262	500
		600	602	318	600

Equations

$$V_{cr} = \frac{K' \cdot P_b \cdot \theta}{(T_{amb} + 460)^{0.5}}$$

$$V_{mstd} = \frac{17.64 \cdot V_d \cdot (P_b + (\Delta H / 13.6))}{(T_m + 460)}$$

$$Q = V_{cr} / \theta$$

$$Y_d = V_{cr} / V_{mstd}$$

$$\Delta H@ = \frac{.0319 \cdot \Delta H \cdot (T_{avg} + 460) \cdot \theta^2}{P_b \cdot Y_d^2 \cdot V_{cr}^2}$$

Airtech Environmental Services
Meter Post Calibration

Average Field Sample Rate (lpm)	1.000	Date	9/14/2012
Highest Field Vacuum (inches Hg)	8	Client	Koppers
Critical Orifice ID	1 LPM	Project No.	4035
Orifice Flow Rate (lpm)	1.121	Meter ID	M-11

	Run 1	Run 2	Run 3
Initial Volume (l)	9453.00	9464.210	9475.400
Final Volume (l)	9464.210	9475.400	9486.580
Volume Metered (l)	11.210	11.190	11.180
DGM Inlet Temperature (°F)	84	85	85
DGM Outlet Temperature (°F)	84	84	85
Average DGM Temperature (°F)	84.0	84.5	85.0
Ambient Temperature (°F)	72	72	72
Elapsed Time (min.)	10	10	10
ΔH (inches H_2O)	2.10	2.10	2.10
Barometric Pressure (inches Hg)	29.5	29.5	29.5
Pump Vacuum (inches Hg)	18	18	18
K'	0.0292	0.0292	0.0292
Vcr (l)	10.575	10.575	10.575
Vmstd (l)	10.779	10.750	10.731
Post Test Yc	0.9811	0.9837	0.9855
Full Test Yd	0.9883	0.9883	0.9883
% Difference	0.73	0.46	0.28
		Average % Difference	0.49

Airtech Environmental Services, Inc.
Meter Box Full Test Calibration

Date: 11/7/2011 Operator: j burton

Meter Box ID M-20				Meter Box ΔH@		1.795		Meter Box Y_d		0.9944		Barometric Pressure (in. Hg.)			29.50
Time	Orifice Data				Meter Box Data								Results		
θ (min)	K'	Vacuum	T_{amb}	V_{cr}	$V_{initial}$	V_{final}	V_d	ΔH	T_i	T_o	T_{avg}	V_{mstd}	Q	Y_d	ΔH@
5.0	0.3445	22.0	78	2.191	220.10	222.37	2.27	0.62	72	69	70.5	2.230	0.438	0.9823	1.745
5.0	0.3445	22.0	78	2.191	222.37	224.63	2.26	0.62	73	70	71.5	2.216	0.438	0.9885	1.764
5.0	0.3445	22.0	78	2.191	224.63	226.89	2.26	0.62	73	70	71.5	2.216	0.438	0.9886	1.764
5.0	0.4436	21.0	78	2.821	227.20	230.12	2.92	1.05	74	70	72.0	2.864	0.564	0.9851	1.791
5.0	0.4436	21.0	79	2.818	230.12	233.03	2.91	1.05	75	71	73.0	2.849	0.564	0.9894	1.807
5.0	0.4436	21.0	79	2.818	233.03	235.93	2.90	1.05	76	71	73.5	2.836	0.564	0.9937	1.821
5.0	0.5885	19.0	80	3.735	236.30	240.12	3.82	1.8	77	72	74.5	3.736	0.747	0.9999	1.803
5.0	0.5885	19.0	80	3.735	240.12	243.94	3.82	1.8	78	72	75.0	3.732	0.747	1.0008	1.804
5.0	0.5885	19.0	80	3.735	243.94	247.77	3.83	1.8	79	73	76.0	3.735	0.747	1.0001	1.798
5.0	0.7954	16.0	80	5.049	248.30	253.47	5.17	3.3	81	73	77.0	5.051	1.010	0.9995	1.813
5.0	0.7954	16.0	80	5.049	253.47	258.65	5.18	3.3	83	74	78.5	5.047	1.010	1.0004	1.811
5.0	0.7954	16.0	80	5.049	258.65	263.82	5.17	3.3	84	75	79.5	5.028	1.010	1.0042	1.821
													Average	0.9944	1.795

Nomenclature	
K'	Critical Orifice Coefficient
T_{amb}	Ambient Temperature (°F)
V_{cr}	Volume Through Orifice (scf)
V_d	Gas Meter Volume (ft³)
ΔH	Orifice Pressure Differential (in. H_2O)
T_i	Meter Inlet Temperature (°F)
T_o	Meter Outlet Temperauture (°F)
T_{avg}	Average Meter Box Temperature (°F)
V_{mstd}	Volume Metered Standardized (scf)
Q	Flow Rate (scfm)
Y_d	Meter Correction Factor (dimensionless)
ΔH@	ΔH yielding 0.75 scfm

Vacuum Guage (in. Hg)		Thermometers (°F)			
Standard	Vacuum Gauge	Standard	Ch. No. 1	Ch. No. 2	Ch. No. 3
5	5.0	32	33	33	32
10	10.0	50	51	51	50
15	15.0	100	101	101	100
20	20.0	150	151	151	150
25	25.0	212	213	213	213
		250	151	251	250
		300	300	301	301
		350	351	351	351
		400	400	401	401
		500	500	501	500
		600	593	600	600

Equations

$$V_{cr} = \frac{K' * P_b * \theta}{(T_{amb} + 460)^{0.5}}$$

$$V_{m,std} = \frac{17.64 * V_d * (P_b + (\Delta H/13.6))}{(T_{avg} + 460)}$$

$$Q = V_{cr} / \theta$$

$$Y_d = V_{cr} / V_{mstd}$$

$$\Delta H@ = \frac{.0319 * \Delta H * (T_{avg} + 460) * \theta^2}{P_b * Y_d^2 * V_{cr}^2}$$

Airtech Environmental Services
Meter Post Calibration

Average Field Sample Rate (cfm)	1.000	Date	9/14/2012
Highest Field Vacuum (inches Hg)	3	Client	Koppers
Critical Orifice ID	BB-55	Project No.	4035
Orifice Flow Rate (cfm)	0.602	Meter ID	M-20

	Run 1	Run 2	Run 3
Initial Volume (ft^3)	283.00	286.01	289.02
Final Volume (ft^3)	286.01	289.02	292.04
Volume Metered (ft^3)	3.01	3.01	3.02
DGM Inlet Temperature (°F)	83	84	85
DGM Outlet Temperature (°F)	77	77	78
Average DGM Temperature (°F)	80.0	80.5	81.5
Ambient Temperature (°F)	73	73	73
Elapsed Time (min.)	5	5	5
ΔH (inches H_2O)	1.05	1.05	1.05
Barometric Pressure (inches Hg)	29.5	29.5	29.5
Pump Vacuum (inches Hg)	21	21	21
K'	0.4407	0.4407	0.4407
Vcr (ft^3)	2.816	2.816	2.816
Vmstd (ft^3)	2.908	2.906	2.910
Post Test Yc	0.9682	0.9690	0.9676
Full Test Yd	0.9944	0.9944	0.9944
% Difference	2.64	2.55	2.69
Average % Difference			2.63

Vost Meter Box Full Test Calibration

Client: Clean Air Rentals
Asset No: 205598
Meter Box Serial No: 80-050708-1
Date of Calibration: 6/26/12

Calibration Due Date: 6/27/13
Meter Box Yd: 1.0136
Q Flow Rate (cfm): 0.032
Meter Box Vacuum: 1.0 in. H_2O

Operator: O.LAVROV
Calibration Signature: [signature]
Barometric Pressure: 29.20
Barometer Serial No: W12637

				Standard Meter Gas Volume (cu.ft.)			Meter Box Gas Volume (cu.ft.)			Standard Meter Temperature (°F)		Meter Box Temperature (°F)				Calibration Results
Q	ΔH	ΔP	Y_{ds}	Initial	Final	V_{ds} Net	Initial	Final	V_d Net	Ambient Temperature	T_{ds} Avg	In	T_o Out	T_d Avg.	Θ Time	Y_d
0.033	1.10	-0.50	1.0000	0.000	1.000	1.000	9214.21	9242.27	0.9910	78.5	78.50	83.0	83.0	83.00	29.41	1.0135
0.033	1.10	-0.50	1.0000	0.000	1.000	1.000	9242.27	9270.35	0.9917	78.5	78.50	84.0	83.0	83.50	29.43	1.0137
0.032	1.10	-0.50	1.0000	0.000	1.000	1.000	9326.97	9355.10	0.9934	78.5	78.50	85.0	84.0	84.50	29.54	1.0137

Averages: 1.01363

Nomenclature

- P_b Barometric Pressure (in. Hg)
- Q Flow Rate (cfm)
- ΔH Orifice Pressure differential (in. H_2O)
- ΔP Inlet Pressure Differential (in. H_2O)
- V_d Gas Meter Volume - Dry (ft³)
- V_{ds} Standard Meter Volume - Dry (ft³)
- T_d Average Meter Box Temperature (°F)
- T_o Outlet Meter Box Temperature (°F)
- T_{ds} Average Standard Meter Temperature (°F)
- Y_d Meter Correction Factor (unit less)
- Y_{ds} Standard Meter Correction Factor (unit less)
- Θ Duration of Run (minutes)

Equations

$$Y_d = (Y_{ds})\left[\frac{V_{ds}}{V_d}\right]\left[\frac{T_d + 460}{T_{ds} + 460}\right]\left[\frac{P_b + \Delta P/13.6}{P_b + \Delta H/13.6}\right]$$

$$Q = \frac{17.64(V_{ds})(P_b)}{(T_{ds} + 460)(\Theta)}$$

Vacuum Gauge

Standard (in.Hg)	Gauge (in.Hg)
4.9	5.0
9.9	10.0
14.8	15.0
19.5	20.0
24.4	25.0

Calibration Reference Information (Standard Meter)

Reference Used: Wet Test Meter
Calibrated By: Clean Air Engineering
Percentage of Deviation (2031dml): 0.2260%

Serial No: 11AH0
Date Calibrated: 10/26/11
Calibration Due Date: 10/26/12

Method 30B Pre-Calibration Inspection

Electrical Check	Pass	Positive Leak Check	Pass
Pyrometer Check	Pass	Negative Leak Check	Pass
Plumbing Check	Pass	Vacuum Gauge Check	Pass

CleanAir

this certification corresponds to CleanAir asset # 205598

CleanAir

Vost Meter Box - Pyrometer Calibration Sheet

Meter Box No. 80-050708-1 | Office: 71

Calibrated by: O.LAVROV | Client: RENTALS

Date: 6/26/12 | Asset No: 205598

Temperature Scale Used: Fahrenheit | Type of Calibration: Full-Test

Calibration Reference Settings (°F)	Pyrometer Reading for each Channel (°F)						
	1 Probe	2 Filter	3 Aux-1	4 Aux-2	5	6	7
50	50	50	51	51			
100	100	100	101	101			
150	150	150	151	151			
200	200	200	201	201			
250	250	250	251	251			
300	300	300	301	301			
350	350	350	351	351			
400	400	400	401	401			
450	450	450	451	451			
500	500	500	501	501			
550	550	550	551	551			
600	600	600	601	601			

Tolerance = ±2°F difference from reference setting.

Calibration Reference Information

Reference Used: Omega CL23A | Serial No: T-279500

Calibrated By: JH Metrology | Date Calibrated: 8/18/11

Calibration Report No: 1000150487 | Calibration Due Date: 8/18/12

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Airtech Environmental Services
Meter Post Calibration

Average Field Sample Rate (lpm)	1.000	Date	9/13/2012
Highest Field Vacuum (inches Hg)	8	Client	Koppers
Critical Orifice ID	1 LPM	Project No.	4035
Orifice Flow Rate (lpm)	1.108	Meter ID	80-050208-1

	Run 1	Run 2	Run 3
Initial Volume (l)	2090.00	2101.080	2112.150
Final Volume (l)	2101.080	2112.15	2123.370
Volume Metered (l)	11.080	11.070	11.220
DGM Inlet Temperature (°F)	93	93	93
DGM Outlet Temperature (°F)	93	93	93
Average DGM Temperature (°F)	93.0	93.0	93.0
Ambient Temperature (°F)	71	71	71
Elapsed Time (min.)	10	10	10
ΔH (Inches H_2O)	1.10	1.10	1.10
Barometric Pressure (inches Hg)	29.5	29.5	29.5
Pump Vacuum (inches Hg)	21	21	21
K'	0.0292	0.0292	0.0292
Vcr (l)	10.585	10.585	10.585
Vmstd (l)	10.455	10.446	10.587
Post Test Yc	1.0125	1.0134	0.9998
Full Test Yd	0.9940	0.9940	0.9940
% Difference	-1.86	-1.95	-0.59
	Average % Difference		-1.46

Airtech Environmental Services
Meter Post Calibration

Average Field Sample Rate (lpm)	0.100	Date	9/17/2012
Highest Field Vacuum (Inches Hg)	22	Client	Koppers
Critical Orifice ID	.35 LPM	Project No.	4035
Orifice Flow Rate (lpm)	0.3444	Meter ID	R19075A

	Run 1	Run 2	Run 3
Initial Volume (l)	0.00	3.444	6.882
Final Volume (l)	3.444	6.882	10.327
Volume Metered (l)	3.444	3.438	3.445
DGM Inlet Temperature (°F)	75	76	76
DGM Outlet Temperature (°F)	75	76	76
Average DGM Temperature (°F)	75.0	76.0	76.0
Ambient Temperature (°F)	73	73	73
Elapsed Time (min.)	10	10	10
ΔH (Inches H_2O)	0.25	0.25	0.25
Barometric Pressure (Inches Hg)	29.5	29.5	29.5
Pump Vacuum (Inches Hg)	18	18	18
K'	0.0096	0.0096	0.0096
Vcr (l)	3.474	3.474	3.474
Vmstd (l)	3.352	3.340	3.347
Post Test Yc	1.0363	1.0400	1.0379
Full Test Yd	1.006	1.0060	1.0060
% Difference	-3.01	-3.38	-3.17
Average % Difference			-3.19

Airtech Environmental Services
Meter Post Calibration

Average Field Sample Rate (lpm)	0.150	Date	9/17/2012
Highest Field Vacuum (inches Hg)	22	Client	Koppers
Critical Orifice ID	.35 LPM	Project No.	4035
Orifice Flow Rate (lpm)	0.3483	Meter ID	R19075B

	Run 1	Run 2	Run 3
Initial Volume (l)	0.00	3.483	6.979
Final Volume (l)	3.483	6.979	10.480
Volume Metered (l)	3.483	3.496	3.501
DGM Inlet Temperature (°F)	77	78	78
DGM Outlet Temperature (°F)	77	78	78
Average DGM Temperature (°F)	77.0	78.0	78.0
Ambient Temperature (°F)	72	72	72
Elapsed Time (min.)	10	10	10
ΔH (inches H_2O)	0.25	0.25	0.25
Barometric Pressure (inches Hg)	29.5	29.5	29.5
Pump Vacuum (inches Hg)	21	21	21
K'	0.0096	0.0096	0.0096
Vcr (l)	3.477	3.477	3.477
Vmstd (l)	3.377	3.384	3.388
Post Test Yc	1.0295	1.0276	1.0261
Full Test Yd	0.9955	0.9955	0.9955
% Difference	-3.41	-3.22	-3.07
	Average % Difference		-3.23

Airtech Environmental Services, Inc.

S-Type Pitot Tube Inspection Form

Date 3/5/12

Pitot ID AE2-LP-2-1

Operator j burton

	Measured	Allowed
Outside Tube Diameter - Dt (inches)	0.250	NA
Base To Opening Distance - Pa (inches)	0.324	NA
Base To Opening Distance - Pb (inches)	0.324	NA
Pa/Dt	1.30	1.05-1.50
Pb/Dt	1.30	1.05-1.50
Angle α1(°)	1.8	10
Angle α2(°)	0.9	10
Angle B1(°)	2.3	5
Angle B1(°)	0.3	5
Opening to Opening Distance Pa+Pb (inches)	0.648	NA
Angle Z (°)	1	NA
z (inches)	0.0113	0.125
Angle W (°)	0.6	NA
w (inches)	0.007	0.031

Note Any Damage, Nicks or Dents to the Pitot Tube

Is the Pitot Tube Part of an Assembly Yes

If Yes, Complete the Section Below

Pitot	Measured	Minimum
Distance From Nozzle (inches)	NA	0.75 in.
Pitot to Thermocouple Distance (inches)	2	2 in.
Pitot to Sample Probe Distance (inches)	3.5	3 in.

Does the Pitot Tube Meet the Above Requirements Yes

Is the Pitot Tube Free of Damage Yes

If Yes to Both, a Pitot Tube Coefficient of 0.84 is Assigned

If No to Either, then the Pitot Tube Must be Calibrated

Airtech Environmental Services, Inc.
S-Type Pitot Tube Inspection Form

Date 2/11/12
Pitot ID AE2-4-2
Operator j burton

	Measured	Allowed
Outside Tube Diameter - Dt (inches)	0.250	NA
Base To Opening Distance - Pa (inches)	0.339	NA
Base To Opening Distance - Pb (inches)	0.339	NA
Pa/Dt	1.36	1.05-1.50
Pb/Dt	1.36	1.05-1.50
Angle α1(°)	0.5	10
Angle α2(°)	0.9	10
Angle B1(°)	3	5
Angle B2(°)	3.2	5
Opening to Opening Distance Pa+Pb (inches)	0.678	NA
Angle Z (°)	0.9	NA
z (inches)	0.0106	0.125
Angle W (°)	0.1	NA
w (inches)	0.001	0.031

Note Any Damage, Nicks or Dents to the Pitot Tube

Is the Pitot Tube Part of an Assembly Yes
If Yes, Complete the Section Below

Pitot	Measured	Minimum
Distance From Nozzle (inches)	NA	0.75 in.
Pitot to Thermocouple Distance (inches)	2	2 in.
Pitot to Sample Probe Distance (inches)	5.5	3 in.

Does the Pitot Tube Meet the Above Requirements Yes
Is the Pitot Tube Free of Damage Yes

If Yes to Both, a Pitot Tube Coefficient of 0.84 is Assigned
If No to Either, then the Pitot Tube Must be Calibrated

Airgas

Airgas Specialty Gases
12722 South Wentworth Avenue
Chicago, IL 60628
(773) 785-3000 Fax: (773) 785-1928
www.airgas.com

CERTIFICATE OF ANALYSIS
Grade of Product: EPA Protocol

Part Number:	E03NI80E15A0138	Reference Number:	54-124312401-4
Cylinder Number:	CC210854	Cylinder Volume:	151 Cu Ft
Laboratory:	ASG - Chicago - IL	Cylinder Pressure:	2015 PSIG
PGVP Number:	B12012	Valve Outlet:	590
Gas Code:	OC2	Analysis Date:	Apr 20, 2012

Expiration Date: Apr 20, 2015

Certification performed in accordance with "EPA Traceability Protocol (Sept. 1997)" using the assay procedures listed. Analytical Methodology does not require correction for analytical interferences. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.
Do Not Use This Cylinder below 150 psig.i.e 1 Mega Pascal

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty
CARBON DIOXIDE	10.00 %	9.930 %	G1	+/- 1% NIST Traceable
OXYGEN	10.00 %	9.965 %	G1	+/- 1% NIST Traceable
NITROGEN	Balance			

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Expiration Date
NTRM/O2	06120108	CC195599	9.898% OXYGEN/NITROGEN	Oct 02, 2012
NTRM/CO2	09060623	CC262373N	9.921% CARBON DIOXIDE/NITROGEN	Apr 10, 2013

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
(CO2-1)HORIBA VIA-510	NDIR	Mar 26, 2012
(O2-1)HORIBA MPA-510	Paramagnetic	Mar 27, 2012

Triad Data Available Upon Request

Notes:

Approved for Release

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CERTIFICATE OF ANALYSIS
Grade of Product: EPA Protocol

Part Number:	E03NI74E15A2VT5	Reference Number:	54-124271415-3
Cylinder Number:	CC300223	Cylinder Volume:	149 Cu.Ft.
Laboratory:	ASG - Chicago - IL	Cylinder Pressure:	2015 PSIG
PGVP Number:	B12011	Valve Outlet:	590
Analysis Date:	Jul 05, 2011		

Expiration Date: Jul 05, 2014

Certification performed in accordance with "EPA Traceability Protocol (Sept. 1997)" using the assay procedures listed. Analytical Methodology does not require correction for analytical interferences. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.
Do Not Use This Cylinder below 150 psig.i.e. 1 Mega Pascal

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty
CARBON DIOXIDE	5.000 %	4.880 %	G1	+/- 1% NIST Traceable
OXYGEN	21.00 %	20.96 %	G1	+/- 1% NIST Traceable
NITROGEN	Balance			

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Expiration Date
NTRM/O2	06120209	CC195591	20.8% OXYGEN/NITROGEN	Dec 01, 2015
NTRM/CO2	10060124	CC282124	5.027% CARBON DIOXIDE/NITROGEN	Nov 01, 2015

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
(CO2-1)HORIBA VIA-510	NDIR	Jun 27, 2011
(O2-1)HORIBA MPA-510	Paramagnetic	Jun 27, 2011

Triad Data Available Upon Request

Notes:

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CERTIFICATE OF ANALYSIS
Grade of Product: EPA Protocol

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Part Number:	E02NI99E15A0646	Reference Number:	54-124305555-3
Cylinder Number:	CC194519	Cylinder Volume:	144 Cu.Ft.
Laboratory:	ASG - Chicago - IL	Cylinder Pressure:	2015 PSIG
PGVP Number:	B12012	Valve Outlet:	660
Gas Code:	SO2	Analysis Date:	Mar 08, 2012

Expiration Date: Mar 08, 2014

Certification performed in accordance with "EPA Traceability Protocol (Sept. 1997)" using the assay procedures listed. Analytical Methodology does not require correction for analytical interferences. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.
Do Not Use This Cylinder below 150 psig.i.e. 1 Mega Pascal

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty
SULFUR DIOXIDE	500.0 PPM	494 9 PPM	G1	+/- 1% NIST Traceable
NITROGEN	Balance			

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Expiration Date
ntrm/so2	09061009	CC300385	479.5PPM SULFUR DIOXIDE/NITROGEN	May 15, 2015

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nexus 470 AEP0000428	FTIR	Feb 14, 2012

Triad Data Available Upon Request

Notes:

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Chicago, IL 60628
1-773-785-3000
FAX: 1-773-785-1928
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CERTIFICATE OF ANALYSIS
Grade of Product: EPA Protocol

Part Number:	E02NI99E15A0051	Reference Number:	54-124210380-2
Cylinder Number:	CC105721	Cylinder Volume:	144 Cu.Ft.
Laboratory:	ASG - Chicago - IL	Cylinder Pressure:	2015 PSIG
Analysis Date:	Mar 12, 2010	Valve Outlet:	660

Expiration Date: Mar 12, 2013

Certification performed in accordance with "EPA Traceability Protocol (Sept. 1997)" using the assay procedures listed. Analytical Methodology does not require correction for analytical interferences. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.
Do Not Use This Cylinder below 150 psig, i.e. 1 Mega Pascal

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty
SULFUR DIOXIDE	900.0 PPM	920.9 PPM	G1	+/- 1% NIST Traceable
NITROGEN	Balance			

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Expiration Date
NTRM/SO2	101306	CC206051	983.2PPM SULFUR DIOXIDE/NITROGEN	Sep 01, 2010

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Thermo 6700	FTIR	Mar 01, 2010

Triad Data Available Upon Request

Notes:

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CERTIFICATE OF ANALYSIS
Grade of Product: EPA Protocol

Part Number:	E02NI99E15A3168	Reference Number:	54-124315034-3
Cylinder Number:	CC124657	Cylinder Volume:	144 Cu.Ft.
Laboratory:	ASG - Chicago - IL	Cylinder Pressure:	2015 PSIG
PGVP Number:	B12012	Valve Outlet:	350
Gas Code:	APPVD	Analysis Date:	May 11, 2012

Expiration Date: May 11, 2015

Certification performed in accordance with "EPA Traceability Protocol (Sept. 1997)" using the assay procedures listed. Analytical Methodology does not require correction for analytical interferences. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.
Do Not Use This Cylinder below 150 psig,i.e. 1 Mega Pascal

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty
CARBON MONOXIDE	500.0 PPM	500.9 PPM	G1	+/- 1% NIST Traceable
NITROGEN	Balance			

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Expiration Date
NTRM/CO	09060434	CC287237	501.3PPM CARBON MONOXIDE/	Feb 01, 2013

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
(CO-1)HORIBA VIA-510	NDIR	Apr 26, 2012

Triad Data Available Upon Request

Notes:

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CERTIFICATE OF ANALYSIS
Grade of Product: EPA Protocol

Part Number:	E02NI99E15A0502	Reference Number:	54-124191901-1
Cylinder Number:	CC51759	Cylinder Volume:	144 Cu.Ft.
Laboratory:	ASG - Chicago - IL	Cylinder Pressure.	2015 PSIG
Analysis Date:	Sep 29, 2009	Valve Outlet:	350

Expiration Date: Sep 29, 2012

Certification performed in accordance with "EPA Traceability Protocol (Sept. 1997)" using the assay procedures listed. Analytical Methodology does not require correction for analytical interferences. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of the calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.
Do Not Use This Cylinder below 150 psig.i.e. 1 Mega Pascal

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty
CARBON MONOXIDE	909.0 PPM	909 9 PPM	G1	+/- 1% NIST Traceable
NITROGEN	Balance			

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Expiration Date
NTRM/CO	80604	CC255645	1002.4PPM CARBON MONOXIDE/NITROGEN	Apr 15, 2012

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet Nexus	FTIR	Sep 21, 2009

Triad Data Available Upon Request

Notes:

QA Approval

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Airgas Specialty Gases
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Chicago IL 60628
http://www.airgas.com

CERTIFICATE OF ANALYSIS
Grade of Product: EPA Protocol

Part Number:	E02NI99E15A0930	Reference Number:	54-124235282-2
Cylinder Number:	CC99234	Cylinder Volume:	144 Cu.Ft.
Laboratory:	ASG - Chicago - IL	Cylinder Pressure:	2015 PSIG
Analysis Date:	Sep 21, 2010	Valve Outlet:	350

Expiration Date: Sep 21, 2013

Certification performed in accordance with "EPA Traceability Protocol (Sept 1997)" using the assay procedures listed. Analytical Methodology does not require correction for analytical interferences. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.
Do Not Use This Cylinder below 150 psig.i.e 1 Mega Pascal

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty
PROPANE	30.00 PPM	30.04 PPM	G1	+/- 1% NIST Traceable
NITROGEN	Balance			

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Expiration Date
NTRM/C3H8	08061006	CC262350	49.62PPM PROPANE/AIR	Jul 16, 2012

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
(FTIR-1)Nicolet Nexus	FTIR	Sep 03, 2010

Triad Data Available Upon Request

Notes:

Approved for Release

Airgas

CERTIFICATE OF ANALYSIS
Grade of Product: EPA Protocol

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Part Number:	E02NI99E15A0931	Reference Number:	54-124258080-3
Cylinder Number:	CC210810	Cylinder Volume:	144 Cu Ft.
Laboratory:	ASG - Chicago - IL	Cylinder Pressure:	2015 PSIG
Analysis Date:	Mar 22, 2011	Valve Outlet:	350

Expiration Date: Mar 22, 2014

Certification performed in accordance with "EPA Traceability Protocol (Sept. 1997)" using the assay procedures listed. Analytical Methodology does not require correction for analytical interferences. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.
Do Not Use This Cylinder below 150 psig, i.e. 1 Mega Pascal

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty
PROPANE	50.00 PPM	50.17 PPM	G1	+/- 1% NIST Traceable
NITROGEN	Balance			

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Expiration Date
NTRM/C3H8	08061008	CC262350	49.62PPM PROPANE/AIR	Jul 15, 2012

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nexus 470 AEP0000428	FTIR	Feb 25, 2011

Triad Data Available Upon Request

Notes:

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CERTIFICATE OF ANALYSIS
Grade of Product: EPA Protocol

Part Number:	E02NI99E15A0393	Reference Number:	54-124268892-2
Cylinder Number:	CC140111	Cylinder Volume:	144 Cu.Ft.
Laboratory:	ASG - Chicago - IL	Cylinder Pressure:	2015 PSIG
PGVP Number:	B12011	Valve Outlet:	350
Analysis Date:	Jun 15, 2011		

Expiration Date: Jun 15, 2014

Certification performed in accordance with "EPA Traceability Protocol (Sept. 1997)" using the assay procedures listed. Analytical Methodology does not require correction for analytical interferences. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.
Do Not Use This Cylinder below 150 psig, i.e. 1 Mega Pascal

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty
PROPANE	80.00 PPM	80.10 PPM	G1	+/- 1% NIST Traceable
NITROGEN	Balance			

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Expiration Date
NTRM/C3H8	09061727	CC303820	97.82PPM PROPANE/AIR	Oct 02, 2013

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nexus 470 AEP0000428	FTIR	May 21, 2011

Triad Data Available Upon Request

Notes:

Approved for Release

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(773) 785-3000 Fax: (773) 785-1928
www.airgas.com

CERTIFICATE OF ANALYSIS
Grade of Product: EPA Protocol

Part Number:	E02NI99E15A0702	Reference Number:	54-124286373-1
Cylinder Number:	CC147666	Cylinder Volume:	145 Cu.Ft.
Laboratory:	ASG - Chicago - IL	Cylinder Pressure:	2015 PSIG
PGVP Number:	B12011	Valve Outlet:	350
		Analysis Date:	Oct 21, 2011

Expiration Date: Oct 21, 2014

Certification performed in accordance with "EPA Traceability Protocol (Sept. 1997)" using the assay procedures listed. Analytical Methodology does not require correction for analytical interferences. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.
Do Not Use This Cylinder below 150 psig i.e. 1 Mega Pascal

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty
PROPANE	3000 PPM	2994 PPM	G1	+/- 1% NIST Traceable
NITROGEN	Balance			

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Expiration Date
NTRM/C3H8	06060516	XC024506B	4941PPM PROPANE/NITROGEN	May 01, 2016

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nexus 470 AEP0000428	FTIR	Oct 18, 2011

Triad Data Available Upon Request

Notes:

Approved for Release

Airgas

Airgas Specialty Gases
12722 S. Wentworth Avenue
Chicago IL 60628
1-773-785-3000
FAX 1-773-785-1928
http://www.airgas.com

CERTIFICATE OF ANALYSIS
Grade of Product: EPA Protocol

Part Number:	E02NI99E15A0561	Reference Number:	54-124211933-2
Cylinder Number:	XC032607B	Cylinder Volume:	145 Cu.Ft.
Laboratory:	ASG - Chicago - IL	Cylinder Pressure:	2015 PSIG
Analysis Date:	Mar 19, 2010	Valve Outlet:	350

Expiration Date: Mar 19, 2013

Certification performed in accordance with "EPA Traceability Protocol (Sept. 1997)" using the assay procedures listed. Analytical Methodology does not require correction for analytical interferences. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.
Do Not Use This Cylinder below 150 psig i.e. 1 Mega Pascal

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty
PROPANE	5000 PPM	5131 PPM	G1	+/- 1% NIST Traceable
NITROGEN	Balance			

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Expiration Date
NTRM/C3H8	6060513	XC024196B	4941PPM PROPANE/NITROGEN	May 01, 2010

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
VARIAN 3800	FID	Mar 01, 2010

Triad Data Available Upon Request

Notes:

[signature]

Approved for Release

Airgas

Airgas Specialty Gases
12722 S Wentworth Avenue
Chicago IL 60628
1-773-785-3000
FAX 1-773-785-1928
http://www.airgas.com

CERTIFICATE OF ANALYSIS
Grade of Product: EPA Protocol

Part Number:	E02NI99E15A1884	Reference Number:	54-124226135-1
Cylinder Number:	CC154434	Cylinder Volume:	145 Cu.Ft.
Laboratory:	ASG - Chicago - IL	Cylinder Pressure:	2015 PSIG
Analysis Date:	Jul 15, 2010	Valve Outlet:	350

Expiration Date: Jul 15, 2013

Certification performed in accordance with "EPA Traceability Protocol (Sept. 1997)" using the assay procedures listed. Analytical Methodology does not require correction for analytical interferences. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.
Do Not Use This Cylinder below 150 psig, i.e. 1 Mega Pascal

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty
PROPANE	8000 PPM	8158 PPM	G1	+/- 1% NIST Traceable
NITROGEN	Balance			

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Expiration Date
NTRM/C3H8	6060614	XC024294B	0.9748% PROPANE/NITROGEN	May 01, 2016

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
(FTIR-1)Nicolet Nexus	FTIR	Jul 06, 2010

Triad Data Available Upon Request

Notes:

Approved for Release

Airtech Environmental Services, Inc

CEMS ANALYZER I.D. Data Sheet

Project No. 4035

Page		of	

Client	Koppers
Plant	Stickney, IL
Location	Inlet/Outlet
Date	###### Unit
Operator/Tech	EA

Analyzer Type	Model	Notes
CO2		Teledyne
SO2		Thermo
THC		JUM
THC		JUM
CO		Thermo

Cylinder Contents	Cylinder No	PPM
Propane	CC154434	8158
	XCO32607B	5131
	CC147666	2994
	CC140111	80.10
	CC210610	50.17
	CC99234	30.04
CO	CC51759	900.9
	CC124657	500.9
S02	CC105721	920.9
	CC194519	494.9
CO2	CC210854	9.930
	CC300223	4.880

Equipment	Type/Lengths	Used Yes
Probe	Dilution x2	
Filter		
HSL	100'	
Cold Lines	Dilution 200'	
Gas Conditioner		
DAS Computer	Airtech 4	
Flow Panel	Large	
	Dilution x2	

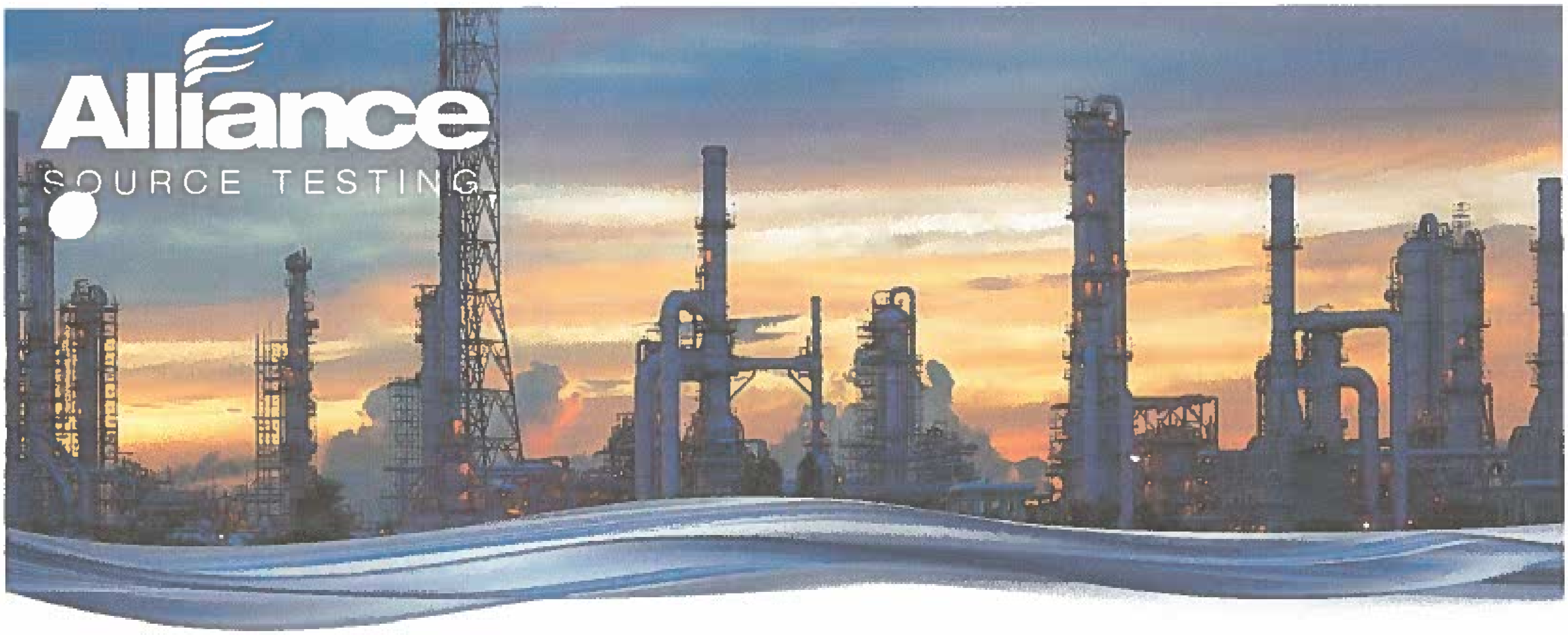
CEM Schematic and Notes

Attachment X

Naphthalene Plant 2020 Stack Test

Response to Violation Notice A-2023-00162

Koppers Inc.



Source Test Report

Koppers, Inc.
3900 South Laramie Ave.
Cicero, IL 60804

Sources Tested: Multiple Sources
Test Dates: September 29-30, 2020

AST Project No. 2020-1351-001

Prepared By
Alliance Source Testing, LLC
1355 Sherman Road, Suite 300
Hiawatha, IA 52233

Regulatory Information

Permit No. IEPA Construction Permit No. 14100012

Source Information

Source Name	*Target Parameters*
Reboiler/SCR Outlet	SO_2, NOx, NH_3
Main Stack	PM, SO_2, NOx, CO, VOM
Thermal Oxidizer Inlet	VOM
Thermal Oxidizer Outlet	SO_2, VOM

Contact Information

Test Location
Koppers, Inc.
3900 South Laramie Ave.
Cicero, IL 60804

Sidney Lipp
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(705) 222-3111

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Analytical Laboratory
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5530 Marshall Street
Arvada, CO 80002
James Davidson
james.davidson@stacktest.com
(720) 457-9504 ext. 802

Alliance Source Testing, LLC (AST) has completed the source testing as described in this report. Results apply only to the source(s) tested and operating condition(s) for the specific test date(s) and time(s) identified within this report. All results are intended to be considered in their entirety, and AST is not responsible for use of less than the complete test report without written consent. This report shall not be reproduced in full or in part without written approval from the customer.

To the best of my knowledge and abilities, all information, facts and test data are correct. Data presented in this report has been checked for completeness and is accurate, error-free and legible. Onsite testing was conducted in accordance with approved internal Standard Operating Procedures. Any deviations or problems are detailed in the relevant sections on the test report.

This report is only considered valid once an authorized representative of AST has signed in the space provided below; any other version is considered draft. This document was prepared in portable document format (.pdf) and contains pages as identified in the bottom footer of this document.

[signature]	11/19/2020
James Holder, QSTI **Alliance Source Testing, LLC**	Date

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APPENDICES

Introduction

1.0 Introduction

Alliance Source Testing, LLC (AST) was retained by Koppers, Inc. (Koppers) to conduct performance testing at the Cicero, Illinois facility. The facility operates under Illinois Department of Natural Resources (DNR) Construction Permit No. 14100012. Testing was conducted to determine the concentrations and/or emission rates of sulfur dioxide (SO_2), nitrogen oxides (NOx) and ammonia (NH_3) at the exhaust of the Reboiler/SCR Outlet. Testing also included determining the emission rates of particulate matter (PM), SO_2, NOx, carbon monoxide (CO) and volatile organic matter (VOM) at the exhaust of the Main Stack. Testing also included determining the emission rate of VOM at the Thermal Oxidizer (TO) Inlet and Outlet. The TO and SCR Outlet combined SO_2 mass emission rates were compared to the Main Stack SO_2 mass emission rates to determine SO_2 removal efficiency (RE). All testing was performed while firing natural gas.

The average concentrations and/or emission rates from the September 29 and 30, 2020 test runs are summarized below. Detailed summary tables containing the sampling data and test results for each source and run are presented in Section 2.0.

Table 1-1
Test Results – Caustic Scrubber (CD-1) Main Stack

Target Compound	Average Test Results	Emission Limit [1]	% of Limit
Sulfur Dioxide Data			
Emission Rate, lb/hr	0.00	*0.04*	**< 1**
Reduction Efficiency, %	>99.9	--	--
Nitrogen Oxides Data			
Emission Rate, lb/hr	2.9	*5.61*	**53**
Carbon Monoxide Data			
Emission Rate, lb/hr	1.1	*5.86*	**19**
Volatile Organic Material Data			
Emission Rate, lb/hr	0.092	*1.90*	**5**
Total Particulate Matter Data			
Emission Rate, lb/hr	0.19	*0.56*	**34**

[1] Permit Limit

Table 1-2
Test Results – Thermal Oxidizer (TO-5)

Target Compound	Average Test Results	Permit Emission Limit [1]	% of Limit
Volatile Organic Material Data			
Concentration, ppmvd @ 3% O_2	6.9	*20*	**35**

[1] TO-5 is required to meet the 20 ppmvd @ 3% O_2 <u>or</u> 98% RE permit limit.

1.1 Source and Control System Descriptions

Koppers owns and operates the Stickney, Illinois facility, which converts various crude tars into liquid pitch and other liquid products such as creosote, refined tars, chemical oils and various grades of coal tar pitch. In 2019, the facility constructed a new Naphthalene Distillation Plant.

The Naphthalene Distillation Plant processes refined chemical oil in columns and process vessels to produce naphthalene and co-products, i.e., light oil, tar acids, and solvents. This feedstock is provided by the Stickney facility's existing Tar Plant and from external sources. The naphthalene product is used as feedstock in the Stickney facility's existing Phthalic Anhydride Plant. The co-products are shipped to customers or are burned as fuel in the process heater for the new naphthalene distillation column.

1.2 Project Team

Personnel involved in this project are identified in the following table.

Table 1-3
Project Team

Koppers Personnel	Sidney Lipp
PPM Consulting	Isaac Smith
AST Personnel	James Holder Josh Carr Marcus Sobetsky Jordan Barnett Blake Borchers Ethan Sperfslage John Wilson

1.3 Test Protocol & Notification

Testing was conducted in accordance with the Test Protocol submitted to IEPA by Koppers.

1.4 Test Program Notes

At the completion of Run 1, the sample probe inadvertently made contact with the test port, causing contamination of the sample. The run was therefore voided, and a fourth run was conducted. Voided test run data is provided in Appendix F – Voided Data.

During Run 3, testing on the TO was paused 1050-1156 due to a unit shutdown.

Summary of Results

2.0 Summary of Results

AST conducted performance testing at the Koppers facility in Cicero, Illinois on September 29-30, 2020. Testing consisted of determining the concentrations and/or emission rates of SO_2, NOx and NH_3 at the exhaust of the Reboiler/SCR Outlet. Testing also included determining the emission rates of PM, SO_2, NOx, CO and VOM at the exhaust of the Main Stack. Testing also included determining the emission rate of VOM at the Thermal Oxidizer (TO) Inlet and Outlet. The TO and SCR Outlet combined SO_2 mass emission rates were compared to the Main Stack to determine SO_2 RE. All testing was performed while firing natural gas.

Tables 2-1 through 2-3 provide summaries of the emission testing results with comparisons to the applicable IEPA permit limits. Any difference between the summary results listed in the following tables and the detailed results contained in appendices is due to rounding for presentation.

Table 2-1
Summary of Results – Reboiler/SCR Outlet

Run Number	Run 2	Run 3	Run 4	Average
Date	**9/29/20**	**9/30/20**	**9/30/20**	**--**
Sulfur Dioxide Data				
Concentration, ppmvd	0.2	0.1	0.2	0.2
Emission Rate, lb/hr	0.012	0.0084	0.013	0.011
Nitrogen Oxide Data				
Concentration, ppmvd	53.2	41.3	49.8	48.1
Emission Rate, lb/hr	2.8	2.1	2.7	2.5
Ammonia Data				
Concentration, ppmvd	0.034	0.41	0.32	0.25
Emission Rate, lb/hr	0.00065	0.0077	0.0063	0.0049

Table 2-2
Summary of Results – Main Stack

Run Number	Run 2	Run 3	Run 4	Average
Date	9/29/20	9/30/20	9/30/20	--
Filterable Particulate Matter Data				
Concentration, grain/dscf	0.00036	0.00021	0.00018	0.00025
Emission Rate, lb/hr	0.030	0.019	0.017	0.022
Condensable Particulate Matter Data				
Concentration, grain/dscf	0.0010	0.0022	0.0025	0.0019
Emission Rate, lb/hr	0.086	0.19	0.22	0.17
Total Particulate Matter Data [1]				
Concentration, grain/dscf	0.0014	0.0024	0.0026	0.0021
Emission Rate, lb/hr	0.12	0.21	0.24	0.19
Sulfur Dioxide Data				
Outlet Concentration, ppmvd [2]	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	0.0
Combined Inlet Emission Rate, lb/hr	0.00065	0.0077	0.0063	0.0049
Outlet Emission Rate, lb/hr	0.00	0.00	0.00	0.00
Nitrogen Oxide Data				
Concentration, ppmvd	48.1	31.1	41.0	40.1
Emission Rate, lb/hr	3.4	2.3	3.1	2.9
Carbon Monoxide Data				
Concentration, ppmvd	24.1	24.3	24.2	24.2
Emission Rate, lb/hr	1.0	1.1	1.1	1.1
Volatile Organic Matter Data				
Concentration, ppmvd	1.8	0.0	2.1	1.3
Emission Rate, lb/hr	0.12	0.00	0.15	0.092
Reduction Efficiency Data				
Sulfur Dioxide RE, %	>99.9	>99.9	>99.9	99.9

[1] Total PM data is the summation of filterable and condensable PM data.
[2] Underlined values returned a slightly negative value and have been corrected to zero.

Table 2-3
Summary of Results – Thermal Oxidizer

Run Number	Run 2	Run 3	Run 4	Average
Date	**9/29/20**	**9/30/20**	**9/30/20**	**--**
Sulfur Dioxide Data				
Concentration, ppmvd	0.0	0.0	0.0	0.0
Emission Rate, lb/hr	0.00	0.00	0.00	0.00
Volatile Organic Matter Data				
Inlet Concentration, ppmvd	29.9	16.1	19.4	21.8
Outlet Concentration, ppmvd @ 3% O_2	9.6	6.4	4.7	6.9
Outlet Emission Rate, lb/hr	0.059	0.040	0.026	0.042

Testing Methodology

3.0 Testing Methodology

The emission testing program was conducted in accordance with the test methods listed in Table 3-1. Method descriptions are provided below while quality assurance/quality control data is provided in Appendix D.

Table 3-1
Source Testing Methodology

Parameter	U.S. EPA Reference Test Methods	Notes/Remarks
Volumetric Flow Rate	1 & 2	Full Velocity Traverses
Oxygen / Carbon Dioxide	3A	Instrumental Analysis
Moisture Content	4	Volumetric / Gravimetric Analysis
Particulate Matter	5 / 202	Isokinetic Sampling
Sulfur Dioxide	6C	Instrumental Analysis
Nitrogen Oxides	7E	Instrumental Analysis
Carbon Monoxide	10	Instrumental Analysis
Volatile Organic Matter	25A	Instrumental Analysis
Gas Dilution Certification System	205	---
Ammonia	320	FTIR – Continuous Sampling

3.1 U.S. EPA Reference Test Methods 1 and 2 – Sampling/Traverse Points and Volumetric Flow Rate

The sampling location and number of traverse (sampling) points were selected in accordance with U.S. EPA Reference Test Method 1. To determine the minimum number of traverse points, the upstream and downstream distances were equated into equivalent diameters and compared to Figure 1-1 in U.S. EPA Reference Test Method 1.

Full velocity traverses were conducted in accordance with U.S. EPA Reference Test Method 2 to determine the average stack gas velocity pressure, static pressure and temperature. The velocity and static pressure measurement system consisted of a pitot tube and inclined manometer. The stack gas temperature was measured with a K-type thermocouple and pyrometer.

Stack gas velocity pressure and temperature readings were recorded during each test run. The data collected was utilized to calculate the volumetric flow rate in accordance with U.S. EPA Reference Test Method 2.

3.2 U.S. EPA Reference Test Method 3A – Oxygen/Carbon Dioxide

The oxygen (O_2) and carbon dioxide (CO_2) testing was conducted in accordance with U.S. EPA Reference Test Method 3A. Data was collected online and reported in one-minute averages. The sampling system consisted of a stainless-steel probe, Teflon sample line(s), gas conditioning system and the identified gas analyzer. The gas conditioning system was a non-contact condenser used to remove moisture from the stack gas. If an unheated Teflon sample line was used, then a portable non-contact condenser was placed in the system directly after the probe. Otherwise, a heated Teflon sample line was used. The quality control measures are described in Section 3.11.

3.3 U.S. EPA Reference Test Method 4 – Moisture Content

The stack gas moisture content was determined in accordance with U.S. EPA Reference Test Method 4. The gas conditioning train consisted of a series of chilled impingers. Prior to testing, each impinger was filled with a known quantity of water or silica gel. Post testing, the quantities of water and silica gel were measured to determine the amount of moisture condensed during the test run. Alternatively, each impinger was analyzed gravimetrically before and after each test run on the same balance to determine the amount of moisture condensed.

3.4 U.S. EPA Reference Test Methods 5 and 202 – Total Particulate Matter

The total particulate matter (filterable and condensable PM) testing was conducted in accordance with U.S. EPA Reference Test Methods 5 and 202. The complete sampling system consisted of a stainless-steel nozzle, glass-lined probe, pre-weighed quartz filter, coil condenser, un-weighed Teflon filter, gas conditioning train, pump and calibrated dry gas meter. The gas conditioning train consisted of a coiled condenser and four (4) chilled impingers. The first, second and fourth impingers were initially empty, the third contained 100 mL of de-ionized water and the last impinger contained 200-300 grams of silica gel. The un-weighed 90 mm Teflon filter was placed between the second and third impingers. The probe liner heating system was maintained at a temperature of 248 ±25°F, and the impinger temperature was maintained at 68°F or less throughout testing. The temperature of the Teflon filter was maintained greater than 65°F but less than or equal to 85°F.

Following the completion of each test run, the sampling train was leak checked at a vacuum pressure greater than or equal to the highest vacuum pressure observed during the run. Condensate was collected in the first dry impinger, therefore the front-half of the sample train (the nozzle, probe, and heated pre-weighed filter) was removed in order to purge the back-half of the sample train (coil condenser, first and second impingers and CPM filter). De-ionized ultra-filtered (DIUF) water was added to the first impinger to raise the water level above the bubbler. The glass bubbler was inserted into the first impinger and the coil condenser was replaced. Zero nitrogen was connected to the condenser, and a 60-minute purge at 14 liters per minute was conducted. After the completion of the nitrogen purge the impinger contents were measured for moisture gain.

The pre-weighed quartz filter was carefully removed and placed in container 1. The probe was rinsed three (3) times, the nozzle and front half of the filter holder were rinsed six (6) times with acetone to remove any adhering particulate matter and these rinses were recovered in container 2. All containers were sealed, labeled and liquid levels marked for transport to the identified laboratory for filterable particulate matter analysis.

The contents of impingers 1 and 2 were recovered in CPM Container 1. The back half of the filterable PM filter holder, the coil condenser, impingers 1 and 2 and all connecting glassware were rinsed with DIUF water and then rinsed with acetone, followed by hexane. The water rinses were added to CPM Container 1 while the solvent rinses were recovered in CPM Container 2. The Teflon filter was removed from the filter holder and placed in CPM Container 3. The front half of the condensable PM filter holder was rinsed with DIUF water and then with acetone, followed by hexane. The water rinse was added to CPM Container 1 while the solvent rinses were added to CPM Container 2. All containers were sealed, labeled and liquid levels marked for transport to the identified laboratory for condensable particulate matter analysis.

3.5 U.S. EPA Reference Test Method 6C – Sulfur Dioxide

The sulfur dioxide (SO_2) testing was conducted in accordance with U.S. EPA Reference Test Method 6C. Data was collected online and reported in one-minute averages. The sampling system consisted of a heated stainless-steel probe, Teflon sample line(s), gas conditioning system and the identified analyzer. The gas conditioning system was a non-contact condenser used to remove moisture from the source gas. If an unheated Teflon sample line was used, then a portable non-contact condenser was placed in the system directly after the probe. Otherwise, a heated Teflon sample line was used. The quality control measures are described in Section 3.11.

3.6 U.S. EPA Reference Test Method 7E – Nitrogen Oxides

The nitrogen oxides (NOx) testing was conducted in accordance with U.S. EPA Reference Test Method 7E. Data was collected online and reported in one-minute averages. The sampling system consisted of a stainless-steel probe, Teflon sample line(s), gas conditioning system and the identified gas analyzer. The gas conditioning system was a non-contact condenser used to remove moisture from the stack gas. If an unheated Teflon sample line was used, then a portable non-contact condenser was placed in the system directly after the probe. Otherwise, a heated Teflon sample line was used. The quality control measures are described in Section 3.11.

3.7 U.S. EPA Reference Test Method 10 – Carbon Monoxide

The carbon monoxide (CO) testing was conducted in accordance with U.S. EPA Reference Test Method 10. Data was collected online and reported in one-minute averages. The sampling system consisted of a stainless-steel probe, Teflon sample line(s), gas conditioning system, and the identified gas analyzer. The gas conditioning system was a non-contact condenser used to remove moisture from the gas. If an unheated Teflon sample line was used, then a portable non-contact condenser was placed in the system directly after the probe. Otherwise, a heated Teflon sample line was used. The quality control measures are described in Section 3.11.

3.8 U.S. EPA Reference Test Method 25A – Volatile Organic Matter

The volatile organic matter (VOM) testing was conducted in accordance with U.S. EPA Reference Test Method 25A. Data was collected online and reported in one-minute averages. The sampling system consisted of a stainless-steel probe, heated Teflon sample line(s) and the identified gas analyzer. The quality control measures are described in Section 3.12.

3.9 U.S. EPA Reference Test Method 205 – Gas Dilution System Certification

A calibration gas dilution system field check was conducted in accordance with U.S. EPA Reference Method 205. Multiple dilution rates and total gas flow rates were utilized to force the dilution system to perform two dilutions on each mass flow controller. The diluted calibration gases were sent directly to the analyzer, and the analyzer response recorded in an electronic field data sheet. The analyzer response agreed within 2% of the actual diluted gas concentration. A second Protocol 1 calibration gas, with a cylinder concentration within 10% of one of the gas divider settings described above, was introduced directly to the analyzer, and the analyzer response recorded in an electronic field data sheet. The cylinder concentration and the analyzer response agreed within 2%. These steps were repeated three (3) times. Copies of the Method 205 data can be found in the Quality Assurance/Quality Control Appendix.

3.10 U.S. EPA Reference Test Method 320 – Ammonia

The concentrations of ammonia (NH_3) were determined in accordance with U.S. EPA Reference Test Method 320. Each source gas stream was extracted at a constant rate through a heated probe, heated filter and heated sample line and analyzed with a MKS MultiGas 2030 FTIR operated by a portable computer. The computer has FTIR spectra of calibration gases stored on the hard drive. These single component calibration spectra are used to analyze the measured sample spectra. The gas components to be measured were selected from the spectra library and incorporated into the analytical method. The signal amplitude, linearity, and signal to noise ratio were measured and recorded to document analyzer performance. A leak check was performed on the sample cell. The instrument path length was verified using ethylene as the Calibration Transfer Standard. Dynamic spiking was performed using a certified standard of the target compound or appropriate surrogate in nitrogen with sulphur hexafluoride blended as a tracer to calculate the dilution factor. All test spectra, interferograms, and analytical method information are recorded and stored with the calculated analytical results. The quality control measures are described in Section 3.13.

3.11 Quality Assurance/Quality Control – U.S. EPA Reference Test Methods 3A, 6C, 7E and 10

Cylinder calibration gases used met EPA Protocol 1 (+/- 2%) standards. Copies of all calibration gas certificates can be found in the Quality Assurance/Quality Control Appendix.

Low Level gas was introduced directly to the analyzer. After adjusting the analyzer to the Low-Level gas concentration and once the analyzer reading was stable, the analyzer value was recorded. This process was repeated for the High-Level gas. For the Calibration Error Test, Low, Mid, and High Level calibration gases were sequentially introduced directly to the analyzer. All values were within 2.0 percent of the Calibration Span or 0.5 ppmv absolute difference.

High or Mid Level gas (whichever was closer to the stack gas concentration) was introduced at the probe and the time required for the analyzer reading to reach 95 percent or 0.5 ppm (whichever was less restrictive) of the gas concentration was recorded. The analyzer reading was observed until it reached a stable value, and this value was recorded. Next, Low Level gas was introduced at the probe and the time required for the analyzer reading to decrease to a value within 5.0 percent or 0.5 ppm (whichever was less restrictive) was recorded. If the Low-Level gas was zero gas, the response was 0.5 ppm or 5.0 percent of the upscale gas concentration (whichever was less restrictive). The analyzer reading was observed until it reached a stable value and this value was recorded. The measurement system response time and initial system bias were determined from these data. The System Bias was within 5.0 percent of the Calibration Span or 0.5 ppmv absolute difference

High or Mid Level gas (whichever was closer to the stack gas concentration) was introduced at the probe. After the analyzer response was stable, the value was recorded. Next, Low Level gas was introduced at the probe, and the analyzer value recorded once it reached a stable response. The System Bias was within 5.0 percent of the Calibration Span or 0.5 ppmv absolute difference or the data was invalidated and the Calibration Error Test and System Bias were repeated.

Drift between pre- and post-run System Bias was within 0.5 ppmv absolute difference or the Calibration Error Test and System Bias were repeated.

To determine the number of sampling points, a gas stratification check was conducted prior to initiating testing. The pollutant concentrations were measured at twelve traverse points (as described in Method 1) for the Main Stack and three points (16.7, 50.0 and 83.3 percent of the measurement line) for the Reboiler/SCR Outlet and Thermal Oxidizer. Each traverse point was sampled for a minimum of twice the system response time.

If the pollutant concentration at each traverse point did not differ more than 5% or 0.5 ppm (whichever was less restrictive) of the average pollutant concentration, then single point sampling was conducted during the test runs. If the pollutant concentration did not meet these specifications but differed less than 10% or 1.0 ppm from the average concentration, then three (3) point sampling was conducted (stacks less than 7.8 feet in diameter - 16.7, 50.0 and 83.3 percent of the measurement line; stacks greater than 7.8 feet in diameter – 0.4, 1.0, and 2.0 meters from the stack wall). If the pollutant concentration differed by more than 10% or 1.0 ppm from the average concentration, then sampling was conducted at a minimum of twelve (12) traverse points. Copies of stratification check data can be found in the Quality Assurance/Quality Control Appendix.

An NO_2 – NO converter check was performed on the analyzer prior to initiating testing and at the completion of testing. An approximately 50 ppm nitrogen dioxide cylinder gas was introduced directly to the NOx analyzer and the instrument response was recorded in an electronic data sheet. The instrument response was within +/- 10 percent of the cylinder concentration.

A Data Acquisition System with battery backup was used to record the instrument response in one (1) minute averages. The data was continuously stored as a *.CSV file in Excel format on the hard drive of a computer. At the completion of testing, the data was also saved to the AST server. All data was reviewed by the Field Team Leader before leaving the facility. Once arriving at AST's office, all written and electronic data was relinquished to the report coordinator and then a final review was performed by the Project Manager.

3.12 Quality Assurance/Quality Control – U.S. EPA Reference Test Method 25A

Cylinder calibration gases used met EPA Protocol 1 (+/- 2%) standards. Copies of all calibration gas certificates can be found in the Quality Assurance/Quality Control Appendix.

Within two (2) hours prior to testing, zero gas was introduced through the sampling system to the analyzer. After adjusting the analyzer to the Zero gas concentration and once the analyzer reading was stable, the analyzer value was recorded. This process was repeated for the High-Level gas, and the time required for the analyzer reading to reach 95 percent of the gas concentration was recorded to determine the response time. Next, Low and Mid-Level gases were introduced through the sampling system to the analyzer, and the response was recorded when it was stable. All values were less than +/- 5 percent of the calibration gas concentrations.

Mid Level gas was introduced through the sampling system. After the analyzer response was stable, the value was recorded. Next, Zero gas was introduced through the sampling system, and the analyzer value recorded once it reached a stable response. The Analyzer Drift was less than +/- 3 percent of the span value.

A Data Acquisition System with battery backup was used to record the instrument response in one (1) minute averages. The data was continuously stored as a *.CSV file in Excel format on the hard drive of a computer. At the completion of testing, the data was also saved to the AST server. All data was reviewed by the Field Team Leader before leaving the facility. Once arriving at AST's office, all written and electronic data was relinquished to the report coordinator and then a final review was performed by the Project Manager.

3.13 Quality Assurance/Quality Control – U.S. EPA Reference Method 320

EPA Protocol 1 Calibration Gases – Cylinder calibration gases used met EPA Protocol 1 (+/- 2%) standards. Copies of all calibration gas certificates can be found in the Quality Assurance/Quality Control Appendix.

After providing ample time for the FTIR to reach the desired temperature and to stabilize, zero gas (nitrogen) was introduced directly to the instrument sample port. While flowing nitrogen the signal amplitude was recorded, a background spectra was taken, a linearity check was performed and recorded, the peak to peak noise and the root mean square in the spectral region of interest was measured and a screenshot was recorded.

Following the zero gas checks, room air was pulled through the sample chamber and the line width and resolution was verified to be at 1879 cm-1, the peak position was entered and the FWHH was recorded (screenshot). Following these checks, another background spectra was recorded and the calibration transfer standard (CTS) was introduced directly to the instrument sample port. The CTS instrument recovery was recorded and the instrument mechanical response time was measured.

Next, stack gas was introduced to the FTIR through the sampling system and several scans were taken until a stable reading was achieved. The native concentration of our surrogate spiking analyte (ethylene) was recorded. Spike gas was introduced to the sampling system at a constant flow rate ≤ 10% of the total sample flow rate and a corresponding dilution ratio was calculated along with a system response time. Matrix spike recovery spectra were recorded and were within the ± 30% of the calculated value of the spike concentration that the method requires.

The matrix spike recovery was conducted once at the beginning of the testing and the CTS recovery procedures were repeated following each test run. The corresponding values were recorded.

Appendix A

Alliance SOURCE TESTING

Location	Koppers Naphthalene Distillation Plant - Cicero, IL
Source	Reboiler/SCR Outlet - Condition 2
Project No.	20-1351
Run No.	1
Parameter(s)	VFR

Meter Pressure (Pm), in. Hg

$$Pm = Pb + \frac{\Delta H}{13.6}$$

where,

Pb	29.25	= barometric pressure, in. Hg
ΔH	1.500	= pressure differential of orifice, in H_2O
Pm	29.36	= in. Hg

Absolute Stack Gas Pressure (Ps), in. Hg

$$Ps = Pb + \frac{Pg}{13.6}$$

where,

Pb	29.25	= barometric pressure, in. Hg
Pg	-6.90	= static pressure, in. H_2O
Ps	28.74	= in. Hg

Standard Meter Volume (Vmstd), dscf

$$Vmstd = \frac{17.647 \times Vm \times Pm}{Tm}$$

where,

Y	0.995	= meter correction factor
Vm	40.758	= meter volume, cf
Pm	29.36	= absolute meter pressure, in. Hg
Tm	528.8	= absolute meter temperature, °R
Vmstd	39.732	= dscf

Standard Wet Volume (Vwstd), scf

$$Vwstd = 0.04707 \times Vlc$$

where,

Vlc	142.8	= volume of H2O collected, ml
Vwstd	6.733	= scf

Moisture Fraction (BWSsat), dimensionless (theoretical at saturated conditions)

$$BWSsat = \frac{10^{6.37 - \left(\frac{2,827}{Ts + 365}\right)}}{Ps}$$

where,

Ts	583.1	= stack temperature, °F
Ps	28.7	= absolute stack gas pressure, in. Hg
BWSsat	85.0	= dimensionless

Moisture Fraction (BWS), dimensionless

$$BWS = \frac{Vwstd}{(Vwstd + Vmstd)}$$

where,

Vwstd	6.733	= standard wet volume, scf
Vmstd	39.732	= standard meter volume, dscf
BWS	0.145	= dimensionless

Moisture Fraction (BWS), dimensionless

$$BWS = BWSmsd \text{ unless } BWSsat < BWSmsd$$

where,

BWSsat	84.951	= moisture fraction (theoretical at saturated conditions)
BWSmsd	0.145	= moisture fraction (measured)
BWS	0.145	

Molecular Weight (DRY) (Md), lb/lb-mole

$$Md = (0.44 \times \% CO_2) + (0.32 \times \% O_2) + (0.28\ (100 - \% CO_2 - \% O_2))$$

where,

CO2	7.7	= carbon dioxide concentration, %
O2	7.9	= oxygen concentration, %
Md	29.55	= lb/lb mol

Alliance
SOURCE TESTING

Location	Koppers Naphthalene Distillation Plant - Cicero, IL
Source	Reboiler/SCR Outlet - Condition 2
Project No.	20-1351
Run No.	1
Parameter(s)	VFR

Molecular Weight (WET) (Ms), lb/lb-mole

$$Ms = Md \; (1 - BWS) + 18 \; (BWS)$$

where,

Md	29.55	= molecular weight (DRY), lb/lb mol
BWS	0.145	= moisture fraction, dimensionless
Ms	27.87	= lb/lb mol

Average Velocity (Vs), ft/sec

$$Vs = 85.49 \times Cp \times (\Delta P^{1/2})\,avg \times \sqrt{\frac{Ts}{Ps \times Ms}}$$

where,

Cp	0.84	= pitot tube coefficient
$\Delta P^{1/2}$	0.580	= average pre/post test velocity head of stack gas, (in. H2O)$^{1/2}$
Ts	1043.1	= average pre/post test absolute stack temperature, °R
Ps	28.74	= absolute stack gas pressure, in. Hg
Ms	27.87	= molecular weight of stack gas, lb/lb mol
Vs	47.5	= ft/sec

Average Stack Gas Flow at Stack Conditions (Qa), acfm

$$Qa = 60 \times Vs \times As$$

where,

Vs	47.5	= stack gas velocity, ft/sec
As	6.12	= cross-sectional area of stack, ft^2
Qa	17,444	= acfm

Average Stack Gas Flow at Standard Conditions (Qs), dscfm

$$Qsd = 17.647 \times Qa \times (1 - BWS) \times \frac{Ps}{Ts}$$

where,

Qa	17,444	= average stack gas flow at stack conditions, acfm
BWS	0.145	= moisture fraction, dimensionless
Ps	28.74	= absolute stack gas pressure, in. Hg
Ts	1043.1	= average pre/post test absolute stack temperature, °R
Qs	7,253	= dscfm

Dry Gas Meter Calibration Check (Yqa), dimensionless

$$Yqa = \frac{Y - \left(\frac{\Theta}{Vm} \sqrt{\frac{0.0319 \times Tm \times 29}{\Delta H@ \times \left(Pb + \frac{\Delta H\,avg.}{13.6} \right) \times Md}} \sqrt{\Delta H}\;avg. \right)}{Y} \times 100$$

where,

Y	0.995	= meter correction factor, dimensionless
Θ	60	= run time, min.
Vm	40.758	= total meter volume, dcf
Tm	528.8	= absolute meter temperature, °R
ΔH@	1.823	= orifice meter calibration coefficient, in. H_2O
Pb	29.25	= barometric pressure, in. Hg
ΔH avg	1.500	= average pressure differential of orifice, in H_2O
Md	29.58	= molecular weight (DRY), lb/lb mol
$(\Delta H)^{1/2}$	1.225	= average squareroot pressure differential of orifice, (in. $H_2O)^{1/2}$
Yqa	-0.7	= dimensionless

Alliance
SOURCE TESTING

Location: Koppers Naphthalene Distillation Plant - Cicero, IL
Source: Main Stack - Condition 2 Natural Gas
Project No.: 2020-1351
Run No.: 2
Parameter: PM/CPM

Meter Pressure (Pm), in. Hg

$$Pm = Pb + \frac{\Delta H}{13.6}$$

where,

Pb	29.25	= barometric pressure, in. Hg
ΔH	1.436	= pressure differential of orifice, in H_2O
Pm	29.36	= in. Hg

Absolute Stack Gas Pressure (Ps), in. Hg

$$Ps = Pb + \frac{Pg}{13.6}$$

where,

Pb	29.25	= barometric pressure, in. Hg
Pg	-0.07	= static pressure, in. H_2O
Ps	29.24	= in. Hg

Standard Meter Volume (Vmstd), dscf

$$Vmstd = \frac{17.647 \times Y \times Vm \times Pm}{Tm}$$

where,

Y	1.013	= meter correction factor
Vm	83.415	= meter volume, cf
Pm	29.36	= absolute meter pressure, in. Hg
Tm	532.2	= absolute meter temperature, °R
Vmstd	82.256	= dscf

Standard Wet Volume (Vwstd), scf

$$Vwstd = 0.04707 \times Vlc$$

where,

Vlc	496.5	= volume of H_2O collected, ml
Vwstd	23.410	= scf

Moisture Fraction (BWSsat), dimensionless (theoretical at saturated conditions)

$$BWSsat = \frac{10^{6.37-\left(\frac{2,827}{Ts+365}\right)}}{Ps}$$

where,

Ts	150.2	= stack temperature, °F
Ps	29.24	= absolute stack gas pressure, in. Hg
BWSsat	0.260	= dimensionless

Moisture Fraction (BWS), dimensionless (measured)

$$BWS = \frac{Vwstd}{(Vwstd + Vmstd)}$$

where,

Vwstd	23.410	= standard wet volume, scf
Vmstd	82.256	= standard meter volume, dscf
BWS	0.222	= dimensionless

Moisture Fraction (BWS), dimensionless

$$BWS = BWSmsd \text{ unless } BWSsat < BWSmsd$$

where,

BWSsat	0.260	= moisture fraction (theoretical at saturated conditions)
BWSmsd	0.222	= moisture fraction (measured)
BWS	0.222	

Alliance
SOURCE TESTING

Location: Koppers Naphthalene Distillation Plant - Cicero, IL
Source: Main Stack - Condition 2 Natural Gas
Project No.: 2020-1351
Run No.: 2
Parameter: PM/CPM

Molecular Weight (DRY) (Md), lb/lb-mole

$$Md = (0.44 \times \% CO_2) + (0.32 \times \% O2) + (0.28\,(100 - \% CO_2 - \% O2))$$

where,

CO_2	6.3	= carbon dioxide concentration, %
O_2	9.9	= oxygen concentration, %
Md	29.40	= lb/lb mol

Molecular Weight (WET) (Ms), lb/lb-mole

$$Ms = Md\,(1 - BWS) + 18\,(BWS)$$

where,

Md	29.40	= molecular weight (DRY), lb/lb mol
BWS	0.222	= moisture fraction, dimensionless
Ms	26.87	= lb/lb mol

Average Velocity (Vs), ft/sec

$$Vs = 85.49 \times Cp \times (\Delta P^{1/2})\,avg \times \sqrt{\frac{Ts}{Ps \times Ms}}$$

where,

Cp	0.840	= pitot tube coefficient
$\Delta P^{1/2}$	0.181	= velocity head of stack gas, (in. H_2O)$^{1/2}$
Ts	610.2	= absolute stack temperature, °R
Ps	29.24	= absolute stack gas pressure, in. Hg
Ms	26.87	= molecular weight of stack gas, lb/lb mol
Vs	11.4	= ft/sec

Average Stack Gas Flow at Stack Conditions (Qa), acfm

$$Qa = 60 \times Vs \times As$$

where,

Vs	11.4	= stack gas velocity, ft/sec
As	21.65	= cross-sectional area of stack, ft^2
Qa	14,852	= acfm

Average Stack Gas Flow at Standard Conditions (Qs), dscfm

$$Qs = 17.647 \times Qa \times (1 - BWS) \times \frac{Ps}{Ts}$$

where,

Qa	14,852	= average stack gas flow at stack conditions, acfm
BWS	0.222	= moisture fraction, dimensionless
Ps	29.24	= absolute stack gas pressure, in. Hg
Ts	610.2	= absolute stack temperature, °R
Qs	9,779	= dscfm

Dry Gas Meter Calibration Check (Yqa), dimensionless

$$Yqa = \frac{Y - \left(\frac{\Theta}{Vm}\sqrt{\frac{0.0319 \times Tm \times 29}{\Delta H@ \times \left(Pb + \frac{\Delta Havg.}{13.6}\right) \times Md}}\sqrt{\Delta H}\ avg.\right)}{Y} \times 100$$

where,

Y	1.013	= meter correction factor, dimensionless
Θ	120	= run time, min.
Vm	83.415	= total meter volume, dcf
Tm	532.2	= absolute meter temperature, °R
ΔH@	1.555	= orifice meter calibration coefficient, in. H_2O
Pb	29.25	= barometric pressure, in. Hg
ΔH avg	1.436	= average pressure differential of orifice, in H_2O
Md	29.40	= molecular weight (DRY), lb/lb mol
$(\Delta H)^{1/2}$	1.327	= average squareroot pressure differential of orifice, (in. H2O)$^{1/2}$
Yqa	-2.1	= dimensionless

Alliance
SOURCE TESTING

Location: Koppers Naphthalene Distillation Plant - Cicero, IL
Source: Main Stack - Condition 2 Natural Gas
Project No.: 2020-1351
Run No.: 2
Parameter: PM/CPM

Volume of Nozzle (Vn), ft³

$$Vn = \frac{Ts}{Ps}\left(0.002669 \times Vlc + \frac{Vm \times Pm \times Y}{Tm}\right)$$

where,

Ts	610.2	= absolute stack temperature, °R
Ps	29.24	= absolute stack gas pressure, in. Hg
Vlc	496.5	= volume of H_2O collected, ml
Vm	83.415	= meter volume, cf
Pm	29.36	= absolute meter pressure, in. Hg
Y	1.013	= meter correction factor, unitless
Tm	532.2	= absolute meter temperature, °R
Vn	124.900	= volume of nozzle, ft³

Isokinetic Sampling Rate (I), %

$$I = \left(\frac{Vn}{\theta \times 60 \times An \times Vs}\right) \times 100$$

where,

Vn	124.900	= nozzle volume, ft³
θ	120.0	= run time, minutes
An	0.00147	= area of nozzle, ft²
Vs	11.4	= average velocity, ft/sec
I	102.9	= %

Filterable PM Concentration (C_s), grain/dscf

$$C_s = \frac{M_n \times 0.0154}{Vmstd}$$

where,

Mn	1.9	= filterable PM mass, mg
Vmstd	82.256	= standard meter volume, dscf
C_s	0.0004	= grain/dscf

Filterable PM Emission Rate (PMR), lb/hr

$$PMR = \frac{C_s \times Qs \times 60}{7.0E+03}$$

where,

C_s	0.0004	= filterable PM concentration, grain/dscf
Qs	9,779	= average stack gas flow at standard conditions, dscfm
PMR	0.030	= lb/hr

Condensable PM Concentration (C_{CPM}), grain/dscf

$$C_{CPM} = \frac{M_{CPM} \times 0.0154}{Vmstd}$$

where,

M_{CPM}	5.5	= condensable PM mass, mg
Vmstd	82.256	= standard meter volume, dscf
C_{CPM}	0.0010	= grain/dscf

Condensable PM Emission Rate (ER_{CPM}), lb/hr

$$ER_{CPM} = \frac{C_{CPM} \times Qs \times 60\,\frac{min}{hr}}{7.0E+03}$$

where,

C_{CPM}	0.0010	= condensable PM concentration, grain/dscf
Qs	9,779	= average stack gas flow at standard conditions, dscfm
ER_{CPM}	0.086	= lb/hr

Location: Koppers Naphthalene Distillation Plant - Cicero, IL
Source: Main Stack - Condition 2 Natural Gas
Project No.: 2020-1351
Run No.: 2
Parameter: PM/CPM

Total PM Concentration (C_{TPM}), grain/dscf

$$C_{TPM} = C_S + C_{CPM}$$

where,

C_s 0.0004 = filterable PM concentration, grain/dscf
C_{CPM} 0.0010 = condensable PM concentration, grain/dscf
C_{TPM} 0.0014 = grain/dscf

Total PM Emission Rate (ER_{TPM}), lb/hr

$$ER_{TPM} = PMR + ER_{CPM}$$

where,

PMR 0.030 = filterable PM emission rate, lb/hr
ER_{CPM} 0.086 = condensable PM emission rate, lb/hr
ER_{TPM} 0.12 = lb/hr

Alliance
SOURCE TESTING

Location: Koppers Naphthalene Distillation Plant - Cicero, IL
Source: Reboiler/SCR Outlet - Condition 2
Project No.: 2020-1351
Run No. /Method Run 2 / Method 6C

SO_2 - Outlet Concentration (C_{SO_2}), ppmvd

$$C_{SO_2} = (C_{obs} - C_0) \times \left(\frac{C_{MA}}{(C_M - C_0)} \right)$$

where,

C_{obs}	0.2	= average analyzer value during test, ppmvd
C_o	0.0	= average of pretest & posttest zero responses, ppmvd
C_{MA}	25.0	= actual concentration of calibration gas, ppmvd
C_M	24.9	= average of pretest & posttest calibration responses, ppmvd
C_{SO_2}	0.2	= SO_2 Concentration, ppmvd

SO_2 - Outlet Emission Rate (ER_{SO_2}), lb/hr

$$ER_{SO_2} = \frac{C_{SO_2} \times MW \times Qs \times 60 \frac{min}{hr} \times 28.32 \frac{L}{ft^3}}{24.04 \frac{L}{g-mole} \times 1.0E06 \times 454 \frac{g}{lb}}$$

where,

C_{SO_2}	0.2	= SO_2 - Outlet Concentration, ppmvd
MW	64.066	= SO_2 molecular weight, g/g-mole
Qs	7,210	= stack gas volumetric flow rate at standard conditions, dscfm
ER_{SO_2}	0.012	= lb/hr

Alliance
SOURCE TESTING

Location: Koppers Naphthalene Distillation Plant - Cicero, IL
Source: Reboiler/SCR Outlet - Condition 2
Project No.: 2020-1351
Run No. /Method Run 2 / Method 7E

NOx - Outlet Concentration (C_{NOx}), ppmvd

$$C_{NOx} = (C_{obs} - C_0) \times \left(\frac{C_{MA}}{(C_M - C_0)} \right)$$

where,

C_{obs}	53.3	= average analyzer value during test, ppmvd
C_o	0.2	= average of pretest & posttest zero responses, ppmvd
C_{MA}	125.0	= actual concentration of calibration gas, ppmvd
C_M	125.0	= average of pretest & posttest calibration responses, ppmvd
C_{NOx}	53.2	= NOx Concentration, ppmvd

NOx - Outlet Emission Rate (ER_{NOx}), lb/hr

$$ER_{NOx} = \frac{C_{NOx} \times MW \times Qs \times 60 \frac{min}{hr} \times 28.32 \frac{L}{ft^3}}{24.04 \frac{L}{g-mole} \times 1.0E06 \times 454 \frac{g}{lb}}$$

where,

C_{NOx}	53.2	= NOx - Outlet Concentration, ppmvd
MW	46.055	= NOx molecular weight, g/g-mole
Qs	7,210	= stack gas volumetric flow rate at standard conditions, dscfm
ER_{NOx}	2.8	= lb/hr

Alliance SOURCE TESTING

Location: Koppers Naphthalene Distillation Plant - Cicero, IL
Source: Main Stack - Condition 2 Natural Gas
Project No.: 2020-1351
Run No. /Method Run 2 / Method 10

CO - Outlet Concentration (C_{CO}), ppmvd

$$C_{CO} = (C_{obs} - C_0) \times \left(\frac{C_{MA}}{(C_M - C_0)} \right)$$

where,

C_{obs} 24.7 = average analyzer value during test, ppmvd
C_o 0.6 = average of pretest & posttest zero responses, ppmvd
C_{MA} 50.0 = actual concentration of calibration gas, ppmvd
C_M 50.7 = average of pretest & posttest calibration responses, ppmvd
C_{CO} 24.1 = CO Concentration, ppmvd

CO - Outlet Emission Rate (ER_{CO}), lb/hr

$$ER_{CO} = \frac{C_{CO} \times MW \times Qs \times 60 \frac{min}{hr} \times 28.32 \frac{L}{ft^3}}{24.04 \frac{L}{g-mole} \times 1.0E06 \times 454 \frac{g}{lb}}$$

where,

C_{CO} 24.1 = CO - Outlet Concentration, ppmvd
MW 28.01 = CO molecular weight, g/g-mole
Qs 9,779 = stack gas volumetric flow rate at standard conditions, dscfm
ER<CO> 1.0 = lb/hr

Alliance SOURCE TESTING

Location: Koppers Naphthalene Distillation Plant - Cicero, IL
Source: Main Stack - Condition 2 Natural Gas
Project No.: 2020-1351
Run No. /Method Run 2 / Method 25A

VOM - Outlet Concentration (C_{VOM}), ppmvd

$$C_{VOM} = \frac{C_{VOMw}}{1 - BWS}$$

where,

C_{VOMw} 1.8 = VOM - Outlet Concentration, ppmvw
BWS 0.222 = moisture fraction, unitless
C_{VOM} 1.4 = ppmvd

VOM - Outlet Emission Rate (ER_{VOM}), lb/hr

$$ER_{VOM} = \frac{C_{VOM} \times MW \times Qs \times 60 \frac{min}{hr} \times 28.32 \frac{L}{ft^3}}{24.04 \frac{L}{g-mole} \times 1.0E06 \times 454 \frac{g}{lb}}$$

where,

C_{VOM} 1.8 = VOM - Outlet Concentration, ppmvd
MW 44.1 = VOM molecular weight, g/g-mole
Qs 9,779 = stack gas volumetric flow rate at standard conditions, dscfm
ER_{VOM} 0.12 = lb/hr

Alliance
SOURCE TESTING

Location: Koppers Naphthalene Distillation Plant - Cicero, IL
Source: Reboiler/SCR Outlet - Condition 2
Project No.: 2020-1351
Run No./Method Run 2 Outlet/ Method 320

Ammonia Concentration (C_{NH3}), ppmvd

$$C_{NH3} = \frac{C_{NH3w}}{1 - BWS}$$

where,

C_{NH3w}	0.028	= NH3 concentration, ppmvw
BWS	0.164	= moisture fraction, unitless
C_{NH3}	0.034	= NH3 Concentration, ppmvd

Ammonia Emission Rate (ER_{NH3}), lb/hr

$$ER_{NH3} = \frac{C_{NH3} \times MW \times Qs \times 60 \times 28.32}{24.04 \times 1.0E+06 \times 454}$$

where,

C_{NH3}	0.034	= NH3 Concentration, ppmvd
MW	17.0305	= NH3 molecular weight, g/g-mole
Qs	7,210	= stack gas volumetric flow rate at standard conditions, dscfm
ER_{NH3}	0.00065	= lb/hr

Location Koppers Naphthalene Distillation Plant - Ci

Source(s) Reboiler/SCR Outlet

Project No. 2020-1351

Date(s) 9/29-30/20

CTS Recovery Value (CTS_R), %

$$\frac{CTS_{avg}}{CTS_{cyl}} \times 100$$

Where,

CTS_{avg}	99.11	= average of all CTS calibration gas readings, ppm
CTS_{cyl}	99.4	= CTS bottle certified gas value, ppm
CTS_R	99.7%	= CTS recovery value, %

Spike Dilutuon Factor (F_d), %

$$\frac{SF6_{spike} - SF6_{nat}}{SF6_{dir}} \times 100$$

Where,

$SF6_{dir}$	4.70	= average of direct tracer gas value readings
$SF6_{nat}$	-0.01125	= average of native tracer gas value readings
$SF6_{spike}$	0.455704	= average of dynamic spike tracer gas value readings
F_d	9.94%	= spike dilution factor, %

Calculated Spike ($Spike_{calc}$), ppm

$$(F_d \times Analyte_{dir}) + (Analyte_{nat} \times (1 - F_d))$$

Where,

F_d	0.099416	= spike dilution factor, %
$Analyte_{dir}$	264.88	= average of direct analyte gas values, ppm
$Analyte_{nat}$	2.00	= average of native analyte gas values, ppm
$Spike_{calc}$	28.13	= calculated spike, ppm value, ppm

Spike Recovery Value ($Spike_R$), %

$$\frac{Analyte_{spike}}{Spike_{calc}} \times 100$$

Where,

$Spike_{calc}$	28.13	= calculated spike, ppm value, ppm
$Analyte_{spike}$	25.11	= average of spiked analyte gas values, ppm
$Spike_R$	89.24%	= spike recovery value, %

Appendix B

Reboiler/SCR Outlet

Location Koppers Naphthalene Distillation Plant - Cicero, IL
Source Reboiler/SCR Outlet - Condition 2
Project No. 2020-1351

Run Number		Run 2	Run 3*	Run 4	Average
Date		9/29/20	9/30/20	9/30/20	--
Start Time		17:12	10:01	13:49	--
Stop Time		19:12	12:09	14:49	--
Input Data - Outlet					
Moisture Fraction, dimensionless	BWS	0.164	0.149	0.139	0.151
Volumetric Flow Rate (M1-4), dscfm	Qs	7,210	7,072	7,525	7,269
Calculated Data - Outlet					
O_2 Concentration, % dry	C_{O_2}	8.13	7.46	7.55	7.71
CO_2 Concentration, % dry	C_{CO_2}	7.57	8.15	7.91	7.87
NOx Concentration, ppmvd	C_{NOx}	53.2	41.3	49.8	48.1
NOx Emission Rate, lb/hr	ER_{NOx}	2.8	2.1	2.7	2.5
SO_2 Concentration, ppmvd	C_{SO_2}	0.2	0.1	0.2	0.2
SO_2 Emission Rate, lb/hr	ER_{SO_2}	0.012	0.0084	0.013	0.011
Ammonia - Outlet Concentration, ppmvd	C_{NH3}	0.034	0.41	0.32	0.25
Ammonia - Outlet Concentration, ppmvw	C_{NH3w}	0.028	0.35	0.27	0.22
Ammonia - Outlet Emission Rate, lb/hr	ER_{NH3}	0.00065	0.0077	0.0063	0.0049

*Run 3 paused due to operational issues

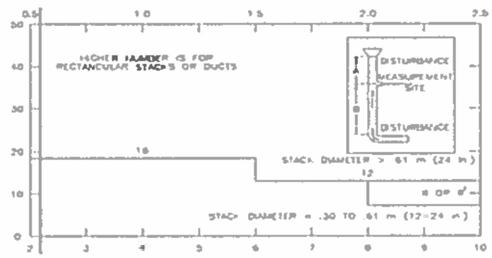
Alliance SOURCE TESTING

Method 1 Data

Location Koppers Naphthalene Distillation Plant - Cicero, IL
Source Reboiler/SCR Outlet - Condition 2
Project No. 20-1351
Date: 09/29/20

Stack Parameters

Duct Orientation:	Vertical	
Duct Design:	Circular	
Distance from Far Wall to Outside of Port:	45.00	in
Nipple Length:	11.50	in
Depth of Duct:	33.50	in
Cross Sectional Area of Duct:	6.12	ft^2
No. of Test Ports:	2	
Number of Readings per Point:	1	
Distance A:	17.0	ft
Distance A Duct Diameters:	6.1	(must be > 0.5)
Distance B:	6.0	ft
Distance B Duct Diameters:	2.1	(must be > 2)
Minimum Number of Traverse Points:	16	
Actual Number of Traverse Points:	16	
Measurer (Initial and Date):	LJC	
Reviewer (Initial and Date):	JEW	



CIRCULAR DUCT

LOCATION OF TRAVERSE POINTS

Number of traverse points on a diameter

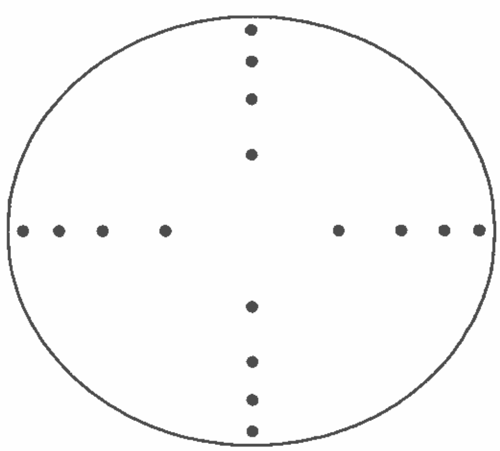
	2	3	4	5	6	7	8	9	10	11	12
1	14.6	--	6.7	--	4.4	--	3.2	--	2.6	--	2.1
2	85.4	--	25.0	--	14.6	--	10.5	--	8.2	--	6.7
3	--	--	75.0	--	29.6	--	19.4	--	14.6	--	11.8
4	--	--	93.3	--	70.4	--	32.3	--	22.6	--	17.7
5	--	--	--	--	85.4	--	67.7	--	34.2	--	25.0
6	--	--	--	--	95.6	--	80.6	--	65.8	--	35.6
7	--	--	--	--	--	--	89.5	--	77.4	--	64.4
8	--	--	--	--	--	--	96.8	--	85.4	--	75.0
9	--	--	--	--	--	--	--	--	91.8	--	82.3
10	--	--	--	--	--	--	--	--	97.4	--	88.2
11	--	--	--	--	--	--	--	--	--	--	93.3
12	--	--	--	--	--	--	--	--	--	--	97.9

Percent of stack diameter from inside wall to traverse point.

Traverse Point	% of Diameter	Distance from inside wall	Distance from outside of port
1	3.2	1.07	12.57
2	10.5	3.52	15.02
3	19.4	6.50	18.00
4	32.3	10.82	22.32
5	67.7	22.68	34.18
6	80.6	27.00	38.50
7	89.5	29.98	41.48
8	96.8	32.43	43.93
9	--	--	--
10	--	--	--
11	--	--	--
12	--	--	--

Stack Diagram
A = 17 ft.
B = 6 ft.
Depth of Duct = 33.5 in.

Cross Sectional Area



Alliance
SOURCE TESTING

Cyclonic Flow Check

Location Koppers Naphthalene Distillation Plant - Cicero, IL
Source Reboiler/SCR Outlet - Condition 2
Project No. 20-1351
Date 9/29/30

Sample Point	Angle (ΔP=0)
1	5
2	1
3	0
4	0
5	3
6	7
7	0
8	3
9	6
10	1
11	0
12	0
13	8
14	4
15	2
16	0
Average	2.5

Alliance
SOURCE TESTING

Location Koppers Naphthalene Distillation Plant - Cicero, IL
Source Reboiler/SCR Outlet - Condition 2
Project No. 20-1351

Run No.	2		3		4	
Date	9/29/20		9/30/20		9/30/20	
Status	VALID		VALID		VALID	
Start Time	17:12		10:15		13:55	
Stop Time	17:22		10:25		14:07	
Leak Check	Pass		Pass		Pass	
Traverse Point	Δ P (in. WC)	Ts (°F)	Δ P (in. WC)	Ts (°F)	Δ P (in. WC)	Ts (°F)
A1	0.28	583	0.24	590	0.27	592
2	0.32	584	0.28	590	0.33	293
3	0.36	584	0.30	591	0.33	293
4	0.41	586	0.33	593	0.37	595
5	0.41	587	0.35	594	0.38	597
6	0.39	588	0.33	595	0.39	597
7	0.37	585	0.32	596	0.40	594
8	0.33	583	0.31	594	0.39	593
B1	0.35	581	0.33	588	0.38	590
2	0.37	584	0.36	591	0.36	592
3	0.38	585	0.38	592	0.37	595
4	0.33	587	0.35	595	0.36	595
5	0.31	588	0.40	597	0.39	598
6	0.32	586	0.37	598	0.33	596
7	0.31	583	0.33	598	0.32	594
8	0.29	582	0.31	597	0.29	591

Parameter	Symbol	Run 2	Run 3	Run 4	Average
Square Root of ΔP, (in. WC)$^{1/2}$	$(\Delta P)^{1/2}$	0.587	0.574	0.594	0.585
Average ΔP, in. WC	(ΔP)	0.35	0.33	0.35	0.34
Pitot Tube Coefficient	(Cp)	0.840	0.840	0.840	0.840
Barometric Pressure, in. Hg	(Pb)	29.25	28.90	28.90	28.97
Static Pressure, in. WC	(Pg)	-6.70	-6.80	-6.80	-6.77
Stack Pressure, in. Hg	(Ps)	28.76	28.40	28.40	28.52
Average Temperature, °F	(Ts)	584.8	593.7	556.6	578.3
Average Temperature, °R	(Ts)	1044.8	1053.7	1016.6	1038.3
Measured Moisture Fraction	(BWSmsd)	0.164	0.149	0.139	0.150
Moisture Fraction @ Saturation	(BWSsat)	85.912	92.735	70.534	83.060
Moisture Fraction	(BWS)	0.164	0.149	0.139	0.150
O2 Concentration, %	(O2)	8.1	7.5	7.6	7.7
CO2 Concentration, %	(CO2)	7.6	8.2	7.9	7.9
Molecuar Weight, lb/lb-mole (dry)	(Md)	29.54	29.60	29.57	29.57
Molecuar Weight, lb/lb-mole (wet)	(Ms)	27.65	27.88	27.96	27.83
Velocity, ft/sec	(Vs)	48.3	47.6	48.3	48.0
VFR at stack conditions, acfm	(Qa)	17,744	17,464	17,722	17,643
VFR at standard conditions, scfh	(Qsw)	517,149	498,402	524,216	513,256
VFR at standard conditions, scfm	(Qsw)	8,619	8,307	8,737	8,554
VFR at standard conditions, dscfm	(Qsd)	7,210	7,072	7,525	7,269

Alliance SOURCE TESTING

Location Koppers Naphthalene Distillation Plant - Cicero, IL
Source Reboiler/SCR Outlet - Condition 2
Project No. 20-1351
Parameter(s): VFR
Console Type Meter Box

Run No.		2					3					4				
Date		9/29/20					9/30/20					9/30/20				
Status		VALID					VALID					VALID				
Start Time		17:12					10:01					13:49				
End Time		19:12					13:09					14:49				
Run Time, min	(θ)	120					120					60				
Meter ID		T9B					T9B					T9B				
Meter Correction Factor	(Y)	0.995					0.995					0.995				
Orifice Calibration Value	(ΔH @)	1.823					1.823					1.823				
Max Vacuum, in. Hg		4					5					4				
Post Leak Check, ft3/min (at max vac.)		0.000					0.000					0.000				
Meter Volume, ft3																
0		0.000					0.000					0.000				
5		3.448					3.476					3.432				
10		6.491					7.016					6.753				
15		9.710					10.463					10.104				
20		12.865					13.956					13.456				
25		15.989					17.421					16.932				
30		19.128					20.862					20.496				
35		22.345					24.296					23.992				
40		25.323					27.721					27.515				
45		28.412					31.126					31.156				
50		31.245					34.665					34.574				
55		34.816					38.215					38.102				
60		37.483					41.786					41.508				
65		40.563					45.317									
70		43.472					48.801									
75		46.449					52.356									
80		49.402					55.963									
85		52.376					59.659									
90		55.302					53.145									
95		58.658					66.978									
100		61.152					69.347									
105		64.135					72.848									
110		66.965					76.398									
115		69.848					79.965									
120		72.721					83.502									
Total Meter Volume, ft3	(Vm)	72.721					83.502					41.508				
Temperature, °F		Meter	Probe	Filter	Vacuum	Imp. Exit	Meter	Probe	Filter	Vacuum	Imp. Exit	Meter	Probe	Filter	Vacuum	Imp. Exit
0		73	--	--	4	49	71	--	--	4	56	72	--	--	4	52
5		73	--	--	4	44	71	--	--	4	46	72	--	--	4	48
10		73	--	--	4	45	71	--	--	4	47	73	--	--	4	49
15		74	--	--	4	47	72	--	--	4	48	73	--	--	4	51
20		74	--	--	4	49	72	--	--	4	49	73	--	--	4	51
25		74	--	--	4	49	73	--	--	4	49	74	--	--	4	52
30		75	--	--	4	50	73	--	--	4	50	75	--	--	4	52
35		75	--	--	4	51	73	--	--	4	50	75	--	--	4	52
40		75	--	--	4	52	73	--	--	4	51	75	--	--	4	52
45		75	--	--	4	52	73	--	--	4	51	75	--	--	4	52
50		75	--	--	4	54	69	--	--	4	54	76	--	--	4	52
55		75	--	--	4	54	69	--	--	4	50	76	--	--	4	53
60		75	--	--	4	54	68	--	--	4	52	76	--	--	4	54
65		75	--	--	4	54	69	--	--	4	53	--	--	--	--	--
70		75	--	--	4	55	69	--	--	4	54	--	--	--	--	--
75		75	--	--	4	56	69	--	--	4	54	--	--	--	--	--
80		75	--	--	4	55	70	--	--	4	54	--	--	--	--	--
85		75	--	--	4	54	70	--	--	4	54	--	--	--	--	--
90		75	--	--	4	55	71	--	--	4	54	--	--	--	--	--
95		75	--	--	4	55	71	--	--	4	54	--	--	--	--	--
100		75	--	--	4	56	71	--	--	4	55	--	--	--	--	--
105		75	--	--	4	58	72	--	--	5	54	--	--	--	--	--
110		75	--	--	4	58	72	--	--	5	55	--	--	--	--	--
115		75	--	--	4	59	72	--	--	5	55	--	--	--	--	--
120		75	--	--	4	59	73	--	--	5	56	--	--	--	--	--
Average Temperature, °F	(Tm)	75	--	--	--	--	71	--	--	--	--	74	--	--	--	--
Average Temperature, °R	(Tm)	535	--	--	--	--	531	--	--	--	--	534	--	--	--	--
Minimum Temperature, °F		73	--	--	--	--	68	--	--	--	--	72	--	--	--	--
Maximum Temperature, °F		75	--	--	--	59	73	--	--	--	56	76	--	--	--	54
Barometric Pressure, in. Hg	(Pb)	29.25					28.90					28.90				
Meter Orifice Pressure, in. WC	(ΔH)	1.200					1.600					1.400				
Meter Pressure, in. Hg	(Pm)	29.34					29.02					29.00				
Standard Meter Volume, ft3	(Vmstd)	70.069					80.111					39.568				
Analysis Type		Gravimetric					Gravimetric					Gravimetric				
Impinger 1, Pre/Post Test, mL		H2O		750.0	954.9	204.9	H2O		785.9	954.5	168.6	H2O		775.8	891.4	115.6
Impinger 2, Pre/Post Test, mL		H2O		733.7	776.1	42.4	H2O		776.1	882.6	106.5	H2O		756.0	763.9	7.9
Impinger 3, Pre/Post Test, mL		Empty		641.5	652.9	11.4	Empty		652.9	658.2	5.3	Empty		647.3	649.1	1.8
Impinger 4, Pre/Post Test, g		Silica		839.7	871.5	31.8	Silica		871.5	887.7	16.2	Silica		852.5	862.4	9.9
Volume Water Collected, mL	(Vlc)	290.5					296.6					135.2				
Standard Water Volume, ft^3	(Vwstd)	13.697					13.985					6.375				
Moisture Fraction Measured	(BWS)	0.164					0.149					0.139				
Gas Molecular Weight, lb/lb-mole (dry)	(Md)	29.54					29.60					29.57				
DGM Calibration Check Value	(Yqa)	-1.6					-2.3					3.4				

Alliance SOURCE TESTING

Location: Koppers Naphthalene Distillation Plant - Cicero, IL
Source: Reboiler/SCR Outlet - Condition 2
Project No.: 2020-1351
Date: 9/29/20

Time Unit Status	O_2 - Outlet % dry Valid	CO_2 - Outlet % dry Valid	NOx - Outlet ppmvd Valid	SO_2 - Outlet ppmvd Valid
17:12	9.33	6.85	47.70	0.10
17:13	9.42	6.82	48.20	0.10
17:14	9.17	6.93	48.82	0.10
17:15	9.13	6.96	48.80	0.10
17:16	9.17	6.94	48.92	0.10
17:17	9.17	6.94	48.93	0.10
17:18	9.22	6.91	48.77	0.10
17:19	9.20	6.93	48.98	0.10
17:20	9.17	6.94	48.97	0.10
17:21	9.15	6.95	49.30	0.10
17:22	9.13	6.97	48.74	0.10
17:23	9.17	6.95	48.94	0.12
17:24	9.18	6.94	48.86	0.10
17:25	9.16	6.96	48.94	0.10
17:26	9.20	6.94	48.65	0.10
17:27	9.26	6.89	48.26	0.10
17:28	9.22	6.92	48.86	0.10
17:29	9.18	6.94	48.69	0.10
17:30	9.23	6.91	48.70	0.10
17:31	9.17	6.94	48.80	0.10
17:32	9.20	6.91	48.70	0.10
17:33	9.20	6.92	48.80	0.10
17:34	9.24	6.91	48.20	0.10
17:35	9.30	6.87	48.54	0.12
17:36	9.20	6.93	48.66	0.12
17:37	9.16	6.95	48.30	0.10
17:38	9.26	6.91	48.22	0.10
17:39	9.21	6.92	48.59	0.12
17:40	9.20	6.93	48.49	0.12
17:41	9.25	6.90	48.33	0.12
17:42	9.37	6.83	48.24	0.10
17:43	9.39	6.82	48.13	0.10
17:44	9.31	6.88	48.31	0.10
17:45	9.35	6.86	48.08	0.10
17:46	9.35	6.85	48.15	0.10
17:47	9.33	6.86	48.36	0.10
17:48	9.30	6.88	48.59	0.10
17:49	9.24	6.91	48.56	0.10
17:50	9.23	6.91	48.71	0.10
17:51	9.19	6.92	48.74	0.10
17:52	9.33	6.85	47.84	0.16
17:53	9.38	6.83	48.20	0.16
17:54	9.21	6.94	49.04	0.19
17:55	9.19	6.95	48.81	0.20
17:56	9.20	6.94	48.72	0.19
17:57	9.20	6.94	48.75	0.20
17:58	9.30	6.89	49.06	0.18
17:59	8.44	7.30	54.51	0.20
18:00	7.60	7.81	56.07	0.20
18:01	7.58	7.80	55.52	0.20
18:02	7.45	7.88	57.00	0.20
18:03	7.34	7.93	56.29	0.20
18:04	7.47	7.85	55.95	0.20
18:05	7.55	7.81	55.96	0.20
18:06	7.55	7.82	55.63	0.20
18:07	7.79	7.65	55.18	0.20
18:08	7.61	7.79	56.15	0.20
18:09	7.44	7.87	56.28	0.20
18:10	7.36	7.92	56.37	0.20
18:11	7.35	7.92	56.61	0.20
18:12	7.35	7.92	56.66	0.20
18:13	7.33	7.93	56.65	0.20
18:14	7.34	7.92	56.50	0.20
18:15	7.34	7.92	56.10	0.20
18:16	7.34	7.92	56.29	0.20
18:17	7.35	7.92	56.61	0.20
18:18	7.38	7.91	56.78	0.20
18:19	7.39	7.90	56.64	0.20
18:20	7.39	7.90	56.51	0.21
18:21	7.39	7.90	56.47	0.20
18:22	7.40	7.90	56.62	0.20
18:23	7.42	7.89	56.29	0.20
18:24	7.45	7.87	56.48	0.20
18:25	7.45	7.87	56.45	0.20
18:26	7.42	7.88	56.40	0.20
18:27	7.41	7.89	56.42	0.20
18:28	7.40	7.90	56.32	0.20

Run 2 - CEMS Data

Location: Koppers Naphthalene Distillation Plant - Cicero, IL
Source: Reboiler/SCR Outlet - Condition 2
Project No.: 2020-1351
Date: 9/29/20

Time Unit Status	O_2 - Outlet % dry Valid	CO_2 - Outlet % dry Valid	NOx - Outlet ppmvd Valid	SO_2 - Outlet ppmvd Valid
18:29	7.41	7.88	56.45	0.20
18:30	7.40	7.89	56.47	0.20
18:31	7.39	7.90	56.53	0.20
18:32	7.40	7.89	56.49	0.20
18:33	7.36	7.91	56.62	0.20
18:34	7.31	7.95	56.84	0.20
18:35	7.34	7.92	56.65	0.20
18:36	7.35	7.93	56.59	0.20
18:37	7.38	7.90	56.36	0.20
18:38	7.37	7.91	56.66	0.20
18:39	7.36	7.92	56.55	0.20
18:40	7.37	7.91	56.67	0.20
18:41	7.34	7.93	56.49	0.20
18:42	7.37	7.90	56.62	0.20
18:43	7.40	7.89	56.24	0.20
18:44	7.40	7.89	56.25	0.20
18:45	7.42	7.88	56.06	0.20
18:46	7.46	7.86	56.10	0.20
18:47	7.45	7.87	56.17	0.20
18:48	7.42	7.88	56.59	0.20
18:49	7.34	7.93	56.66	0.20
18:50	7.35	7.92	56.48	0.20
18:51	7.42	7.88	56.36	0.20
18:52	7.45	7.87	56.33	0.20
18:53	7.45	7.87	56.11	0.20
18:54	7.41	7.90	56.15	0.20
18:55	7.42	7.90	56.10	0.20
18:56	7.45	7.87	56.34	0.20
18:57	7.41	7.89	56.43	0.20
18:58	7.40	7.90	56.34	0.20
18:59	7.39	7.89	56.62	0.20
19:00	7.37	7.91	56.61	0.20
19:01	7.38	7.89	56.49	0.20
19:02	7.39	7.90	56.35	0.20
19:03	7.40	7.89	56.53	0.20
19:04	7.43	7.88	56.49	0.20
19:05	7.47	7.86	56.35	0.20
19:06	7.56	7.81	55.76	0.20
19:07	7.64	7.76	55.79	0.20
19:08	7.50	7.86	56.40	0.20
19:09	7.36	7.93	56.56	0.20
19:10	7.38	7.92	56.33	0.20
19:11	7.42	7.90	56.57	0.20

Parameter	O_2 - Outlet	CO_2 - Outlet	NOx - Outlet	SO_2 - Outlet
Uncorrected Run Average (C_{obs})	8.1	7.5	53.3	0.2
Cal Gas Concentration (C_{MA})	10.0	10.00	125.0	25.0
Pretest System Zero Response	0.07	0.04	0.19	0.00
Posttest System Zero Response	0.10	0.04	0.19	0.00
Average Zero Response (Co)	0.1	0.0	0.2	0.0
Pretest System Cal Response	9.98	9.89	124.81	25.28
Posttest System Cal Response	10.01	9.90	125.19	24.61
Average Cal Response (C_M)	10.0	9.9	125.0	24.9
Corrected Run Average (Corr)	8.1	7.6	53.2	0.2

Alliance SOURCE TESTING

Location: Koppers Naphthalene Distillation Plant - Cicero, IL
Source: Reboiler/SCR Outlet - Condition 2
Project No.: 2020-1351
Date: 9/30/20

Time Unit Status	O_2 - Outlet % dry Valid	CO_2 - Outlet % dry Valid	NOx - Outlet ppmvd Valid	SO_2 - Outlet ppmvd Valid
10:01	7.53	7.94	49.57	0.10
10:02	7.55	7.93	49.54	0.10
10:03	7.57	7.92	49.42	0.10
10:04	7.57	7.92	49.68	0.10
10:05	7.52	7.95	50.00	0.10
10:06	7.49	7.97	49.49	0.10
10:07	7.45	7.99	49.35	0.10
10:08	7.46	7.99	49.61	0.10
10:09	7.53	7.95	49.52	0.10
10:10	7.49	7.98	49.97	0.10
10:11	7.41	8.02	50.30	0.10
10:12	7.40	8.03	50.23	0.10
10:13	7.43	8.01	50.10	0.10
10:14	7.44	8.01	49.97	0.10
10:15	7.49	7.98	49.76	0.10
10:16	7.47	8.00	50.03	0.10
10:17	7.45	8.01	49.99	0.10
10:18	7.45	8.01	49.80	0.10
10:19	7.50	7.98	49.89	0.10
10:20	7.48	7.99	49.92	0.10
10:21	7.50	7.98	49.86	0.10
10:22	7.47	8.00	50.31	0.10
10:23	7.42	8.02	50.41	0.10
10:24	7.44	8.01	50.13	0.10
10:25	7.49	7.99	49.81	0.12
10:26	7.53	7.97	49.97	0.10
10:27	7.49	7.99	50.15	0.15
10:28	7.48	8.00	50.11	0.19
10:29	7.49	7.99	50.01	0.20
10:30	7.50	7.99	49.99	0.20
10:31	7.47	8.01	50.25	0.20
10:32	7.47	8.00	50.18	0.20
10:33	7.46	8.01	50.34	0.20
10:34	7.46	8.01	50.17	0.20
10:35	7.49	7.99	50.22	0.20
10:36	7.45	8.01	50.44	0.20
10:37	7.46	8.01	50.16	0.20
10:38	7.49	8.00	50.03	0.20
10:39	7.53	7.97	49.53	0.20
10:40	7.52	7.98	49.05	0.20
10:41	7.48	8.00	49.22	0.20
10:42	7.45	8.01	49.81	0.20
10:43	7.50	7.99	50.17	0.20
10:44	7.44	8.01	50.37	0.20
10:45	7.41	8.03	50.35	0.20
10:46	7.43	8.02	50.32	0.20
10:47	7.72	7.84	45.16	0.20
11:56	7.60	7.97	35.38	0.18
11:57	7.59	7.98	24.99	0.10
11:58	7.58	7.98	7.86	0.08
11:59	7.61	7.96	2.14	0.00
12:00	7.64	7.96	1.38	0.00
12:01	7.66	7.93	1.54	0.00
12:02	7.63	7.95	1.68	0.00
12:03	7.62	7.96	1.88	0.00
12:04	7.58	7.99	2.07	0.00
12:05	7.54	8.00	2.30	0.00
12:06	7.56	7.98	34.27	0.03
12:07	7.59	7.98	17.17	0.01
12:08	7.60	7.97	11.24	0.00

Parameter	O_2 - Outlet	CO_2 - Outlet	NOx - Outlet	SO_2 - Outlet
Uncorrected Run Average (C_{obs})	7.5	8.0	41.4	0.1
Cal Gas Concentration (C_{MA})	10.0	10.00	125.0	25.0
Pretest System Zero Response	0.14	0.05	0.19	0.00
Posttest System Zero Response	0.22	0.06	0.18	0.00
Average Zero Response (Co)	0.2	0.1	0.2	0.0
Pretest System Cal Response	10.03	9.73	124.83	25.03
Posttest System Cal Response	9.99	9.84	125.56	24.80
Average Cal Response (C_M)	10.0	9.8	125.2	24.9
Corrected Run Average (Corr)	7.5	8.1	41.3	0.1

Alliance
SOURCE TESTING

Location: Koppers Naphthalene Distillation Plant - Cicero, IL
Source: Reboiler/SCR Outlet - Condition 2
Project No.: 2020-1351
Date: 9/30/20

Time Unit Status	O_2 - Outlet % dry Valid	CO_2 - Outlet % dry Valid	NOx - Outlet ppmvd Valid	SO_2 - Outlet ppmvd Valid
13:49	7.53	7.78	50.15	0.46
13:50	7.61	7.74	50.50	0.40
13:51	7.63	7.75	50.27	0.38
13:52	7.65	7.75	50.36	0.30
13:53	7.65	7.76	50.50	0.30
13:54	7.63	7.77	50.55	0.30
13:55	7.60	7.79	50.67	0.30
13:56	7.60	7.79	50.44	0.29
13:57	7.63	7.78	50.01	0.22
13:58	7.64	7.77	50.16	0.20
13:59	7.64	7.79	50.43	0.20
14:00	7.60	7.80	50.28	0.20
14:01	7.56	7.83	50.17	0.20
14:02	7.56	7.82	49.99	0.20
14:03	7.60	7.79	49.89	0.20
14:04	7.58	7.81	49.89	0.20
14:05	7.61	7.79	49.76	0.20
14:06	7.64	7.77	49.90	0.20
14:07	7.63	7.78	49.91	0.20
14:08	7.61	7.80	49.94	0.20
14:09	7.63	7.79	50.03	0.20
14:10	7.59	7.82	49.97	0.20
14:11	7.59	7.81	50.03	0.20
14:12	7.58	7.83	50.25	0.20
14:13	7.61	7.81	50.16	0.20
14:14	7.61	7.80	49.87	0.20
14:15	7.57	7.82	49.80	0.20
14:16	7.57	7.81	49.88	0.20
14:17	7.55	7.82	49.71	0.20
14:18	7.55	7.81	49.74	0.20
14:19	7.52	7.83	50.05	0.20
14:20	7.51	7.83	50.09	0.20
14:21	7.54	7.82	50.06	0.20
14:22	7.58	7.80	50.02	0.20
14:23	7.60	7.79	49.82	0.20
14:24	7.60	7.79	49.88	0.20
14:25	7.56	7.82	49.60	0.20
14:26	7.55	7.81	49.49	0.20
14:27	7.53	7.82	49.50	0.20
14:28	7.50	7.84	49.46	0.20
14:29	7.51	7.85	49.79	0.20
14:30	7.52	7.84	49.75	0.20
14:31	7.53	7.85	49.71	0.20
14:32	7.55	7.84	49.91	0.20
14:33	7.55	7.85	49.67	0.20
14:34	7.53	7.85	49.89	0.20
14:35	7.58	7.81	49.89	0.20
14:36	7.61	7.81	49.89	0.20
14:37	7.56	7.84	49.85	0.20
14:38	7.57	7.81	49.92	0.20
14:39	7.54	7.83	49.64	0.20
14:40	7.58	7.81	49.63	0.20
14:41	7.61	7.79	49.54	0.20
14:42	7.58	7.83	49.41	0.20
14:43	7.58	7.82	48.93	0.20
14:44	7.59	7.83	49.06	0.20
14:45	7.59	7.83	49.15	0.20
14:46	7.58	7.84	49.50	0.20
14:47	7.58	7.83	49.87	0.20
14:48	7.58	7.85	49.84	0.20

Parameter	O_2 - Outlet	CO_2 - Outlet	NOx - Outlet	SO_2 - Outlet
Uncorrected Run Average (C_{obs})	7.6	7.8	49.9	0.2
Cal Gas Concentration (C_{MA})	10.0	10.00	125.0	25.0
Pretest System Zero Response	0.22	0.06	0.19	0.00
Posttest System Zero Response	0.19	0.07	0.07	0.10
Average Zero Response (Co)	0.2	0.1	0.1	0.1
Pretest System Cal Response	9.99	9.84	125.56	24.80
Posttest System Cal Response	9.96	9.88	124.67	24.47
Average Cal Response (C_M)	10.0	9.9	125.1	24.6
Corrected Run Average (Corr)	7.5	7.9	49.8	0.2

![Alliance Source Testing]

Location: Koppers Naphthalene Distillation Plant - Cicero, IL
Source: Reboiler/SCR Outlet - Condition 2
Project No.: 2020-1351
Date: 9/29/20

Time Unit Status	Temperature °C Valid	Pressure atm Valid	Ammonia - Outlet ppmvw Valid	BWS - Outlet % (wet) Valid
17:12	190.4	0.894	0.1	13.5
17:13	190.4	0.894	0.2	13.5
17:14	190.4	0.894	0.1	13.0
17:15	190.4	0.894	0.1	13.3
17:16	190.4	0.894	0.1	13.5
17:17	190.4	0.894	0.1	13.8
17:19	190.3	0.894	0.1	13.4
17:20	190.4	0.894	0.1	13.1
17:21	190.4	0.894	0.1	13.7
17:22	190.4	0.893	0.1	13.5
17:23	190.4	0.894	0.1	13.1
17:24	190.4	0.893	0.1	14.4
17:25	190.4	0.894	0.1	13.2
17:26	190.4	0.893	0.1	13.8
17:27	190.4	0.894	0.1	13.5
17:28	190.4	0.894	0.1	13.4
17:29	190.4	0.894	0.1	13.5
17:30	190.4	0.893	0.0	13.7
17:31	190.4	0.893	0.1	13.7
17:32	190.4	0.893	0.1	13.6
17:33	190.4	0.894	0.1	13.4
17:34	190.4	0.894	0.1	13.0
17:35	190.4	0.894	0.1	13.5
17:36	190.4	0.894	0.1	13.8
17:37	190.4	0.894	0.0	13.3
17:38	190.4	0.893	0.1	13.5
17:40	190.4	0.893	0.0	13.6
17:41	190.3	0.894	0.1	13.0
17:42	190.3	0.893	0.0	13.6
17:43	190.4	0.894	0.0	13.4
17:44	190.4	0.893	0.0	13.1
17:45	190.4	0.893	0.0	13.6
17:46	190.4	0.894	0.0	13.3
17:47	190.4	0.894	0.1	13.1
17:48	190.4	0.893	0.0	13.6
17:49	190.4	0.894	0.1	13.5
17:50	190.4	0.894	0.1	12.9
17:51	190.4	0.893	0.0	13.6
17:52	190.3	0.893	0.0	13.6
17:53	190.3	0.893	0.0	13.3
17:54	190.4	0.893	0.0	13.3
17:55	190.4	0.893	0.1	13.5
17:56	190.4	0.894	0.0	13.5
17:57	190.4	0.894	0.0	13.2
17:58	190.4	0.893	0.0	13.6
17:59	190.4	0.894	0.0	13.7
18:00	190.4	0.894	0.1	12.9
18:02	190.4	0.893	0.0	14.0
18:03	190.4	0.892	0.0	15.0
18:04	190.4	0.892	0.1	14.9
18:05	190.3	0.893	0.0	15.1
18:06	190.3	0.893	0.0	15.2
18:07	190.3	0.893	0.0	15.0
18:08	190.4	0.893	0.0	14.9
18:09	190.4	0.892	0.0	15.1
18:10	190.4	0.892	0.1	14.9
18:11	190.4	0.892	0.0	15.0
18:12	190.4	0.892	0.0	14.9
18:13	190.4	0.892	0.0	15.4
18:14	190.4	0.892	0.0	15.3

Parameter	Temperature	Pressure	Ammonia - Outlet	BWS - Outlet
Run Average	190.4	0.893	0.0	14.5

Alliance SOURCE TESTING

Location: Koppers Naphthalene Distillation Plant - Cicero, IL
Source: Reboiler/SCR Outlet - Condition 2
Project No.: 2020-1351
Date: 9/30/20

Time	Temperature	Pressure	Ammonia - Outlet	BWS - Outlet
Unit	°C	atm	ppmvw	% (wet)
Status	Valid	Valid	Valid	Valid
10:01	190.4	0.891	0.6	14.6
10:02	190.4	0.891	0.6	14.6
10:03	190.4	0.891	0.6	14.1
10:04	190.4	0.891	0.6	14.5
10:05	190.5	0.890	0.6	14.9
10:07	190.4	0.891	0.5	14.5
10:08	190.4	0.891	0.5	14.5
10:09	190.4	0.890	0.5	14.4
10:10	190.4	0.890	0.5	14.9
10:11	190.4	0.890	0.5	14.6
10:12	190.4	0.891	0.5	14.4
10:13	190.4	0.891	0.5	14.4
10:14	190.4	0.891	0.5	15.1
10:15	190.4	0.891	0.5	14.6
10:16	190.4	0.891	0.4	14.4
10:17	190.4	0.891	0.4	14.8
10:18	190.4	0.891	0.4	14.5
10:19	190.4	0.891	0.4	14.5
10:20	190.4	0.891	0.4	14.7
10:21	190.4	0.891	0.4	14.5
10:22	190.4	0.891	0.4	14.4
10:23	190.4	0.891	0.4	14.3
10:24	190.4	0.891	0.3	14.7
10:25	190.4	0.890	0.4	14.5
10:26	190.4	0.890	0.4	14.9
10:27	190.4	0.891	0.4	14.5
10:29	190.4	0.891	0.4	14.4
10:30	190.4	0.891	0.3	14.5
10:31	190.4	0.891	0.3	14.7
10:32	190.4	0.891	0.4	14.7
10:33	190.4	0.891	0.3	14.3
10:34	190.4	0.891	0.3	14.7
10:35	190.4	0.891	0.3	14.6
10:36	190.4	0.891	0.3	14.8
10:37	190.4	0.891	0.3	14.4
10:38	190.4	0.891	0.3	14.5
10:39	190.4	0.891	0.3	14.4
10:40	190.4	0.891	0.3	14.5
10:41	190.4	0.891	0.3	14.9
10:42	190.4	0.891	0.3	14.4
10:43	190.4	0.891	0.3	14.5
10:44	190.4	0.891	0.3	14.6
10:45	190.4	0.891	0.3	14.4
10:46	190.4	0.891	0.3	13.9
10:47	190.4	0.890	0.3	15.0
11:56	190.4	0.891	0.3	14.4
11:57	190.4	0.893	0.3	14.1
11:58	190.4	0.899	0.2	12.3
11:59	190.4	0.904	0.2	9.6
12:00	190.4	0.907	0.1	5.4
12:01	190.4	0.909	0.1	2.9
12:02	190.4	0.909	0.1	2.6
12:03	190.4	0.909	0.1	2.9
12:04	190.4	0.908	0.1	3.3
12:05	190.4	0.908	0.1	3.6
12:06	190.4	0.908	0.1	3.7
12:07	190.4	0.907	0.1	4.4
12:08	190.4	0.899	0.2	11.0
12:09	190.4	0.895	0.2	12.5
12:10	190.4	0.893	0.2	13.6

Parameter	Temperature	Pressure	Ammonia - Outlet	BWS - Outlet
Run Average	190.4	0.894	0.3	12.8

Alliance SOURCE TESTING

Run 4 - FTIR Data

Location: Koppers Naphthalene Distillation Plant - Cicero, IL
Source: Reboiler/SCR Outlet - Condition 2
Project No.: 2020-1351
Date: 9/30/20

Time Unit Status	Temperature °C Valid	Pressure atm Valid	Ammonia - Outlet ppmvw Valid	BWS - Outlet % (wet) Valid
13:49	190.4	0.878	0.3	15.0
13:50	190.4	0.878	0.3	15.2
13:51	190.4	0.878	0.3	14.9
13:52	190.4	0.878	0.3	15.2
13:53	190.4	0.878	0.3	15.1
13:54	190.4	0.878	0.3	15.1
13:55	190.4	0.878	0.3	15.3
13:56	190.4	0.878	0.3	15.0
13:57	190.4	0.878	0.3	15.0
13:58	190.4	0.879	0.3	15.1
13:59	190.4	0.879	0.2	14.7
14:00	190.4	0.878	0.2	15.7
14:01	190.4	0.878	0.3	15.2
14:02	190.4	0.879	0.2	15.1
14:03	190.4	0.879	0.3	15.1
14:04	190.4	0.879	0.3	14.9
14:05	190.3	0.878	0.3	15.4
14:07	190.3	0.878	0.3	15.5
14:08	190.4	0.878	0.3	15.3
14:09	190.4	0.878	0.3	15.1
14:10	190.4	0.879	0.3	15.1
14:11	190.4	0.878	0.3	15.2
14:12	190.4	0.879	0.3	15.1
14:13	190.4	0.879	0.3	15.1
14:14	190.4	0.879	0.3	15.0
14:15	190.4	0.879	0.3	15.1
14:16	190.4	0.879	0.3	15.1
14:17	190.4	0.879	0.3	15.1
14:18	190.4	0.879	0.3	15.1
14:19	190.4	0.879	0.3	15.1
14:20	190.3	0.879	0.3	15.0
14:21	190.4	0.879	0.3	15.0
14:22	190.4	0.879	0.3	15.0
14:23	190.4	0.879	0.3	15.2
14:24	190.4	0.879	0.3	15.1
14:25	190.4	0.879	0.3	15.3
14:26	190.4	0.879	0.3	15.1
14:28	190.4	0.879	0.3	15.2
14:29	190.4	0.879	0.3	15.1
14:30	190.4	0.879	0.3	15.2
14:31	190.4	0.879	0.3	15.1
14:32	190.3	0.879	0.2	15.0
14:33	190.3	0.879	0.3	15.0
14:34	190.4	0.879	0.3	15.1
14:35	190.4	0.879	0.3	15.4
14:36	190.3	0.880	0.3	15.0
14:37	190.4	0.880	0.3	15.0
14:38	190.4	0.880	0.3	15.0
14:39	190.4	0.879	0.2	15.1
14:40	190.4	0.880	0.3	15.1
14:41	190.4	0.879	0.2	15.2
14:42	190.3	0.880	0.2	15.1
14:43	190.3	0.880	0.2	15.1
14:44	190.3	0.880	0.2	15.1
14:45	190.3	0.880	0.2	15.1
14:46	190.4	0.880	0.2	15.0
14:47	190.3	0.880	0.2	15.2
14:48	190.3	0.880	0.2	15.1

Parameter	Temperature	Pressure	Ammonia - Outlet	BWS - Outlet
Run Average	190.4	0.879	0.3	15.1

Main Stack

Emission Calculations

Location Koppers Naphthalene Distillation Plant - Cicero, IL
Source Main Stack - Condition 2 Natural Gas
Project No. 2020-1351
Parameter PM/CPM

Run Number		Run 2	Run 3*	Run 4	Average
Date		9/29/20	9/30/20	9/30/20	--
Start Time		17:26	10:01	14:08	--
Stop Time		19:32	13:12	16:17	--
Run Time, min	(θ)	120.0	120.0	120.0	120.0
INPUT DATA					
Barometric Pressure, in. Hg	(Pb)	29.25	28.90	28.90	29.02
Meter Correction Factor	(Y)	1.013	1.013	1.013	1.013
Orifice Calibration Value	(ΔH @)	1.555	1.555	1.555	1.555
Meter Volume, ft^3	(Vm)	83.415	83.745	86.535	84.565
Meter Temperature, °F	(Tm)	72.2	67.0	65.5	68.2
Meter Temperature, °R	(Tm)	532.2	527.0	525.5	528.2
Meter Orifice Pressure, in. WC	(ΔH)	1.436	1.450	1.521	1.469
Volume H_2O Collected, mL	(Vlc)	496.5	419.7	463.1	459.8
Nozzle Diameter, in	(Dn)	0.520	0.520	0.520	0.520
Area of Nozzle, ft^2	(An)	0.0015	0.0015	0.0015	0.0015
Filterable PM Mass, mg	(Mn)	1.9	1.1	1.0	1.3
Condensable PM Mass, mg	(M_{CPM})	5.5	11.5	13.6	10.2
ISOKINETIC DATA					
Standard Meter Volume, ft^3	(Vmstd)	82.256	82.406	85.396	83.353
Standard Water Volume, ft^3	(Vwstd)	23.410	19.789	21.835	21.678
Moisture Fraction Measured	(BWSmsd)	0.222	0.194	0.204	0.206
Moisture Fraction @ Saturation	(BWSsat)	0.260	0.247	0.252	0.253
Moisture Fraction	(BWS)	0.222	0.194	0.204	0.206
Meter Pressure, in Hg	(Pm)	29.36	29.01	29.01	29.12
Volume at Nozzle, ft^3	(Vn)	124.900	121.760	127.917	124.859
Isokinetic Sampling Rate, (%)	(I)	102.9	96.0	98.0	98.9
DGM Calibration Check Value, (+/- 5%)	(Y_{qa})	-2.1	-2.6	-1.7	-2.1
EMISSION CALCULATIONS					
Filterable PM Concentration, grain/dscf	(C_s)	0.00036	0.00021	0.00018	0.00025
Filterable PM Emission Rate, lb/hr	(PMR)	0.030	0.019	0.017	0.022
Condensable PM Concentration, grain/dscf	(C_{CPM})	0.0010	0.0022	0.0025	0.0019
Condensable PM Emission Rate, lb/hr	(ER_{CPM})	0.086	0.19	0.22	0.17
Total PM Concentration, grain/dscf	(C_{TPM})	0.0014	0.0024	0.0026	0.0021
Total PM Emission Rate, lb/hr	(ER_{TPM})	0.12	0.21	0.24	0.19

*Run 3 paused due to operational issues

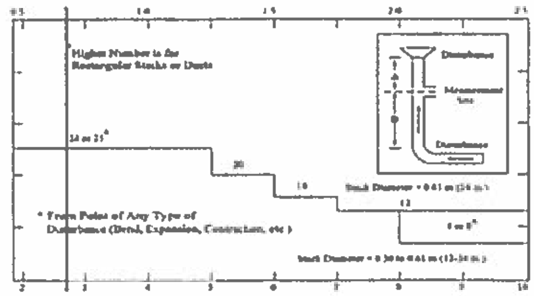
Alliance SOURCE TESTING

Method 1 Data

Location: Koppers Naphthalene Distillation Plant - Cicero, IL
Source: Main Stack - Condition 2 Natural Gas
Project No. 2020-1351
Date: 09/29/20

Stack Parameters

Duct Orientation:	Horizontal	
Duct Design:	Circular	
Distance from Far Wall to Outside of Port:	75.00	in
Nipple Length:	12.00	in
Depth of Duct:	63.00	in
Cross Sectional Area of Duct:	21.65	ft²
No. of Test Ports:	2	
Distance A:	17.9	ft
Distance A Duct Diameters:	3.4	(must be > 0.5)
Distance B:	14.2	ft
Distance B Duct Diameters:	2.7	(must be > 2)
Minimum Number of Traverse Points:	24	
Actual Number of Traverse Points:	24	
Number of Readings per Point:	1	
Measurer (Initial and Date):	EAS 9/29/20	
Reviewer (Initial and Date):	BRB 9/29/20	



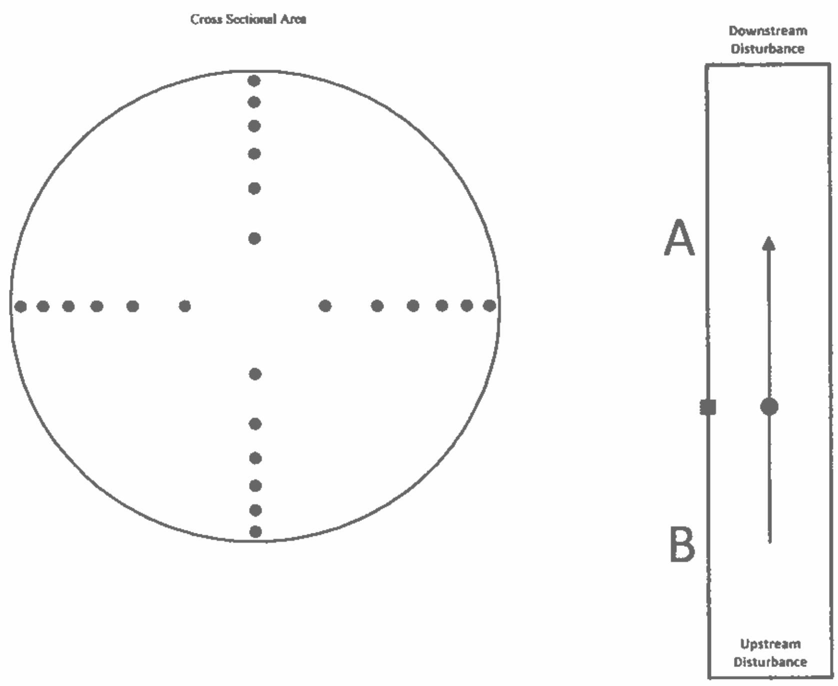
CIRCULAR DUCT

LOCATION OF TRAVERSE POINTS											
	Number of traverse points on a diameter										
	2	3	4	5	6	7	8	9	10	11	12
1	14.6	--	6.7	--	4.4	--	3.2	--	2.6	--	2.1
2	85.4	--	25.0	--	14.6	--	10.5	--	8.2	--	6.7
3	--	--	75.0	--	29.6	--	19.4	--	14.6	--	11.8
4	--	--	93.3	--	70.4	--	32.3	--	22.6	--	17.7
5	--	--	--	--	85.4	--	67.7	--	34.2	--	25.0
6	--	--	--	--	95.6	--	80.6	--	65.8	--	35.6
7	--	--	--	--	--	--	89.5	--	77.4	--	64.4
8	--	--	--	--	--	--	96.8	--	85.4	--	75.0
9	--	--	--	--	--	--	--	--	91.8	--	82.3
10	--	--	--	--	--	--	--	--	97.4	--	88.2
11	--	--	--	--	--	--	--	--	--	--	93.3
12	--	--	--	--	--	--	--	--	--	--	97.9

**Percent of stack diameter from inside wall to traverse point.*

Traverse Point	% of Diameter	Distance from inside wall	Distance from outside of port
1	2.1	1.32	13.32
2	6.7	4.22	16.22
3	11.8	7.43	19.43
4	17.7	11.15	23.15
5	25.0	15.75	27.75
6	35.6	22.43	34.43
7	64.4	40.57	52.57
8	75.0	47.25	59.25
9	82.3	51.85	63.85
10	88.2	55.57	67.57
11	93.3	58.78	70.78
12	97.9	61.68	73.68

Stack Diagram
A = 17.9 ft.
B = 14.2 ft.
Depth of Duct = 63 in.



Alliance SOURCE TESTING

Cyclonic Flow Check

Location Koppers Naphthalene Distillation Plant - Cicero, IL
Source Main Stack - Condition 2 Natural Gas
Project No. 2020-1351
Date 09/29/20

Sample Point	Angle (ΔP=0)
1	10
2	10
3	10
4	15
5	15
6	15
7	10
8	10
9	10
10	5
11	5
12	15
13	15
14	10
15	10
16	10
17	5
18	5
19	5
20	5
21	5
22	5
23	5
24	0
Average	9

Location Koppers Naphthalene Distillation Plant - Cicero, IL
Source Main Stack - Condition 2 Natural Gas
Project No. 2020-1351
Parameter PM/CPM

Run Number		Run 2	Run 3*	Run 4	Average
Date		9/29/20	9/30/20	9/30/20	--
Start Time		17:26	10:01	14:08	--
Stop Time		19:32	13:12	16:17	--
Run Time, min		120.0	120.0	120.0	120.0
VELOCITY HEAD, in. WC					
Point 1		0.05	0.04	0.05	0.05
Point 2		0.05	0.04	0.05	0.04
Point 3		0.05	0.05	0.05	0.05
Point 4		0.04	0.05	0.05	0.04
Point 5		0.03	0.04	0.05	0.04
Point 6		0.03	0.04	0.05	0.04
Point 7		0.03	0.04	0.04	0.04
Point 8		0.04	0.04	0.04	0.04
Point 9		0.03	0.04	0.03	0.03
Point 10		0.03	0.04	0.03	0.03
Point 11		0.02	0.03	0.03	0.03
Point 12		0.02	0.02	0.03	0.02
Point 13		0.06	0.05	0.05	0.05
Point 14		0.05	0.05	0.05	0.05
Point 15		0.04	0.05	0.05	0.04
Point 16		0.05	0.04	0.05	0.04
Point 17		0.04	0.04	0.04	0.04
Point 18		0.03	0.04	0.04	0.03
Point 19		0.03	0.04	0.03	0.03
Point 20		0.03	0.03	0.03	0.03
Point 21		0.03	0.03	0.03	0.03
Point 22		0.03	0.03	0.03	0.03
Point 23		0.02	0.03	0.03	0.03
Point 24		0.03	0.03	0.03	0.03
CALCULATED DATA					
Square Root of ΔP, (in. WC)$^{1/2}$	(ΔP)	0.181	0.189	0.194	0.188
Pitot Tube Coefficient	(Cp)	0.840	0.840	0.840	0.840
Barometric Pressure, in. Hg	(Pb)	29.25	28.90	28.90	29.02
Static Pressure, in. WC	(Pg)	-0.07	-0.06	-0.06	-0.06
Stack Pressure, in. Hg	(Ps)	29.24	28.90	28.90	29.01
Stack Cross-sectional Area, ft^2	(As)	21.65	21.65	21.65	21.65
Temperature, °F	(Ts)	150.2	147.7	148.4	148.8
Temperature, °R	(Ts)	610.2	607.7	608.4	608.8
Moisture Fraction Measured	(BWSmsd)	0.222	0.194	0.204	0.206
Moisture Fraction @ Saturation	(BWSsat)	0.260	0.247	0.252	0.253
Moisture Fraction	(BWS)	0.222	0.194	0.204	0.206
O_2 Concentration, %	(O_2)	9.9	10.1	10.4	10.1
CO_2 Concentration, %	(CO_2)	6.3	6.2	5.9	6.1
Molecular Weight, lb/lb-mole (dry)	(Md)	29.40	29.39	29.37	29.38
Molecular Weight, lb/lb-mole (wet)	(Ms)	26.87	27.18	27.05	27.04
Velocity, ft/sec	(Vs)	11.4	12.0	12.3	11.9
VOLUMETRIC FLOW RATE					
At Stack Conditions, acfm	(Qa)	14,852	15,521	15,972	15,448
At Standard Conditions, dscfm	(Qs)	9,779	10,503	10,660	10,314

*Run 3 paused due to operational issues

Method 4 Data

Location Koppers Naphthalene Distillation Plant - Cicero, IL
Source Main Stack - Condition 2 Natural Gas
Project No. 2020-1351
Parameter PM/CPM
Analysis Gravimetric

Run 1	**Date:**	9/29/20			
Impinger No.	**1**	**2**	**3**	**4**	**Total**
Contents	Empty	Empty	H2O	Silica	--
Initial Mass, g	849.2	767.7	735.3	1038.6	3390.8
Final Mass, g	1153.0	919.2	756.3	1068.4	3896.9
Gain	303.8	151.5	21.0	29.8	506.1
Run 2	**Date:**	9/29/20			
Impinger No.	**1**	**2**	**3**	**4**	**Total**
Contents	Empty	Empty	H2O	Silica	--
Initial Mass, g	507.7	646.4	716.6	975.7	2846.4
Final Mass, g	884.9	696.3	753.6	1008.1	3342.9
Gain	377.2	49.9	37.0	32.4	496.5
Run 3	**Date:**	9/30/20			
Impinger No.	**1**	**2**	**3**	**4**	**Total**
Contents	Empty	Empty	H2O	Silica	--
Initial Mass, g	494.6	656.4	756.1	943.8	2850.9
Final Mass, g	733.5	779.2	783.6	974.3	3270.6
Gain	238.9	122.8	27.5	30.5	419.7
Run 4	**Date:**	9/30/20			
Impinger No.	**1**	**2**	**3**	**4**	**Total**
Contents	Empty	Empty	H2O	Silica	--
Initial Mass, g	508.9	647.6	752.6	923.6	2832.7
Final Mass, g	775.1	777.1	787.6	956.0	3295.8
Gain	266.2	129.5	35.0	32.4	463.1

Alliance
SOURCE TESTING

Isokinetic Field Data

Location:	Koppers Naphthalene Distillation Plant - Cicero, IL		Start Time:	17:26	Source:	Main Stack - Condition 2 Natural Gas
Date:	9/29/20	Run 2 / VALID	End Time:	19:32	Project No.:	2020-1351 / Parameter: PM/CPM

STACK DATA (EST)			EQUIPMENT		STACK DATA (EST)			FILTER NO.	STACK DATA (FINAL)			MOIST. DATA
Moisture:	18.0	% est.	Meter Box ID:	5828	Est. Tm:	68	°F	13206	Pb:	29.25	in. Hg	Vlc (ml)
Barometric:	29.25	in. Hg	Y:	1.013	Est. Ts:	150	°F		Pg:	-0.07	in. WC	496.5
Static Press:	-0.07	in. WC	ΔH @ (in.WC):	1.555	Est. ΔP:	0.04	in. WC		O_2:	9.9	%	K-FACTOR
Stack Press:	29.24	in. Hg	Probe ID:	PR-606-0	Est. Dn:	0.520	in.		CO_2:	6.3	%	42.43
CO_2:	9.7	%	Liner Material:	glass	Target Rate:	0.80	scfm					
O_2:	8.6	%	Pitot ID:	PT-606-0								
N_2/CO:	81.7	%	Pitot Cp/Type:	0.840 / S-type								
Md:	29.90	lb/lb-mole	Nozzle ID:	SS-602-4 / SS								
Ms:	27.75	lb/lb-mole	Nozzle Dn (in.):	0.520								

LEAK CHECK:	Pre	Mid 1	Mid 2	Mid 3	Post
Leak Rate (cfm):	0.000	--	--	--	0.000
Vacuum (in Hg):	10	--	--	--	10
Pitot Tube:	Pass	--	--	--	Pass

Check Pt.	Initial	Final	Corr.
Mid 1 (cf)			--
Mid 2 (cf)			--
Mid 3 (cf)			--
Mid-Point Leak Check Vol (cf):			--

Sample Pt.	Sample Time (minutes)		Dry Gas Meter Reading (ft³)	Pitot Tube ΔP (in WC)	Gas Temperatures (°F)		Orifice Press. ΔH (in. WC)		Pump Vac (in. Hg)	Gas Temperatures (°F)				% ISO	Vs (fps)
	Begin	End			DGM Average (Amb. --)	Stack (Amb. --)	Ideal	Actual		Probe (Amb. --)	Filter (Amb. --)	Imp Exit (Amb. --)	Aux (Amb. --)		
A1	0.00	5.00	375.350	0.050	65	146	2.12	2.10	5	255	250	49	66	94.1	13.87
2	5.00	10.00	379.380	0.045	68	150	1.91	1.90	6	248	251	46	67	94.3	13.21
3	10.00	15.00	383.220	0.045	68	149	1.91	1.90	7	251	248	46	67	101.8	13.20
4	15.00	20.00	387.370	0.035	69	151	1.48	1.50	6	254	246	50	75	99.5	11.66
5	20.00	25.00	390.950	0.030	70	151	1.28	1.30	6	255	246	54	78	100.3	10.79
6	25.00	30.00	394.300	0.030	70	151	1.28	1.30	6	253	248	57	79	107.8	10.79
7	30.00	35.00	397.900	0.030	71	150	1.28	1.30	6	242	249	61	76	99.4	10.78
8	35.00	40.00	401.230	0.035	72	151	1.49	1.50	6	249	250	62	76	98.3	11.66
9	40.00	45.00	404.790	0.030	73	150	1.29	1.30	6	250	251	62	75	99.5	10.78
10	45.00	50.00	408.135	0.025	73	151	1.07	1.10	4	252	251	61	75	98.9	9.85
11	50.00	55.00	411.170	0.020	73	150	0.86	0.90	4	248	250	59	74	99.5	8.80
12	55.00	60.00	413.905	0.020	73	150	0.86	0.90	4	249	250	58	72	93.7	8.80
B1	60.00	65.00	416.480	0.055	68	145	2.35	2.40	6	261	249	54	65	99.1	14.54
2	65.00	70.00	420.955	0.045	73	150	1.92	1.90	5	253	250	52	77	98.7	13.21
3	70.00	75.00	425.015	0.040	74	151	1.71	1.70	5	247	249	52	78	99.3	12.46
4	75.00	80.00	428.870	0.045	75	151	1.93	1.90	5	241	258	54	78	99.9	13.22
5	80.00	85.00	432.990	0.035	75	151	1.50	1.50	5	255	244	55	80	100.4	11.66
6	85.00	90.00	436.645	0.030	75	150	1.29	1.30	5	254	246	56	78	98.7	10.78
7	90.00	95.00	439.975	0.030	75	150	1.29	1.30	5	255	253	56	79	101.2	10.78
8	95.00	100.00	443.390	0.025	75	152	1.07	1.10	5	251	240	57	80	100.6	9.86
9	100.00	105.00	446.485	0.030	75	151	1.29	1.30	5	252	249	56	78	99.2	10.79
10	105.00	110.00	449.830	0.025	75	151	1.07	1.10	5	249	246	55	78	100.7	9.85
11	110.00	115.00	452.930	0.020	74	151	0.86	0.86	5	251	249	55	76	99.6	8.81
12	115.00	120.00	455.670	0.025	73	151	1.07	1.10	5	251	250	54	75	100.9	9.85
	Final DGM:		458.765												

RESULTS	Run Time	Vm	ΔP	Tm	Ts	Max Vac	ΔH	%ISO	BWS	Y_{qa}
	120.0 min	83.415 ft³	0.03 in. WC	72.2 °F	150.2 °F	7	1.436 in. WC	102.9	0.222	-2.1

Alliance
SOURCE TESTING

Isokinetic Field Data

Location:	Koppers Naphthalene Distillation Plant - Cicero, IL	Start Time:	10:01
Date:	9/30/20	End Time:	13:12
Run 3*	VALID	Source:	Main Stack - Condition 2 Natural Gas
Project No.:	2020-1351	Parameter:	PM/CPM

STACK DATA (EST)		EQUIPMENT		STACK DATA (EST)		FILTER NO.	STACK DATA (FINAL)		MOIST. DATA
Moisture:	21.0 % est.	Meter Box ID:	5828	Est. Tm:	72 °F	14113-C	Pb:	28.90 in. Hg	Vlc (ml)
Barometric:	29.25 in. Hg	Y:	1.013	Est. Ts:	150 °F		Pg:	-0.06 in. WC	419.7
Static Press:	-0.07 in. WC	ΔH @ (in.WC):	1.555	Est. ΔP:	0.03 in. WC		O_2:	10.1 %	K-FACTOR
Stack Press:	29.24 in. Hg	Probe ID:	PR-606-0	Est. Dn:	0.558 in.		CO_2:	6.2 %	40.181
CO_2:	9.7 %	Liner Material:	glass	Target Rate:	0.80 scfm				
O_2:	8.6 %	Pitot ID:	PT-606-0						
N_2/CO:	81.7 %	Pitot Cp/Type:	0.840 S-type						
Md:	29.90 lb/lb-mole	Nozzle ID:	SS-602-4 SS						
Ms:	27.40 lb/lb-mole	Nozzle Dn (in.):	0.520						

LEAK CHECK:	Pre	Mid 1	Mid 2	Mid 3	Post
Leak Rate (cfm):	0.000	–	–	–	0.000
Vacuum (in Hg):	10	–	–	–	8
Pitot Tube:	Pass	–	–	–	Pass

Check Pt.	Initial	Final	Corr.
Mid 1 (cf)			–
Mid 2 (cf)			–
Mid 3 (cf)			–
Mid-Point Leak Check Vol (cf):			–

Sample Pt.	Sample Time (minutes) Begin	End	Dry Gas Meter Reading (ft³)	Pitot Tube ΔP (in WC)	Gas Temperatures (°F) DGM Average	Stack	Orifice Press. ΔH (in. WC) Ideal	Actual	Pump Vac (in. Hg)	Gas Temperatures (°F) Probe	Filter	Imp Exit	Aux	% ISO	Vs (fps)
					Amb.	Amb.				Amb.	Amb.	Amb.	Amb.		
					–	–				–	–	–	–		
A1	0.00	5.00	460.770	0.040	61	148	1.58	1.60	7	256	254	52	66	96.3	12.51
2	5.00	10.00	464.315	0.035	62	149	1.38	1.40	7	243	241	51	69	101.0	11.71
3	10.00	15.00	467.800	0.045	63	148	1.78	1.80	8	246	242	54	74	99.9	13.27
4	15.00	20.00	471.715	0.045	64	148	1.79	1.80	8	250	245	57	80	99.3	13.27
5	20.00	25.00	475.615	0.040	65	148	1.59	1.60	7	252	244	58	72	94.2	12.51
6	25.00	30.00	479.110	0.040	66	148	1.59	1.60	7	256	243	59	73	100.0	12.51
7	30.00	35.00	482.830	0.040	67	148	1.60	1.60	7	254	239	58	71	99.9	12.51
8	35.00	40.00	486.550	0.035	67	148	1.40	1.40	6	255	245	59	73	102.0	11.70
9	40.00	45.00	490.105	0.040	67	148	1.60	1.60	6	255	246	61	72	94.6	12.51
10	45.00	50.00	493.630	0.040	68	149	1.60	1.60	7	255	247	61	72	99.5	12.52
11	50.00	55.00	497.340	0.025	65	148	1.00	1.00	5	249	252	57	67	100.7	9.89
12	55.00	60.00	500.300	0.020	65	148	0.80	0.80	5	247	249	56	69	98.5	8.85
B1	60.00	65.00	502.890	0.050	66	147	1.99	2.00	8	253	265	56	73	95.8	13.98
2	65.00	70.00	506.870	0.045	67	148	1.80	1.80	7	245	259	57	75	96.5	13.27
3	70.00	75.00	510.680	0.045	68	147	1.80	1.80	7	249	258	59	76	99.0	13.26
4	75.00	80.00	514.600	0.040	69	147	1.61	1.60	7	244	252	61	79	98.3	12.50
5	80.00	85.00	518.280	0.040	69	147	1.61	1.60	7	245	253	62	76	100.7	12.50
6	85.00	90.00	522.050	0.035	69	146	1.41	1.40	6	248	260	62	75	105.3	11.68
7	90.00	95.00	525.740	0.035	70	147	1.41	1.40	6	246	250	63	75	100.7	11.69
8	95.00	100.00	529.275	0.030	70	147	1.21	1.20	5	258	252	63	78	99.4	10.83
9	100.00	105.00	532.505	0.030	70	147	1.21	1.20	5	252	254	63	77	99.4	10.83
10	105.00	110.00	535.735	0.025	70	147	1.01	1.00	5	246	246	63	77	104.1	9.88
11	110.00	115.00	538.825	0.025	70	148	1.01	1.00	5	249	248	63	76	98.8	9.89
12	115.00	120.00	541.755	0.025	69	148	1.00	1.00	5	253	253	63	77	93.2	9.89
	Final DGM:		544.515												

RESULTS	Run Time	Vm	ΔP	Tm	Ts	Max Vac	ΔH	%ISO	BWS	Y_{qa}
	120.0 min	83.745 ft³	0.04 in. WC	67.0 °F	147.7 °F	8	1.450 in. WC	96.0	0.194	-2.6

Alliance SOURCE TESTING

Isokinetic Field Data

Location:	Koppers Naphthalene Distillation Plant - Cicero, IL		14:08
Date:	9/30/20	Run 4 VALID	End Time: 16:17
Source:	Main Stack - Condition 2 Natural Gas		
Project No.:	2020-1351	Parameter: PM/CPM	

STACK DATA (EST)		EQUIPMENT		STACK DATA (EST)		FILTER NO.	STACK DATA (FINAL)		MOIST. DATA
Moisture:	21.0 % est.	Meter Box ID:	5828	Est. Tm:	67 °F	13228	Pb:	28.90 in. Hg	Vlc (ml)
Barometric:	29.25 in. Hg	Y:	1.013	Est. Ts:	148 °F		Pg:	-0.06 in. WC	463.1
Static Press:	-0.07 in. WC	ΔH @ (in.WC):	1.555	Est. ΔP:	0.04 in. WC		O_2:	10.4 %	K-FACTOR
Stack Press:	29.24 in. Hg	Probe ID:	PR-606-0	Est. Dn:	0.549 in.		CO_2:	5.9 %	39.952
CO_2:	9.7 %	Liner Material:	glass	Target Rate:	0.80 scfm				
O_2:	8.6 %	Pitot ID:	PT-606-0						
N_2/CO:	81.7 %	Pitot Cp/Type:	0.840 S-type						
Md:	29.90 lb/lb-mole	Nozzle ID:	SS-602-4 SS						
Ms:	27.40 lb/lb-mole	Nozzle Dn (in.):	0.520						

LEAK CHECK:	Pre	Mid 1	Mid 2	Mid 3	Post
Leak Rate (cfm):	0.000	–	–	–	0.000
Vacuum (in Hg):	10	–	–	–	8
Pitot Tube:	Pass	–	–	–	Pass

Check Pt.	Initial	Final	Corr.
Mid 1 (cf)			–
Mid 2 (cf)			–
Mid 3 (cf)			–
Mid-Point Leak Check Vol (cf):			–

Sample Pt.	Sample Time (minutes)		Dry Gas Meter Reading (ft³)	Pitot Tube ΔP (in WC)	Gas Temperatures (°F)		Orifice Press. ΔH (in. WC)		Pump Vac (in. Hg)	Gas Temperatures (°F)				% ISO	Vs (fps)
					DGM Average	Stack				Probe	Filter	Imp Exit	Aux		
					Amb.	Amb.				Amb.	Amb.	Amb.	Amb.		
	Begin	End			–	–	Ideal	Actual		–	–	–	–		
A1	0.00	5.00	550.745	0.050	66	147	1.99	2.00	7	255	247	64	69	100.0	13.98
2	5.00	10.00	554.900	0.045	67	147	1.80	1.80	7	254	245	68	81	99.6	13.26
3	10.00	15.00	558.835	0.050	67	148	1.99	2.00	7	250	246	67	78	97.7	13.99
4	15.00	20.00	562.900	0.045	67	149	1.79	1.80	7	258	247	65	71	99.8	13.28
5	20.00	25.00	566.840	0.045	66	148	1.79	1.80	7	257	248	61	68	100.5	13.27
6	25.00	30.00	570.800	0.045	65	149	1.79	1.80	7	247	245	57	66	102.0	13.28
7	30.00	35.00	574.810	0.040	65	149	1.59	1.50	7	247	245	57	66	97.3	12.52
8	35.00	40.00	578.420	0.035	64	150	1.39	1.40	7	245	243	55	67	100.0	11.72
9	40.00	45.00	581.880	0.030	65	149	1.19	1.20	7	241	241	56	67	97.4	10.84
10	45.00	50.00	585.012	0.030	65	148	1.19	1.20	6	242	248	56	68	104.2	10.83
11	50.00	55.00	588.365	0.030	65	149	1.19	1.20	6	246	241	55	65	101.4	10.84
12	55.00	60.00	591.625	0.025	65	149	0.99	1.00	5	251	242	56	67	95.2	9.90
B1	60.00	65.00	594.420	0.050	63	147	1.98	2.00	7	259	247	57	65	99.3	13.98
2	65.00	70.00	598.525	0.050	65	148	1.99	2.00	7	263	248	56	75	102.3	13.99
3	70.00	75.00	602.765	0.045	66	149	1.79	1.80	7	259	264	59	84	97.4	13.28
4	75.00	80.00	606.600	0.045	66	149	1.79	1.80	7	255	256	60	78	99.3	13.28
5	80.00	85.00	610.510	0.040	66	148	1.59	1.60	7	258	266	60	80	100.6	12.51
6	85.00	90.00	614.250	0.035	66	148	1.40	1.40	7	257	253	60	80	102.2	11.70
7	90.00	95.00	617.805	0.030	66	148	1.20	1.20	7	259	251	61	81	100.7	10.83
8	95.00	100.00	621.050	0.030	66	149	1.19	1.20	7	258	247	61	78	103.7	10.84
9	100.00	105.00	624.390	0.030	66	148	1.20	1.20	7	257	248	60	75	99.0	10.83
10	105.00	110.00	627.580	0.030	65	148	1.19	1.20	7	257	247	59	75	98.8	10.83
11	110.00	115.00	630.760	0.030	65	149	1.19	1.20	7	256	241	59	78	99.5	10.84
12	115.00	120.00	633.960	0.030	66	149	1.19	1.20	7	256	249	60	81	103.1	10.84
	Final DGM:		637.280												

RESULTS	Run Time	Vm	ΔP	Tm	Ts	Max Vac	ΔH	%ISO	BWS	Y_{qa}
	120.0 min	86.535 ft³	0.04 in. WC	65.5 °F	148.4 °F	7	1.521 in. WC	98.0	0.204	-1.7

Location Koppers Naphthalene Distillation Plant - Cicero, IL
Source Main Stack - Condition 2 Natural Gas
Project No. 2020-1351

Run Number		Run 2	Run 3*	Run 4	Average
Date		9/29/20	9/30/20	9/30/20	--
Start Time		17:26	10:01	14:08	--
Stop Time		19:26	13:07	16:08	--
Input Data - Outlet					
Moisture Fraction, dimensionless	BWS	0.222	0.194	0.204	0.207
Volumetric Flow Rate (M1-4), dscfm	Qs	9,779	10,503	10,660	10,314
Calculated Data - Outlet					
O_2 Concentration, % dry	C_{O_2}	9.85	10.09	10.44	10.13
CO_2 Concentration, % dry	C_{CO_2}	6.27	6.16	5.94	6.12
CO Concentration, ppmvd	C_{CO}	24.1	24.3	24.2	24.2
CO Concentration, ppmvd @ 3 % O_2	C_{COc3}	39.0	40.3	41.4	40.2
CO Emission Rate, lb/hr	ER_{CO}	1.0	1.1	1.1	1.1
NOx Concentration, ppmvd	C_{NOx}	48.1	31.1	41.0	40.1
NOx Emission Rate, lb/hr	ER_{NOx}	3.4	2.3	3.1	2.9
SO_2 Concentration, ppmvd	C_{SO_2}	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	0.0
SO_2 Emission Rate, lb/hr	ER_{SO_2}	0.00	0.00	0.00	0.00
VOM (as C3H8) Concentration, ppmvd	C_{VOM}	1.8	0.0	2.1	1.3
VOM (as C3H8) Concentration, ppmvw	$C_{VOM\ w}$	1.4	0.0	1.7	1.0
VOM (as C3H8) Emission Rate, lb/hr	ER_{VOM}	0.12	0.00	0.15	0.092
Reduction Efficiency Data					
SCR Outlet SO_2 Emission Rate, lb/hr	$ERSO_2$	0.00065	0.0077	0.0063	0.0049
TO-5 Outlet SO_2 Emission Rate, lb/hr	$ERSO_2$	0.00	0.00	0.00	0.00
Combined Inlet SO_2 Emission Rate, lb/hr	$ERSO_2$	0.00065	0.0077	0.0063	0.0049
SO_2 Emission Rate, lb/hr	$ERSO_2$	0.00	0.00	0.00	0.00
SO_2 Reduction Efficiency, %	$ER_{THC\ (as\ C3H8)}$	>99.9	>99.9	>99.9	99.9

Underlined values returned a slightly negative value and have been corrected to zero.

*Run 3 paused due to operational issues

Alliance
SOURCE TESTING

Location: Koppers Naphthalene Distillation Plant - Cicero, IL
Source: Main Stack - Condition 2 Natural Gas
Project No.: 2020-1351
Date: 9/29/20

Time Unit Status	O_2 - Outlet % dry Valid	CO_2 - Outlet % dry Valid	CO - Outlet ppmvd Valid	NOx - Outlet ppmvd Valid	SO_2 - Outlet ppmvd Valid	VOM - Outlet ppmvw Valid
17:26	9.65	6.16	24.51	47.68	0.12	2.01
17:27	9.63	6.17	23.57	47.86	0.12	1.04
17:28	9.64	6.17	24.59	47.86	0.10	2.02
17:29	9.66	6.16	24.53	47.80	0.11	0.85
17:30	9.63	6.18	23.49	47.95	0.11	0.50
17:31	9.61	6.18	20.83	48.03	0.16	0.61
17:32	9.58	6.20	24.74	48.13	0.11	1.98
17:33	9.60	6.19	25.39	48.03	0.11	0.74
17:34	9.66	6.16	25.62	47.94	0.10	1.85
17:35	9.64	6.16	25.01	47.95	0.06	1.24
17:36	9.58	6.20	24.92	48.05	0.06	1.58
17:37	9.59	6.19	26.78	47.89	0.08	0.57
17:38	9.61	6.18	23.62	47.89	0.12	1.91
17:39	9.59	6.19	25.32	47.99	0.13	1.39
17:40	9.59	6.20	26.80	48.07	0.16	0.68
17:41	9.66	6.17	25.56	47.92	0.10	1.75
17:42	9.69	6.14	26.20	47.96	0.11	1.09
17:43	9.68	6.15	24.78	47.84	0.11	1.97
17:44	9.64	6.18	24.66	47.92	0.14	1.22
17:45	9.61	6.19	25.08	48.09	0.10	1.95
17:46	9.62	6.19	25.64	47.95	0.16	0.68
17:47	9.60	6.20	24.17	48.24	0.20	1.74
17:48	9.57	6.21	24.69	48.20	0.13	1.80
17:49	9.55	6.23	25.31	48.34	0.13	0.72
17:50	9.56	6.22	23.98	48.23	0.10	1.34
17:51	9.58	6.21	25.25	48.08	0.13	1.15
17:52	9.60	6.20	24.58	48.10	0.23	1.04
17:53	9.59	6.21	26.38	48.19	0.22	1.56
17:54	9.60	6.20	26.48	48.11	0.19	1.81
17:55	9.56	6.14	26.02	47.51	0.12	1.30
17:56	9.58	6.22	25.91	48.22	0.16	1.71
17:57	9.66	6.17	26.52	47.78	0.15	1.86
17:58	9.67	6.17	25.38	47.75	0.19	1.40
17:59	9.72	6.14	26.83	47.57	0.24	1.62
18:00	9.72	6.14	25.91	47.52	0.21	1.92
18:01	10.10	5.92	25.44	45.85	0.16	0.65
18:02	10.49	5.70	24.91	43.99	0.17	1.62
18:03	10.60	5.64	23.80	43.66	0.26	1.75
18:04	10.65	5.61	22.76	43.45	0.21	1.04
18:05	10.67	5.60	23.91	43.39	0.19	1.29
18:06	10.19	5.87	25.62	45.56	0.18	1.39
18:07	9.89	6.04	24.62	47.02	0.17	1.84
18:08	9.77	6.11	24.40	47.34	0.21	1.92
18:09	9.69	6.16	24.87	47.46	0.15	0.89
18:10	9.66	6.17	23.96	47.62	0.16	1.47
18:11	9.67	6.17	24.00	47.80	0.13	0.82
18:12	9.65	6.18	23.59	47.94	0.10	1.64
18:13	9.66	6.18	23.57	47.84	0.10	1.51
18:14	9.69	6.16	24.05	47.62	0.15	1.83
18:15	9.66	6.18	24.85	47.74	0.19	0.67
18:16	9.67	6.17	24.79	47.96	0.08	0.97
18:17	9.70	6.15	23.21	47.91	0.11	1.16
18:18	9.74	6.13	24.81	47.76	0.15	1.93
18:19	9.73	6.13	24.55	47.61	0.21	1.47
18:20	9.73	6.13	24.43	47.66	0.10	0.68
18:21	9.73	6.13	23.79	47.44	0.23	0.91
18:22	9.74	6.13	24.15	47.57	0.20	1.60
18:23	9.79	6.09	25.86	47.27	0.19	1.75
18:24	9.78	6.11	26.27	47.32	0.25	1.66
18:25	9.75	6.12	24.28	47.50	0.22	1.85
18:26	9.74	6.13	25.74	47.47	0.20	1.12
18:27	9.78	6.11	24.77	47.15	0.16	1.35
18:28	9.76	6.11	24.84	47.41	0.23	0.98
18:29	9.73	6.13	23.18	47.52	0.20	1.90
18:30	9.74	6.12	25.27	47.53	0.26	1.80
18:31	9.73	6.14	22.86	47.62	0.19	1.95
18:32	9.69	6.16	25.45	47.71	0.17	0.90
18:33	9.64	6.19	23.54	47.93	0.20	0.76
18:34	9.66	6.18	24.99	47.93	0.25	1.36
18:35	9.66	6.18	25.26	47.86	0.30	1.41
18:36	9.68	6.17	24.31	47.71	0.25	0.51
18:37	9.67	6.17	24.34	47.59	0.23	0.63
18:38	9.67	6.18	24.86	47.88	0.25	0.71
18:39	9.68	6.17	24.53	47.86	0.32	0.79
18:40	9.68	6.17	25.83	47.57	0.35	1.83
18:41	9.71	6.15	25.92	47.68	0.27	1.81
18:42	9.72	6.13	25.27	47.54	0.29	1.77
18:43	9.73	6.13	23.45	47.45	0.34	1.79

Alliance
SOURCE TESTING

Location: Koppers Naphthalene Distillation Plant - Cicero, IL
Source: Main Stack - Condition 2 Natural Gas
Project No.: 2020-1351
Date: 9/29/20

Time Unit Status	O_2 - Outlet % dry Valid	CO_2 - Outlet % dry Valid	CO - Outlet ppmvd Valid	NOx - Outlet ppmvd Valid	SO_2 - Outlet ppmvd Valid	VOM - Outlet ppmvw Valid
18:44	9.75	6.11	23.46	47.33	0.30	1.10
18:45	9.77	6.10	23.60	47.20	0.34	1.53
18:46	9.75	6.10	22.93	47.22	0.34	1.82
18:47	9.74	6.11	23.14	47.40	0.29	1.78
18:48	9.68	6.14	23.31	47.60	0.34	0.96
18:49	9.66	6.15	23.35	47.75	0.36	1.11
18:50	9.71	6.12	23.67	47.52	0.37	1.47
18:51	9.74	6.11	23.52	47.46	0.36	1.02
18:52	9.74	6.10	24.53	47.43	0.38	1.35
18:53	9.71	6.12	23.57	47.48	0.29	0.92
18:54	9.72	6.12	23.65	47.58	0.27	1.95
18:55	9.72	6.12	22.78	47.69	0.37	1.73
18:56	9.70	6.13	25.30	47.65	0.29	1.16
18:57	9.69	6.13	23.93	47.68	0.36	1.42
18:58	9.68	6.14	24.01	47.79	0.38	1.87
18:59	9.65	6.15	23.51	47.95	0.40	0.78
19:00	9.64	6.16	23.17	47.89	0.33	1.67
19:01	9.67	6.14	25.42	47.77	0.27	1.16
19:02	9.66	6.15	22.82	47.89	0.32	0.56
19:03	9.69	6.13	25.30	47.72	0.32	2.05
19:04	9.72	6.12	24.77	47.95	0.36	1.64
19:05	9.80	6.07	26.87	47.33	0.36	2.05
19:06	9.87	6.03	26.59	47.13	0.33	1.00
19:07	9.78	6.08	24.51	47.50	0.33	0.84
19:08	9.66	6.15	23.50	47.77	0.28	1.72
19:09	9.66	6.15	25.53	47.76	0.28	1.29
19:10	9.70	6.13	25.32	47.82	0.32	0.66
19:11	9.66	6.15	23.57	47.96	0.31	1.67
19:12	9.70	6.12	25.89	47.70	0.30	1.36
19:13	9.72	6.11	25.38	47.91	0.34	1.20
19:14	9.67	6.14	23.59	47.97	0.32	1.41
19:15	9.65	6.15	25.18	48.04	0.35	1.59
19:16	9.67	6.14	26.14	47.77	0.35	1.94
19:17	9.69	6.12	24.27	47.71	0.38	1.36
19:18	9.69	6.13	25.02	47.82	0.26	1.51
19:19	9.66	6.14	25.44	47.99	0.30	1.46
19:20	9.68	6.13	26.06	47.92	0.34	0.50
19:21	9.69	6.13	26.33	47.84	0.36	1.12
19:22	9.68	6.13	25.14	47.84	0.41	1.51
19:23	9.68	6.14	25.32	47.92	0.38	1.87
19:24	9.67	6.14	25.48	48.06	0.35	1.96
19:25	9.67	6.14	26.20	47.86	0.42	0.82

Parameter	O_2 - Outlet	CO_2 - Outlet	CO - Outlet	NOx - Outlet	SO_2 - Outlet	VOM - Outlet
Uncorrected Run Average (C_{obs})	9.7	6.1	24.7	47.6	0.2	1.4
Cal Gas Concentration (C_{MA})	10.0	10.0	50.0	50.0	20.0	12.0
Pretest System Zero Response	0.02	0.02	-0.70	0.40	0.20	-0.10
Posttest System Zero Response	0.00	0.00	1.80	0.20	0.27	-0.80
Average Zero Response (Co)	0.0	0.0	0.6	0.3	0.2	-0.5
Pretest System Cal Response	9.86	9.80	49.24	50.10	19.80	11.90
Posttest System Cal Response	9.88	9.74	52.10	48.70	19.90	12.00
Average Cal Response (C_M)	9.9	9.8	50.7	49.4	19.9	12.0
Corrected Run Average (Corr)	9.8	6.3	24.1	48.1	0.0	1.8

Alliance SOURCE TESTING

Location: Koppers Naphthalene Distillation Plant - Cicero, IL
Source: Main Stack - Condition 2 Natural Gas
Project No.: 2020-1351
Date: 9/30/2020

Time Unit Status	O_2 - Outlet % dry Valid	CO_2 - Outlet % dry Valid	CO - Outlet ppmvd Valid	NOx - Outlet ppmvd Valid	SO_2 - Outlet ppmvd Valid	VOM - Outlet ppmvw Valid
10:01	9.58	6.33	28.49	42.74	0.00	0.00
10:02	9.59	6.32	29.60	42.76	0.00	0.00
10:03	9.60	6.31	28.89	42.58	0.00	0.00
10:04	9.58	6.33	26.54	42.88	0.00	0.00
10:05	9.56	6.34	27.54	42.90	0.00	0.00
10:06	9.56	6.34	26.97	42.44	0.00	0.00
10:07	9.56	6.34	27.67	42.36	0.00	0.00
10:08	9.59	6.32	27.93	42.56	0.00	0.00
10:09	9.60	6.32	27.57	42.56	0.00	0.00
10:10	9.53	6.35	27.33	42.78	0.00	0.00
10:11	9.50	6.37	27.04	43.00	0.00	0.00
10:12	9.52	6.36	27.58	42.85	0.00	0.00
10:13	9.53	6.36	25.97	42.85	0.00	0.00
10:14	9.54	6.35	26.59	42.73	0.00	0.50
10:15	9.54	6.35	28.19	42.80	0.00	0.00
10:16	9.52	6.36	29.01	42.97	0.00	0.00
10:17	9.51	6.37	29.39	43.04	0.00	0.00
10:18	9.53	6.35	27.20	42.81	0.00	0.11
10:19	9.54	6.35	28.14	42.74	0.00	0.00
10:20	9.55	6.35	27.83	42.81	0.00	0.44
10:21	9.53	6.36	26.36	42.92	0.00	0.00
10:22	9.50	6.38	28.27	43.15	0.00	0.00
10:23	9.51	6.37	28.72	43.10	0.00	0.00
10:24	9.54	6.36	28.37	42.79	0.00	0.08
10:25	9.57	6.34	27.10	42.71	0.00	0.06
10:26	9.54	6.35	28.63	42.81	0.00	0.08
10:27	9.53	6.36	29.58	42.77	0.00	0.42
10:28	9.55	6.35	26.95	42.72	0.00	0.00
10:29	9.57	6.34	29.04	42.97	0.00	0.00
10:30	9.54	6.35	29.00	43.12	0.00	0.12
10:31	9.54	6.36	25.82	42.98	0.00	0.00
10:32	9.55	6.35	29.41	43.10	0.00	0.00
10:33	9.55	6.35	29.54	42.89	0.00	0.22
10:34	9.57	6.34	28.65	43.04	0.00	0.25
10:35	9.56	6.35	27.97	43.01	0.00	0.28
10:36	9.55	6.35	30.39	42.95	0.00	0.01
10:37	9.56	6.34	28.91	42.78	0.00	0.00
10:38	9.57	6.34	27.63	42.60	0.00	0.31
10:39	9.58	6.33	26.22	42.27	0.00	0.02
10:40	9.56	6.34	28.49	41.89	0.00	0.00
10:41	9.54	6.36	28.45	42.60	0.00	0.56
10:42	9.55	6.35	27.21	42.67	0.00	0.00
10:43	9.55	6.35	29.32	42.87	0.00	0.00
10:44	9.50	6.38	28.20	43.02	0.00	0.00
10:45	9.53	6.36	28.59	42.88	0.00	0.05
10:46	9.11	6.60	24.53	45.57	0.00	0.00
10:47	8.49	7.01	10.25	52.92	0.00	0.00
10:48	10.91	5.64	1.68	46.25	0.00	0.02
10:49	12.02	5.00	0.35	45.74	0.00	0.02
11:56	10.22	5.95	22.16	12.58	0.00	0.00
11:57	10.19	5.97	22.52	12.59	0.00	0.00
11:58	10.17	5.98	23.94	12.55	0.00	0.00
11:59	10.18	5.97	24.23	12.55	0.00	0.00
12:00	10.20	5.96	22.88	12.69	0.00	0.00
12:01	10.19	5.97	23.14	12.59	0.00	0.00
12:02	10.20	5.96	25.31	12.60	0.00	0.00
12:03	10.16	5.98	22.94	12.81	0.00	0.00
12:04	10.13	6.00	23.61	12.93	0.00	0.00
12:05	10.14	6.00	24.40	12.92	0.00	0.00
12:06	10.15	5.99	24.26	12.80	0.00	0.00
12:07	10.19	5.96	25.82	12.51	0.00	0.00
12:08	10.19	5.97	23.89	12.61	0.00	0.00
12:09	10.19	5.97	24.24	12.72	0.00	0.00
12:10	10.21	5.96	25.89	12.78	0.00	0.00
12:11	10.22	5.95	24.69	12.70	0.00	0.00
12:12	10.20	5.97	22.76	12.89	0.00	0.00
12:13	10.22	5.96	23.54	12.66	0.00	0.00
12:14	10.23	5.95	23.38	12.50	0.00	0.00
12:15	10.22	5.96	24.25	12.78	0.00	0.00
12:16	10.22	5.96	23.81	12.72	0.00	0.00
12:17	10.21	5.96	24.31	12.89	0.00	0.00
12:18	10.20	5.97	23.33	12.98	0.00	0.00
12:19	10.22	5.96	23.85	12.98	0.00	0.00
12:20	10.22	5.96	23.68	12.92	0.00	0.00
12:21	10.23	5.95	24.88	13.08	0.00	0.00
12:22	10.21	5.96	22.73	13.18	0.00	0.00
12:23	10.22	5.96	24.03	13.29	0.00	0.00
12:24	10.22	5.95	22.55	13.40	0.00	0.00

Alliance SOURCE TESTING

Location: Koppers Naphthalene Distillation Plant - Cicero, IL
Source: Main Stack - Condition 2 Natural Gas
Project No.: 2020-1351
Date: 9/30/2020

Time Unit Status	O_2 - Outlet % dry Valid	CO_2 - Outlet % dry Valid	CO - Outlet ppmvd Valid	NOx - Outlet ppmvd Valid	SO_2 - Outlet ppmvd Valid	VOM - Outlet ppmvw Valid
12:25	10.20	5.96	23.09	13.37	0.00	0.00
12:26	10.18	5.97	23.83	13.41	0.00	0.00
12:27	10.18	5.97	23.76	13.36	0.00	0.00
12:28	10.25	5.93	24.03	13.39	0.00	0.00
12:29	10.30	5.91	21.64	13.32	0.00	0.00
12:30	10.26	5.93	22.81	13.38	0.00	0.00
12:31	10.48	5.81	22.68	13.20	0.00	0.00
12:32	10.92	5.57	19.92	12.57	0.00	0.00
12:33	11.01	5.52	20.99	12.15	0.00	0.00
12:34	11.12	5.45	22.57	11.84	0.00	0.00
12:35	11.13	5.45	21.58	11.95	0.00	0.00
12:36	10.88	5.58	21.64	12.49	0.00	0.00
12:37	10.52	5.78	23.24	12.94	0.00	0.00
12:38	10.36	5.88	22.27	13.44	0.00	0.00
12:39	10.28	5.93	23.06	13.55	0.00	0.00
12:40	10.26	5.94	23.35	13.31	0.00	0.00
12:41	10.25	5.94	22.62	13.25	0.00	0.00
12:42	10.25	5.95	22.84	13.35	0.00	0.00
12:43	10.30	5.91	24.55	13.23	0.00	0.00
12:44	10.39	5.87	22.99	16.05	0.00	0.00
12:45	10.40	5.86	23.58	34.60	0.00	0.00
12:46	10.40	5.86	22.51	39.95	0.00	0.00
12:47	10.39	5.87	23.20	40.35	0.00	0.00
12:48	10.49	5.81	24.81	40.38	0.00	0.00
12:49	10.52	5.80	24.72	40.33	0.00	0.00
12:50	10.55	5.78	23.59	40.20	0.00	0.00
12:51	10.49	5.82	22.90	40.32	0.00	0.00
12:52	10.42	5.86	21.85	40.81	0.00	0.00
12:53	10.38	5.88	21.47	41.02	0.00	0.00
12:54	10.38	5.88	23.20	41.10	0.00	0.00
12:55	10.38	5.88	23.72	41.00	0.00	0.00
12:56	10.35	5.90	20.36	41.36	0.00	0.00
12:57	10.37	5.89	23.23	41.21	0.00	0.00
12:58	10.40	5.87	22.09	41.37	0.00	0.00
12:59	10.41	5.86	23.02	41.47	0.00	0.00
13:00	10.39	5.88	22.09	41.63	0.00	0.00
13:01	10.40	5.87	19.75	41.74	0.00	0.00
13:02	10.40	5.87	22.82	41.74	0.00	0.00
13:03	10.42	5.86	21.42	41.20	0.00	0.00
13:04	10.41	5.86	20.43	41.21	0.00	0.00
13:05	10.48	5.82	22.48	40.97	0.00	0.00
13:06	10.49	5.81	20.98	41.30	0.00	0.00

Parameter	O_2 - Outlet	CO_2 - Outlet	CO - Outlet	NOx - Outlet	SO_2 - Outlet	VOM - Outlet
Uncorrected Run Average (C_{obs})	10.0	6.1	24.5	30.4	0.0	0.03
Cal Gas Concentration (C_{MA})	10.0	10.0	50.0	50.0	20.0	12.0
Pretest System Zero Response	0.00	0.00	0.00	0.00	0.40	0.20
Posttest System Zero Response	0.00	0.00	0.60	0.10	0.20	0.30
Average Zero Response (Co)	0.0	0.0	0.3	0.1	0.3	0.3
Pretest System Cal Response	9.90	9.90	50.00	47.80	19.80	11.90
Posttest System Cal Response	10.00	9.80	50.00	49.90	19.60	11.90
Average Cal Response (C_M)	10.0	9.9	50.0	48.9	19.7	11.9
Corrected Run Average (Corr)	10.1	6.2	24.3	31.1	0.0	0.0

Alliance SOURCE TESTING

Location: Koppers Naphthalene Distillation Plant - Cicero, IL
Source: Main Stack - Condition 2 Natural Gas
Project No.: 2020-1351
Date: 9/30/20

Time Unit Status	O_2 - Outlet % dry Valid	CO_2 - Outlet % dry Valid	CO - Outlet ppmvd Valid	NOx - Outlet ppmvd Valid	SO_2 - Outlet ppmvd Valid	VOM - Outlet ppmvw Valid
14:08	10.48	5.81	24.45	40.61	0.33	0.69
14:09	10.46	5.82	23.94	40.56	0.22	0.72
14:10	10.45	5.82	22.57	40.67	0.31	0.73
14:11	10.43	5.84	25.25	40.85	0.29	0.61
14:12	10.45	5.82	25.89	40.75	0.31	2.59
14:13	10.45	5.82	22.43	40.73	0.31	0.92
14:14	10.44	5.83	23.26	40.55	0.23	2.04
14:15	10.46	5.82	24.20	40.50	0.24	1.20
14:16	10.45	5.83	22.55	40.62	0.25	2.90
14:17	10.45	5.83	24.99	40.51	0.25	2.59
14:18	10.43	5.84	24.36	40.62	0.20	0.47
14:19	10.42	5.85	24.03	40.64	0.23	1.75
14:20	10.44	5.83	24.50	40.62	0.27	1.59
14:21	10.46	5.82	25.88	40.56	0.25	2.73
14:22	10.47	5.82	25.99	40.54	0.28	1.07
14:23	10.50	5.80	26.10	40.45	0.27	0.63
14:24	10.46	5.83	23.06	40.47	0.23	1.05
14:25	10.46	5.82	24.60	40.28	0.30	0.44
14:26	10.45	5.83	24.50	40.23	0.27	1.50
14:27	10.41	5.85	25.16	40.19	0.27	2.24
14:28	10.42	5.84	25.66	40.26	0.33	2.69
14:29	10.41	5.85	24.98	40.42	0.23	1.21
14:30	10.41	5.85	25.02	40.47	0.27	0.62
14:31	10.43	5.84	25.30	40.39	0.26	0.54
14:32	10.42	5.84	25.39	40.52	0.26	0.88
14:33	10.42	5.84	27.08	40.38	0.24	0.41
14:34	10.43	5.84	23.72	40.60	0.28	2.02
14:35	10.48	5.81	25.37	40.39	0.28	1.83
14:36	10.44	5.83	26.11	40.52	0.25	0.66
14:37	10.46	5.82	24.69	40.44	0.23	2.01
14:38	10.46	5.83	26.28	40.45	0.27	2.86
14:39	10.45	5.83	25.76	40.36	0.28	0.87
14:40	10.49	5.81	25.97	40.29	0.22	1.57
14:41	10.47	5.82	26.38	40.27	0.30	1.01
14:42	10.44	5.84	25.47	40.13	0.33	3.00
14:43	10.45	5.83	27.21	39.75	0.30	2.00
14:44	10.44	5.84	26.30	39.90	0.28	1.63
14:45	10.43	5.84	25.80	40.16	0.29	1.74
14:46	10.43	5.85	25.42	40.36	0.32	2.91
14:47	10.44	5.84	26.11	40.53	0.28	2.03
14:48	10.43	5.85	25.87	40.57	0.28	1.91
14:49	10.45	5.84	25.39	40.49	0.30	2.94
14:50	10.50	5.81	25.19	40.24	0.28	2.54
14:51	10.48	5.82	25.47	40.43	0.27	1.26
14:52	10.46	5.83	26.82	40.38	0.34	2.22
14:53	10.46	5.83	26.79	40.64	0.31	1.12
14:54	10.46	5.83	26.13	40.62	0.29	1.67
14:55	10.53	5.79	26.69	40.54	0.22	2.67
14:56	10.46	5.83	25.81	40.64	0.29	0.92
14:57	10.44	5.84	25.32	40.77	0.27	1.89
14:58	10.40	5.86	25.05	40.70	0.36	1.15
14:59	10.39	5.87	24.39	40.73	0.32	1.06
15:00	10.39	5.88	28.17	40.79	0.30	2.18
15:01	10.35	5.90	26.42	40.94	0.27	1.31
15:02	10.35	5.90	24.66	40.91	0.22	2.68
15:03	10.37	5.89	26.68	41.09	0.26	2.60
15:04	10.38	5.88	26.37	40.99	0.30	0.64
15:05	10.40	5.87	25.48	40.90	0.27	2.00
15:06	10.42	5.86	26.67	41.03	0.24	0.72
15:07	10.45	5.85	28.45	40.85	0.30	1.54
15:08	10.40	5.87	24.11	41.13	0.39	2.68
15:09	10.41	5.86	26.05	40.97	0.30	2.67
15:10	10.45	5.85	24.44	41.20	0.34	0.85
15:11	10.46	5.84	26.47	41.35	0.27	1.69
15:12	10.49	5.82	24.32	40.97	0.34	0.62
15:13	10.49	5.82	25.90	41.04	0.37	2.84
15:14	10.47	5.83	26.38	41.31	0.30	1.11
15:15	10.53	5.80	26.63	41.18	0.34	0.47
15:16	10.54	5.79	24.97	41.21	0.33	0.54
15:17	10.50	5.82	25.43	41.32	0.35	2.72
15:18	10.47	5.83	24.32	41.38	0.38	0.67
15:19	10.46	5.84	24.90	41.18	0.36	2.51
15:20	10.42	5.86	23.57	41.07	0.40	2.07
15:21	10.35	5.90	23.80	41.32	0.35	1.76
15:22	10.38	5.89	26.17	41.42	0.36	0.86
15:23	10.42	5.86	23.92	41.65	0.36	2.23
15:24	10.41	5.87	25.59	41.59	0.28	2.93
15:25	10.94	5.57	22.71	39.82	0.35	2.56

Alliance SOURCE TESTING

Location: Koppers Naphthalene Distillation Plant - Cicero, IL
Source: Main Stack - Condition 2 Natural Gas
Project No.: 2020-1351
Date: 9/30/20

Time Unit Status	O_2 - Outlet % dry Valid	CO_2 - Outlet % dry Valid	CO - Outlet ppmvd Valid	NOx - Outlet ppmvd Valid	SO_2 - Outlet ppmvd Valid	VOM - Outlet ppmvw Valid
15:26	10.74	5.68	24.13	40.44	0.41	2.13
15:27	10.70	5.70	23.96	40.64	0.38	1.59
15:28	10.98	5.55	23.29	39.69	0.37	2.19
15:29	10.81	5.64	21.14	40.22	0.33	2.96
15:30	10.52	5.81	24.34	41.43	0.45	1.89
15:31	10.48	5.83	23.26	41.71	0.43	1.75
15:32	10.52	5.80	23.96	41.48	0.37	1.96
15:33	10.53	5.80	24.24	41.52	0.42	1.42
15:34	10.51	5.81	23.83	41.71	0.45	2.10
15:35	10.54	5.79	24.22	41.72	0.38	1.91
15:36	10.51	5.81	23.58	41.80	0.38	2.93
15:37	10.48	5.82	23.91	41.75	0.43	1.45
15:38	10.44	5.85	21.77	41.70	0.42	2.37
15:39	10.45	5.84	25.32	41.38	0.48	1.13
15:40	10.45	5.84	24.37	41.50	0.46	1.75
15:41	10.43	5.85	22.68	41.65	0.42	0.99
15:42	10.44	5.84	23.34	41.68	0.42	1.49
15:43	10.46	5.83	23.23	41.69	0.45	1.35
15:44	10.55	5.78	24.88	41.30	0.45	0.69
15:45	10.50	5.81	23.25	41.67	0.49	1.11
15:46	10.52	5.79	22.89	41.70	0.53	2.98
15:47	10.52	5.79	23.46	41.75	0.44	1.67
15:48	10.52	5.79	23.46	41.63	0.46	2.78
15:49	10.50	5.80	23.34	41.78	0.47	1.57
15:50	10.49	5.80	24.56	41.68	0.48	2.58
15:51	10.56	5.76	22.75	41.55	0.45	2.64
15:52	10.58	5.75	23.12	41.54	0.44	1.04
15:53	10.57	5.76	22.97	41.45	0.45	2.22
15:54	10.56	5.76	22.91	41.37	0.49	2.20
15:55	10.58	5.75	23.16	41.31	0.44	1.20
15:56	10.57	5.75	23.81	41.34	0.49	0.88
15:57	10.55	5.77	23.24	41.28	0.51	1.07
15:58	10.52	5.78	24.17	41.46	0.51	2.74
15:59	10.53	5.78	22.80	41.36	0.50	1.34
16:00	10.51	5.79	23.33	41.40	0.53	2.39
16:01	10.52	5.79	24.28	41.39	0.46	0.81
16:02	10.49	5.80	24.68	41.56	0.44	2.11
16:03	10.53	5.78	24.27	41.59	0.43	0.43
16:04	10.51	5.79	23.07	41.73	0.47	0.93
16:05	10.53	5.78	24.39	41.36	0.48	2.79
16:06	10.52	5.79	22.62	41.55	0.46	0.68
16:07	10.53	5.78	23.69	41.60	0.56	1.61

Parameter	O_2 - Outlet	CO_2 - Outlet	CO - Outlet	NOx - Outlet	SO_2 - Outlet	VOM - Outlet
Uncorrected Run Average (C_{obs})	10.5	5.8	24.7	40.9	0.3	1.7
Cal Gas Concentration (C_{MA})	10.0	10.0	50.0	50.0	20.0	12.0
Pretest System Zero Response	0.00	0.00	0.60	0.40	0.20	0.30
Posttest System Zero Response	0.00	0.00	0.71	0.10	0.60	0.50
Average Zero Response (Co)	0.0	0.0	0.7	0.3	0.4	0.4
Pretest System Cal Response	10.00	9.80	50.00	49.90	19.60	11.90
Posttest System Cal Response	10.07	9.80	50.70	49.90	19.60	11.80
Average Cal Response (C_M)	10.0	9.8	50.4	49.9	19.6	11.9
Corrected Run Average (Corr)	10.4	5.9	24.2	41.0	0.0	NA

Thermal Oxidizer

Location Koppers Naphthalene Distillation Plant - Cicero, IL
Source TO-5 Inlet - Condition 2
Project No. 2020-1351

Run Number		Run 2	Run 3*	Run 4	Average
Date		9/29/20	9/30/20	9/30/20	--
Start Time		17:12	10:01	13:49	--
Stop Time		19:12	12:09	14:49	--
Input Data - Inlet					
Moisture Fraction, dimensionless	BWSI	0.012	0.010	0.012	0.011
Volumetric Flow Rate (M1-4), dscfm	QsI	75	73	70	73
Calculated Data - Inlet					
O_2i Concentration, % dry	C_{O_2i}	20.92	20.91	21.01	20.95
CO_2i Concentration, % dry	C_{CO_2i}	0.01	0.00	0.00	0.00
VOMi (as C3H8) Concentration, ppmvd	C_{VOMi}	29.9	16.1	19.4	21.8
VOMi (as C3H8) Concentration, ppmvw	C_{VOMiw}	29.5	15.9	19.2	21.5
VOMi (as C3H8) Emission Rate, lb/hr	ER_{VOMi}	0.015	0.0080	0.0093	0.011

*Run 3 paused due to operational issues

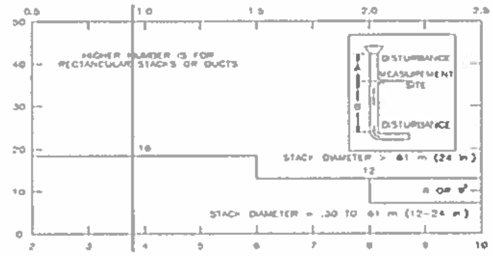
Alliance SOURCE TESTING

Method 1 Data

Location Koppers Naphthalene Distillation Plant - Cicero, IL
Source TO-5 Inlet - Condition 2
Project No. 2020-1351
Date: 09/29/20

Stack Parameters

Duct Orientation:	Horizontal	
Duct Design:	Circular	
Distance from Far Wall to Outside of Port:	28.75	in
Nipple Length:	16.00	in
Depth of Duct:	12.75	in
Cross Sectional Area of Duct:	0.89	ft^2
No. of Test Ports:	2	
Number of Readings per Point:	1	
Distance A:	10.0	ft
Distance A Duct Diameters:	9.4	(must be > 0.5)
Distance B:	4.0	ft
Distance B Duct Diameters:	3.8	(must be > 2)
Minimum Number of Traverse Points:	16	
Actual Number of Traverse Points:	16	
Measurer (Initial and Date):	LJC	
Reviewer (Initial and Date):	JEW	



CIRCULAR DUCT

LOCATION OF TRAVERSE POINTS

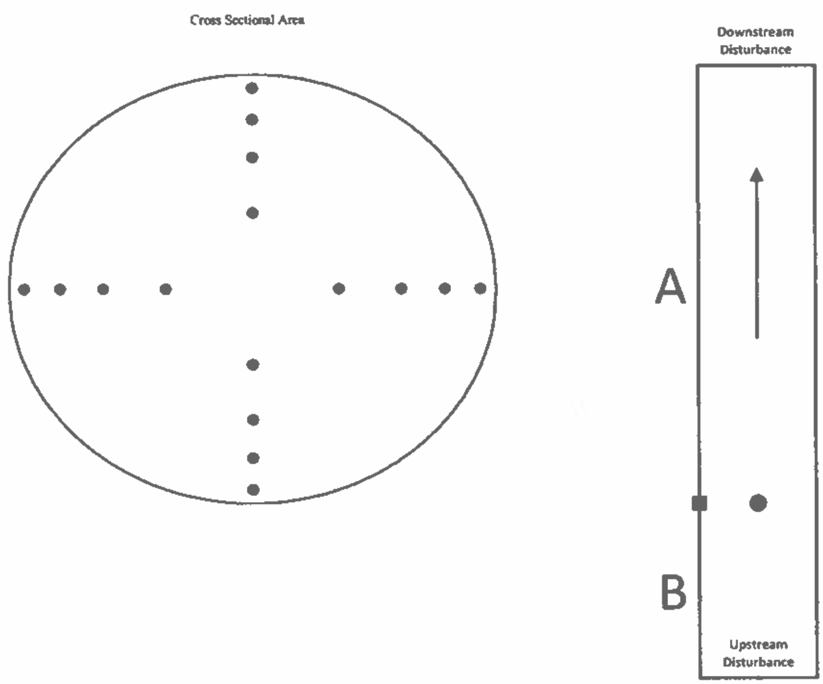
Number of traverse points on a diameter

	2	3	4	5	6	7	8	9	10	11	12
1	14.6	--	6.7	--	4.4	--	3.2	--	2.6	--	2.1
2	85.4	--	25.0	--	14.6	--	10.5	--	8.2	--	6.7
3	--	--	75.0	--	29.6	--	19.4	--	14.6	--	11.8
4	--	--	93.3	--	70.4	--	32.3	--	22.6	--	17.7
5	--	--	--	--	85.4	--	67.7	--	34.2	--	25.0
6	--	--	--	--	95.6	--	80.6	--	65.8	--	35.6
7	--	--	--	--	--	--	89.5	--	77.4	--	64.4
8	--	--	--	--	--	--	96.8	--	85.4	--	75.0
9	--	--	--	--	--	--	--	--	91.8	--	82.3
10	--	--	--	--	--	--	--	--	97.4	--	88.2
11	--	--	--	--	--	--	--	--	--	--	93.3
12	--	--	--	--	--	--	--	--	--	--	97.9

*Percent of stack diameter from inside wall to traverse point.

Traverse Point	% of Diameter	Distance from inside wall	Distance from outside of port
1	3.2	0.50	16.50
2	10.5	1.34	17.34
3	19.4	2.47	18.47
4	32.3	4.12	20.12
5	67.7	8.63	24.63
6	80.6	10.28	26.28
7	89.5	11.41	27.41
8	96.8	12.25	28.25
9	--	--	--
10	--	--	--
11	--	--	--
12	--	--	--

Stack Diagram
A = 10 ft.
B = 4 ft.
Depth of Duct = 12.75 in.



Alliance
SOURCE TESTING

Cyclonic Flow Check

Location Koppers Naphthalene Distillation Plant - Cicero, IL
Source TO-5 Inlet - Condition 2
Project No. 2020-1351
Date 9/29/20

Sample Point	Angle (ΔP=0)
1	0
2	1
3	0
4	1
5	0
6	2
7	1
8	3
9	0
10	0
11	1
12	3
13	0
14	1
15	2
16	1
Average	1.0

Alliance SOURCE TESTING

Field Data
Method 2 Data

Location Koppers Naphthalene Distillation Plant - Cicero, IL
Source TO-5 Inlet - Condition 2
Project No. 2020-1351

	Run No.	2		3		4	
	Date	9/29/20		9/30/20		9/30/20	
	Status	VALID		VALID		VALID	
	Start Time	17:25		10:15		14:04	
	Stop Time	17:39		10:23		14:11	
	Leak Check	Pass		Pass		Pass	
Traverse Point		Δ P (in. WC)	Ts (°F)	Δ P (in. WC)	Ts (°F)	Δ P (in. WC)	Ts (°F)
A1		0.0006	84	0.0004	86	0.0004	84
2		0.0008	84	0.0007	84	0.0007	85
3		0.0007	83	0.0008	84	0.0009	83
4		0.0005	84	0.0006	83	0.0006	82
5		0.0008	84	0.0007	82	0.0005	83
6		0.0006	85	0.0008	83	0.0008	84
7		0.0006	83	0.0006	85	0.0007	83
8		0.0008	84	0.0007	84	0.0006	84
B1		0.0007	84	0.0008	83	0.0004	82
2		0.0008	82	0.0007	82	0.0007	83
3		0.0009	83	0.0005	83	0.0009	85
4		0.0005	84	0.0006	84	0.0008	84
5		0.0006	82	0.0006	85	0.0007	85
6		0.0007	83	0.0007	85	0.0003	84
7		0.0004	84	0.0006	84	0.0005	83
8		0.0006	84	0.0004	83	0.0002	84

		Run 2	Run 3	Run 4	Average
Square Root of ΔP, (in. WC)$^{1/2}$	(ΔP)$^{1/2}$	0.026	0.025	0.024	0.025
Average ΔP, in. WC	(ΔP)	0.00	0.00	0.00	0.00
Pitot Tube Coefficient	(Cp)	0.840	0.840	0.840	0.840
Barometric Pressure, in. Hg	(Pb)	29.25	28.90	28.90	28.97
Static Pressure, in. WC	(Pg)	5.16	5.22	5.20	5.19
Stack Pressure, in. Hg	(Ps)	29.63	29.28	29.28	29.40
Average Temperature, °F	(Ts)	83.6	83.8	83.6	83.6
Average Temperature, °R	(Ts)	543.6	543.8	543.6	543.6
Measured Moisture Fraction	(BWSmsd)	0.012	0.010	0.012	0.011
Moisture Fraction @ Saturation	(BWSsat)	0.039	0.040	0.040	0.040
Moisture Fraction	(BWS)	0.012	0.010	0.012	0.011
O2 Concentration, %	(O2)	20.9	20.9	21.0	20.9
CO2 Concentration, %	(CO2)	0.0	0.0	0.0	0.0
Molecuar Weight, lb/lb-mole (dry)	(Md)	28.84	28.84	28.84	28.84
Molecuar Weight, lb/lb-mole (wet)	(Ms)	28.70	28.73	28.71	28.72
Velocity, ft/sec	(Vs)	1.5	1.5	1.4	1.4
VFR at stack conditions, acfm	(Qa)	78	77	74	77
VFR at standard conditions, scfh	(Qsw)	4,514	4,400	4,244	4,386
VFR at standard conditions, scfm	(Qsw)	75	73	71	73
VFR at standard conditions, dscfm	(Qsd)	74	73	70	72

Alliance SOURCE TESTING

Location Koppers Naphthalene Distillation Plant - Cicero, IL
Source TO-5 Inlet - Condition 2
Project No. 2020-1351
Parameter(s): VFR
Console Type Meter Box

Run No.	2					3					4				
Date	9/29/20					9/30/20					9/30/20				
Status	VALID					VALID					VALID				
Start Time	17:12					10:01					13:49				
End Time	19:12					13:09					14:49				
Run Time, min (θ)	120					120					60				
Meter ID	2026					2026					2026				
Meter Correction Factor (Y)	1.002					1.002					1.002				
Orifice Calibration Value (ΔH @)	1.773					1.773					1.773				
Max Vacuum, in. Hg	2					4					3				
Post Leak Check, ft3/min (at max vac.)	0.000					0.000					0.000				
Meter Volume, ft3															
0	103.922					169.943					258.820				
5	107.181					173.665					262.365				
10	109.721					177.232					266.010				
15	112.232					180.732					269.813				
20	115.265					184.593					273.658				
25	117.845					188.355					277.165				
30	120.473					192.086					280.865				
35	123.315					195.753					284.540				
40	126.151					199.532					288.280				
45	128.854					203.175					291.825				
50	131.547					206.782					295.515				
55	134.624					210.442					299..210				
60	137.023					214.132					302.911				
65	139.768					217.825									
70	142.443					221.532									
75	145.215					225.210									
80	147.940					228.963									
85	150.732					233.523									
90	153.411					236.798									
95	155.234					239.910									
100	158.956					243.492									
105	161.713					247.261									
110	164.321					250.970									
115	167.148					254.688									
120	169.813					258.439									
Total Meter Volume, ft3 (Vm)	65.891					88.496					44.091				
Temperature, °F	Meter	Probe	Filter	Vacuum	Imp. Exit	Meter	Probe	Filter	Vacuum	Imp. Exit	Meter	Probe	Filter	Vacuum	Imp. Exit
0	71	--	--	2	54	70	--	--	4	61	69.0	--	--	3	53.0
5	72	--	--	2	45	73	--	--	4	50	72.0	--	--	3	49.0
10	73	--	--	2	45	74	--	--	4	51	72.0	--	--	3	51.0
15	73	--	--	2	45	74	--	--	4	51	73.0	--	--	3	52.0
20	74	--	--	2	45	74	--	--	4	51	73.0	--	--	3	52.0
25	74	--	--	2	45	74	--	--	4	51	73.0	--	--	3	53.0
30	73	--	--	2	46	74	--	--	4	52	73.0	--	--	3	53.0
35	74	--	--	2	45	74	--	--	4	52	73.0	--	--	3	53.0
40	73	--	--	2	46	74	--	--	4	52	73.0	--	--	3	52.0
45	73	--	--	2	46	74	--	--	4	52	73.0	--	--	3	52.0
50	74	--	--	2	46	66	--	--	4	55	73.0	--	--	3	52.0
55	73	--	--	2	46	66	--	--	4	53	73.0	--	--	3	52.0
60	73	--	--	2	46	68	--	--	4	55	73.0	--	--	3	53.0
65	73	--	--	2	46	68	--	--	4	55	--	--	--	--	--
70	74	--	--	2	46	69	--	--	4	56	--	--	--	--	--
75	73	--	--	2	46	70	--	--	4	57	--	--	--	--	--
80	73	--	--	2	46	70	--	--	4	57	--	--	--	--	--
85	73	--	--	2	46	71	--	--	4	57	--	--	--	--	--
90	73	--	--	2	46	71	--	--	4	57	--	--	--	--	--
95	73	--	--	2	46	71	--	--	4	57	--	--	--	--	--
100	73	--	--	2	46	71	--	--	4	58	--	--	--	--	--
105	74	--	--	2	46	72	--	--	4	57	--	--	--	--	--
110	73	--	--	2	46	72	--	--	4	58	--	--	--	--	--
115	74	--	--	2	47	72	--	--	4	58	--	--	--	--	--
120	73	--	--	2	47	71	--	--	4	58	--	--	--	--	--
Average Temperature, °F (Tm)	73	--	--	--	--	71	--	--	--	--	73	--	--	--	--
Average Temperature, °R (Tm)	533	--	--	--	--	531	--	--	--	--	533	--	--	--	--
Minimum Temperature, °F	71	--	--	--	--	66	--	--	--	--	69	--	--	--	--
Maximum Temperature, °F	74	--	--	--	54	74	--	--	--	61	73	--	--	--	53
Barometeric Pressure, in. Hg (Pb)	29.25					28.90					28.90				
Meter Orifice Pressure , in. WC (ΔH)	1.000					1.700					1.700				
Meter Pressure, in. Hg (Pm)	29.32					29.03					29.03				
Standard Meter Volume, ft3 (Vmstd)	64.080					85.483					42.492				
Analysis Type	Gravimetric					Gravimetric					Gravimetric				
Impinger 1, Pre/Post Test, mL	H2O		704.3	707.0	2.7	H2O		707.0	708.2	1.2	H2O		706.0	707.7	1.7
Impinger 2, Pre/Post Test, mL	H2O		711.5	713.1	1.6	H2O		713.1	713.3	0.2	H2O		734.2	735.2	1.0
Impinger 3, Pre/Post Test, mL	Empty		607.1	609.1	2.0	Empty		609.1	609.7	0.6	Empty		568.8	569.3	0.5
Impinger 4, Pre/Post Test, g	Silica		842.2	852.7	10.5	Silica		852.7	868.9	16.2	Silica		743.7	751.1	7.4
Volume Water Collected, mL (Vlc)	16.8					18.2					10.6				
Standard Water Volume, ft^3 (Vwstd)	0.792					0.858					0.500				
Moisture Fraction Measured (BWS)	0.012					0.010					0.012				
Gas Molecular Weight, lb/lb-mole (dry) (Md)	28.84					28.84					28.84				
DGM Calibration Check Value (Yqa)	-4.2					-1.5					-2.0				

Location: Koppers Naphthalene Distillation Plant - Cicero, IL
Source: TO-5 Inlet - Condition 2
Project No.: 2020-1351
Date: 9/29/20

Time Unit Status	O_2 - Inlet % dry Valid	CO_2 - Inlet % dry Valid	VOM - Inlet ppmvw Valid
17:12	20.76	0.01	20.91
17:13	20.76	0.01	21.84
17:14	20.76	0.01	22.37
17:15	20.76	0.01	23.06
17:16	20.76	0.01	23.99
17:17	20.76	0.01	24.98
17:18	20.76	0.01	25.10
17:19	20.76	0.01	25.64
17:20	20.76	0.01	26.51
17:21	20.76	0.01	27.02
17:22	20.76	0.01	27.40
17:23	20.76	0.01	27.45
17:24	20.76	0.01	27.54
17:25	20.76	0.01	27.27
17:26	20.76	0.01	27.81
17:27	20.76	0.01	27.76
17:28	20.76	0.01	27.80
17:29	20.76	0.01	27.73
17:30	20.76	0.01	27.45
17:31	20.76	0.01	27.21
17:32	20.76	0.01	26.76
17:33	20.76	0.01	26.37
17:34	20.76	0.01	25.69
17:35	20.76	0.01	25.13
17:36	20.76	0.01	24.98
17:37	20.76	0.01	24.69
17:38	20.76	0.01	24.08
17:39	20.76	0.01	23.97
17:40	20.76	0.01	23.24
17:41	20.76	0.01	22.95
17:42	20.76	0.01	22.30
17:43	20.76	0.01	21.64
17:44	20.76	0.01	21.27
17:45	20.76	0.01	20.86
17:46	20.76	0.01	20.49
17:47	20.76	0.01	20.12
17:48	20.76	0.01	19.86
17:49	20.76	0.01	19.23
17:50	20.76	0.01	19.10
17:51	20.76	0.01	19.37
17:52	20.76	0.01	19.29
17:53	20.76	0.01	19.10
17:54	20.76	0.01	18.92
17:55	20.76	0.01	19.01
17:56	20.76	0.01	18.92
17:57	20.76	0.01	18.89
17:58	20.76	0.01	19.00
17:59	20.76	0.01	18.69
18:00	20.76	0.01	18.57
18:01	20.76	0.01	18.24
18:02	20.76	0.01	18.38
18:03	20.76	0.01	18.28
18:04	20.76	0.01	17.83
18:05	20.76	0.01	17.91
18:06	20.76	0.01	17.80
18:07	20.76	0.01	17.69
18:08	20.76	0.01	17.88
18:09	20.76	0.01	17.56
18:10	20.76	0.01	17.50
18:11	20.76	0.01	17.35
18:12	20.76	0.01	18.49
18:13	20.76	0.01	19.17
18:14	20.76	0.01	19.34
18:15	20.76	0.01	19.67
18:16	20.76	0.01	19.98
18:17	20.76	0.01	20.00
18:18	20.76	0.01	20.79
18:19	20.76	0.01	37.91
18:20	20.76	0.01	74.26
18:21	20.75	0.01	89.13
18:22	20.75	0.01	86.48
18:23	20.74	0.01	74.70
18:24	20.74	0.01	61.78
18:25	20.74	0.01	54.98
18:26	20.74	0.01	50.90
18:27	20.74	0.01	47.67

Alliance
SOURCE TESTING

Location: Koppers Naphthalene Distillation Plant - Cicero, IL
Source: TO-5 Inlet - Condition 2
Project No.: 2020-1351
Date: 9/29/20

Time Unit Status	O_2 - Inlet % dry Valid	CO_2 - Inlet % dry Valid	VOM - Inlet ppmvw Valid
18:28	20.74	0.01	46.61
18:29	20.74	0.01	45.03
18:30	20.74	0.01	44.53
18:31	20.74	0.01	44.97
18:32	20.74	0.01	44.57
18:33	20.74	0.01	43.70
18:34	20.74	0.01	43.03
18:35	20.74	0.01	42.32
18:36	20.74	0.01	41.04
18:37	20.74	0.01	40.25
18:38	20.74	0.01	40.03
18:39	20.74	0.01	39.33
18:40	20.74	0.01	39.15
18:41	20.74	0.01	37.82
18:42	20.74	0.01	37.65
18:43	20.74	0.01	37.13
18:44	20.74	0.01	36.27
18:45	20.74	0.01	35.47
18:46	20.74	0.01	34.65
18:47	20.74	0.01	34.12
18:48	20.74	0.01	33.36
18:49	20.74	0.01	32.78
18:50	20.74	0.01	32.27
18:51	20.74	0.01	31.71
18:52	20.74	0.01	31.13
18:53	20.74	0.01	30.66
18:54	20.74	0.01	30.12
18:55	20.74	0.01	29.64
18:56	20.74	0.01	29.14
18:57	20.74	0.01	29.15
18:58	20.74	0.01	28.24
18:59	20.74	0.01	28.34
19:00	20.74	0.01	28.46
19:01	20.74	0.01	27.60
19:02	20.74	0.01	27.24
19:03	20.74	0.01	27.07
19:04	20.74	0.01	26.37
19:05	20.74	0.01	26.39
19:06	20.74	0.01	25.82
19:07	20.74	0.01	25.70
19:08	20.74	0.01	25.49
19:09	20.74	0.01	25.34
19:10	20.74	0.01	25.41
19:11	20.74	0.01	25.52

Parameter	O_2 - Inlet	CO_2 - Inlet	VOM - Inlet
Uncorrected Run Average (C_{obs})	20.8	0.0	29.5
Cal Gas Concentration (C_{MA})	10.0	9.9	250.0
Pretest System Zero Response	0.01	0.00	0.27
Posttest System Zero Response	0.05	0.00	1.20
Average Zero Response (Co)	0.0	0.0	0.7
Pretest System Cal Response	9.93	9.81	124.31
Posttest System Cal Response	9.94	9.76	126.61
Average Cal Response (C_M)	9.9	9.8	125.5
Corrected Run Average (Corr)	20.9	0.0	NA

Alliance
SOURCE TESTING

Location: Koppers Naphthalene Distillation Plant - Cicero, IL
Source: TO-5 Inlet - Condition 2
Project No.: 2020-1351
Date: 9/30/20

Time Unit Status	O_2 - Inlet % dry Valid	CO_2 - Inlet % dry Valid	VOM - Inlet ppmvw Valid
10:01	20.76	0.00	21.89
10:02	20.76	0.00	20.57
10:03	20.76	0.00	19.68
10:04	20.76	0.00	19.27
10:05	20.76	0.00	18.62
10:06	20.76	0.00	18.33
10:07	20.76	0.00	18.09
10:08	20.76	0.00	18.06
10:09	20.76	0.00	17.60
10:10	20.77	0.00	17.45
10:11	20.77	0.00	17.04
10:12	20.77	0.00	16.77
10:13	20.77	0.00	16.37
10:14	20.77	0.00	16.62
10:15	20.77	0.00	16.71
10:16	20.77	0.00	16.71
10:17	20.77	0.00	16.34
10:18	20.77	0.00	16.31
10:19	20.77	0.00	16.20
10:20	20.77	0.00	16.07
10:21	20.77	0.00	15.97
10:22	20.77	0.00	15.86
10:23	20.77	0.00	15.79
10:24	20.76	0.00	15.54
10:25	20.77	0.00	15.35
10:26	20.76	0.00	15.31
10:27	20.77	0.00	15.20
10:28	20.77	0.00	15.22
10:29	20.77	0.00	15.26
10:30	20.77	0.00	15.57
10:31	20.77	0.00	15.59
10:32	20.77	0.00	15.51
10:33	20.77	0.00	15.61
10:34	20.77	0.00	15.69
10:35	20.77	0.00	15.85
10:36	20.77	0.00	16.10
10:37	20.77	0.00	16.02
10:38	20.77	0.00	16.12
10:39	20.77	0.00	15.98
10:40	20.77	0.00	15.49
10:41	20.77	0.00	15.31
10:42	20.77	0.00	15.31
10:43	20.77	0.00	15.34
10:44	20.77	0.00	15.75
10:45	20.77	0.00	15.89
10:46	20.77	0.00	15.54
10:47	20.76	0.00	16.57
11:56	20.78	0.00	12.23
11:57	20.78	0.00	12.44
11:58	20.78	0.00	12.38
11:59	20.78	0.00	12.24
12:00	20.78	0.00	12.61
12:01	20.78	0.00	12.79
12:02	20.78	0.00	12.70
12:03	20.78	0.00	13.08
12:04	20.78	0.00	13.92
12:05	20.78	0.00	14.41
12:06	20.78	0.00	15.36
12:07	20.78	0.00	15.85
12:08	20.78	0.00	16.07

Parameter	O_2 - Inlet	CO_2 - Inlet	VOM - Inlet
Uncorrected Run Average (C_{obs})	20.8	0.0	15.9
Cal Gas Concentration (C_{MA})	10.0	9.9	123.2
Pretest System Zero Response	0.06	0.00	0.25
Posttest System Zero Response	0.10	0.00	1.16
Average Zero Response (Co)	0.1	0.0	0.7
Pretest System Cal Response	9.95	9.85	126.61
Posttest System Cal Response	9.94	9.85	124.46
Average Cal Response (C_M)	9.9	9.9	125.5
Corrected Run Average (Corr)	20.9	0.0	NA

Alliance
SOURCE TESTING

Location: Koppers Naphthalene Distillation Plant - Cicero, IL
Source: TO-5 Inlet - Condition 2
Project No.: 2020-1351
Date: 9/30/20

Time Unit Status	O_2 - Inlet % dry Valid	CO_2 - Inlet % dry Valid	VOM - Inlet ppmvw Valid
13:49	20.82	0.00	20.12
13:50	20.82	0.00	20.19
13:51	20.82	0.00	21.07
13:52	20.82	0.00	21.41
13:53	20.82	0.00	21.32
13:54	20.82	0.00	21.93
13:55	20.82	0.00	21.75
13:56	20.82	0.00	21.52
13:57	20.82	0.00	21.83
13:58	20.82	0.00	21.33
13:59	20.82	0.00	21.28
14:00	20.82	0.00	20.80
14:01	20.82	0.00	21.09
14:02	20.83	0.00	20.74
14:03	20.83	0.00	20.17
14:04	20.83	0.00	20.53
14:05	20.83	0.00	20.20
14:06	20.83	0.00	20.25
14:07	20.83	0.00	19.98
14:08	20.83	0.00	19.61
14:09	20.83	0.00	19.65
14:10	20.83	0.00	19.63
14:11	20.83	0.00	19.64
14:12	20.83	0.00	19.01
14:13	20.84	0.00	19.15
14:14	20.84	0.00	19.16
14:15	20.84	0.00	19.17
14:16	20.84	0.00	18.99
14:17	20.84	0.00	18.55
14:18	20.84	0.00	17.85
14:19	20.84	0.00	17.40
14:20	20.84	0.00	17.17
14:21	20.84	0.00	17.47
14:22	20.84	0.00	17.57
14:23	20.85	0.00	17.69
14:24	20.85	0.00	17.84
14:25	20.85	0.00	17.66
14:26	20.85	0.00	17.92
14:27	20.85	0.00	17.54
14:28	20.85	0.00	17.63
14:29	20.85	0.00	17.47
14:30	20.85	0.00	17.22
14:31	20.85	0.00	17.08
14:32	20.85	0.00	16.98
14:33	20.85	0.00	17.47
14:34	20.85	0.00	17.56
14:35	20.85	0.00	17.60
14:36	20.85	0.00	18.17
14:37	20.85	0.00	18.37
14:38	20.85	0.00	18.40
14:39	20.86	0.00	18.25
14:40	20.86	0.00	18.88
14:41	20.86	0.00	18.79
14:42	20.86	0.00	18.74
14:43	20.86	0.00	18.80
14:44	20.86	0.00	19.01
14:45	20.86	0.00	18.96
14:46	20.86	0.00	19.41
14:47	20.86	0.00	19.29
14:48	20.86	0.00	19.74

Parameter	O_2 - Inlet	CO_2 - Inlet	VOM - Inlet
Uncorrected Run Average (C_{obs})	20.8	0.0	19.2
Cal Gas Concentration (C_{MA})	10.0	9.9	250.0
Pretest System Zero Response	0.10	0.00	1.16
Posttest System Zero Response	0.16	0.00	0.82
Average Zero Response (Co)	0.1	0.0	1.0
Pretest System Cal Response	9.94	9.85	124.46
Posttest System Cal Response	10.03	9.93	124.79
Average Cal Response (C_M)	10.0	9.9	124.6
Corrected Run Average (Corr)	21.0	0.0	NA

Location Koppers Naphthalene Distillation Plant - Cicero, IL
Source TO-5 Outlet - Condition 2
Project No. 2020-1351

Run Number		Run 2	Run 3*	Run 4	Average
Date		9/29/20	9/30/20	9/30/20	--
Start Time		17:26	10:01	14:08	--
Stop Time		18:26	12:06	15:08	--
Input Data - Outlet					
Moisture Fraction, dimensionless	BWS	0.069	0.062	0.069	0.067
Volumetric Flow Rate (M1-4), dscfm	Qs	3,064	3,121	2,729	2,971
Calculated Data - Inlet					
VOMi (as C3H8) Concentration, ppmvd	C_{VOMi}	29.87	16.05	19.40	21.77
VOMi (as C3H8) Concentration, ppmvw	C_{VOMiw}	29.51	15.89	19.17	21.52
VOMi (as C3H8) Emission Rate, lb/hr	ER_{VOMi}	0.015	0.0080	0.0093	0.0109
Calculated Data - Outlet					
O_2 Concentration, % dry	C_{O_2}	15.65	15.64	15.59	15.62
CO_2 Concentration, % dry	C_{CO_2}	3.29	3.55	3.36	3.40
SO_2 Concentration, ppmvd	C_{SO_2}	0.0	0.0	0.0	0.0
SO_2 Emission Rate, lb/hr	ER_{SO_2}	0.00	0.00	0.00	0.00
VOM (as C3H8) Concentration, ppmvd	C_{VOM}	2.8	1.9	1.4	2.0
VOM (as C3H8) Concentration, ppmvw	$C_{VOM\,w}$	2.6	1.8	1.3	1.9
VOM (as C3H8) Concentration, ppmvd @ 3 % O_2	$C_{VOM\,(as\,C3H8)c3}$	9.6	6.4	4.7	6.9
VOM (as C3H8) Emission Rate, lb/hr	ER_{VOM}	0.059	0.040	0.026	0.042

*Run 3 paused due to operational issues

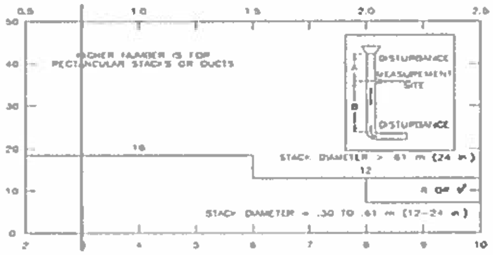
Alliance SOURCE TESTING

Method 1 Data

Location Koppers Naphthalene Distillation Plant - Cicero, IL
Source TO-5 Outlet - Condition 2
Project No. 2020-1351
Date: 09/29/20

Stack Parameters

Duct Orientation:	Vertical	
Duct Design:	Circular	
Distance from Far Wall to Outside of Port:	41.00	in
Nipple Length:	4.50	in
Depth of Duct:	36.50	in
Cross Sectional Area of Duct:	7.27	ft²
No. of Test Ports:	2	
Number of Readings per Point:	1	
Distance A:	15.4	ft
Distance A Duct Diameters:	5.1	(must be > 0.5)
Distance B:	9.0	ft
Distance B Duct Diameters:	3.0	(must be > 2)
Minimum Number of Traverse Points:	16	
Actual Number of Traverse Points:	16	
Measurer (Initial and Date):	BRB	
Reviewer (Initial and Date):	JH	



CIRCULAR DUCT

LOCATION OF TRAVERSE POINTS

Number of traverse points on a diameter

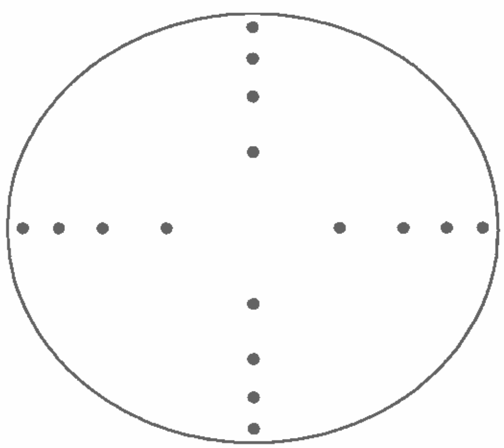
	2	3	4	5	6	7	8	9	10	11	12
1	14.6	--	6.7	--	4.4	--	3.2	--	2.6	--	2.1
2	85.4	--	25.0	--	14.6	--	10.5	--	8.2	--	6.7
3	--	--	75.0	--	29.6	--	19.4	--	14.6	--	11.8
4	--	--	93.3	--	70.4	--	32.3	--	22.6	--	17.7
5	--	--	--	--	85.4	--	67.7	--	34.2	--	25.0
6	--	--	--	--	95.6	--	80.6	--	65.8	--	35.6
7	--	--	--	--	--	--	89.5	--	77.4	--	64.4
8	--	--	--	--	--	--	96.8	--	85.4	--	75.0
9	--	--	--	--	--	--	--	--	91.8	--	82.3
10	--	--	--	--	--	--	--	--	97.4	--	88.2
11	--	--	--	--	--	--	--	--	--	--	93.3
12	--	--	--	--	--	--	--	--	--	--	97.9

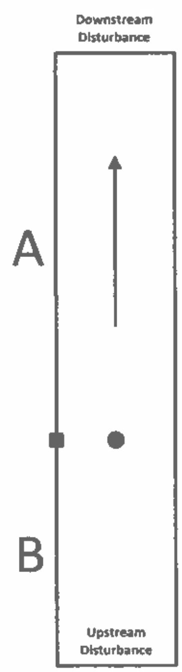
**Percent of stack diameter from inside wall to traverse point.*

Traverse Point	% of Diameter	Distance from inside wall	Distance from outside of port
1	3.2	1.17	5.67
2	10.5	3.83	8.33
3	19.4	7.08	11.58
4	32.3	11.79	16.29
5	67.7	24.71	29.21
6	80.6	29.42	33.92
7	89.5	32.67	37.17
8	96.8	35.33	39.83
9	--	--	--
10	--	--	--
11	--	--	--
12	--	--	--

Stack Diagram
A = 15.4 ft.
B = 9 ft.
Depth of Duct = 36.5 in.

Cross Sectional Area





Alliance SOURCE TESTING

Cyclonic Flow Check

Location Koppers Naphthalene Distillation Plant - Cicero, IL
Source TO-5 Outlet - Condition 2
Project No. 2020-1351
Date 9/29/20

Sample Point	Angle (ΔP=0)
1	5
2	6
3	7
4	9
5	0
6	1
7	5
8	1
9	0
10	6
11	7
12	9
13	5
14	1
15	3
16	5
Average	4.4

Alliance
SOURCE TESTING

Location Koppers Naphthalene Distillation Plant - Cicero, IL
Source TO-5 Outlet - Condition 2
Project No. 2020-1351

Run No.	2		3		4	
Date	9/29/20		9/30/2020		9/30/2020	
Status	VALID		VALID		VALID	
Start Time	18:15		10:05		14:10	
Stop Time	18:25		10:15		14:20	
Leak Check	Pass		Pass		Pass	
Traverse Point	Δ P (in. WC)	Ts (°F)	Δ P (in. WC)	Ts (°F)	Δ P (in. WC)	Ts (°F)
A1	0.032	432	0.023	427	0.014	427
2	0.023	432	0.037	425	0.025	426
3	0.017	432	0.041	425	0.036	426
4	0.067	432	0.018	426	0.041	426
5	0.001	431	0.052	426	0.033	427
6	0.001	432	0.013	426	0.067	427
7	0.045	431	0.008	426	0.015	426
8	0.052	432	0.055	427	0.002	426
B1	0.044	432	0.031	427	0.042	426
2	0.051	431	0.029	427	0.023	425
3	0.028	432	0.037	427	0.021	426
4	0.011	432	0.040	427	0.030	426
5	0.029	432	0.058	428	0.033	427
6	0.054	432	0.032	429	0.005	427
7	0.072	433	0.031	429	0.034	427
8	0.043	432	0.029	428	0.014	428

Parameter	Symbol	Run 2	Run 3	Run 4	Average
Square Root of ΔP, (in. WC)$^{1/2}$	$(\Delta P)^{1/2}$	0.175	0.178	0.157	0.170
Average ΔP, in. WC	(ΔP)	0.04	0.03	0.03	0.03
Pitot Tube Coefficient	(Cp)	0.840	0.840	0.840	0.840
Barometric Pressure, in. Hg	(Pb)	29.25	28.90	28.90	28.97
Static Pressure, in. WC	(Pg)	-0.32	-0.29	-0.29	-0.30
Stack Pressure, in. Hg	(Ps)	29.23	28.88	28.88	28.99
Average Temperature, °F	(Ts)	431.9	426.9	426.4	428.4
Average Temperature, °R	(Ts)	891.9	886.9	886.4	888.4
Measured Moisture Fraction	(BWSmsd)	0.069	0.062	0.069	0.067
Moisture Fraction @ Saturation	(BWSsat)	22.684	21.803	21.704	22.064
Moisture Fraction	(BWS)	0.069	0.062	0.069	0.067
O2 Concentration, %	(O2)	15.7	15.6	15.6	15.6
CO2 Concentration, %	(CO2)	3.3	3.6	3.4	3.4
Molecuar Weight, lb/lb-mole (dry)	(Md)	29.15	29.20	29.16	29.17
Molecuar Weight, lb/lb-mole (wet)	(Ms)	28.39	28.50	28.39	28.42
Velocity, ft/sec	(Vs)	13.0	13.3	11.7	12.7
VFR at stack conditions, acfm	(Qa)	5,689	5,792	5,099	5,527
VFR at standard conditions, scfh	(Qsw)	197,405	199,708	175,896	191,003
VFR at standard conditions, scfm	(Qsw)	3,290	3,328	2,932	3,183
VFR at standard conditions, dscfm	(Qsd)	3,064	3,121	2,729	2,971

Alliance
SOURCE TESTING

Location Koppers Naphthalene Distillation Plant - Cicero, IL
Source TO-5 Outlet - Condition 2
Project No. 2020-1351
Parameter(s): VFR
Console Type Meter Box

Run No.		2					3*					4				
Date		9/29/20					9/30/2020					9/30/2020				
Status		VALID					VALID					VALID				
Start Time		17:26					10:01					14:08				
End Time		18:36					12:09					15:08				
Run Time, min	(0)	70					60					60				
Meter ID		1369					1369					1369				
Meter Correction Factor	(Y)	1.009					1.009					1.009				
Orifice Calibration Value	(ΔH @)	1.803					1.803					1.803				
Max Vacuum, in. Hg		2					2					2				
Post Leak Check, ft3/min (at max vac.)		0.000					0.000					0.000				
Meter Volume, ft3																
0		633.100					672.200					706.499				
5		635.850					675.000					709.650				
10		638.600					677.800					712.340				
15		641.350					680.720					714.970				
20		644.250					683.430					717.391				
25		646.850					686.240					720.590				
30		649.700					689.130					723.451				
35		652.350					691.800					726.330				
40		655.100					694.400					729.415				
45		657.650					697.220					731.900				
50		660.710					700.000					734.800				
55		663.350					702.860					737.800				
60		666.160					705.738					740.455				
65		668.890														
70		672.045														
Total Meter Volume, ft3	(Vm)	38.945					33.538					33.956				
Temperature, °F		Meter	Probe	Filter	Vacuum	Imp. Exit	Meter	Probe	Filter	Vacuum	Imp. Exit	Meter	Probe	Filter	Vacuum	Imp. Exit
0		72	--	--	2	64	72	--	--	2	67	69.0	--	--	2	62.0
5		72	--	--	2	64	72	--	--	2	64	69.0	--	--	2	61.0
10		72	--	--	2	64	71	--	--	2	62	70.0	--	--	2	61.0
15		73	--	--	2	63	71	--	--	2	60	70.0	--	--	2	61.0
20		73	--	--	2	63	71	--	--	2	59	70.0	--	--	2	61.0
25		73	--	--	2	63	70	--	--	2	59	70.0	--	--	2	61.0
30		74	--	--	2	63	70	--	--	2	59	70.0	--	--	2	61.0
35		74	--	--	2	62	70	--	--	2	59	70.0	--	--	2	60.0
40		74	--	--	2	62	69	--	--	2	60	70.0	--	--	2	60.0
45		74	--	--	2	62	69	--	--	2	60	70.0	--	--	2	60.0
50		74	--	--	2	62	69	--	--	2	60	70.0	--	--	2	60.0
55		74	--	--	2	62	69	--	--	2	60	70.0	--	--	2	60.0
60		74	--	--	2	62	69	--	--	2	60	70.0	--	--	2	60.0
65		74	--	--	2	62	--	--	--		--	--	--	--	--	
70		74	--	--	2	62	--	--	--		--	--	--	--	--	--
Average Temperature, °F	(Tm)	73	--	--	--	--	70	--	--	--	--	70	--	--	--	--
Average Temperature, °R	(Tm)	533	--	--	--	--	530	--	--	--	--	530	--	--	--	--
Minimum Temperature, °F		72	--	--	--	--	69	--	--	--	--	69	--	--	--	--
Maximum Temperature, °F		74	--	--	--	64	72	--	--	--	67	70	--	--	--	62
Barometeric Pressure, in. Hg	(Pb)	29.25					28.90					28.90				
Meter Orifice Pressure , in. WC	(ΔH)	1.000					1.000					1.000				
Meter Pressure, in. Hg	(Pm)	29.32					28.97					28.97				
Standard Meter Volume, ft3	(Vmstd)	38.122					32.636					33.062				
Analysis Type		Gravimetric					Gravimetric					Gravimetric				
Impinger 1, Pre/Post Test, ml.		H2O		780.8	827.9	47.1	H2O		827.9	865.4	37.5	H2O		723.6	761.7	38.1
Impinger 2, Pre/Post Test, ml.		H2O		861.1	864.8	3.7	H2O		864.8	866.3	1.5	H2O		756.5	760.5	4.0
Impinger 3, Pre/Post Test, ml.		Empty		768.1	769.5	1.4	Empty		769.5	770.1	0.6	Empty		669.6	670.7	1.1
Impinger 4, Pre/Post Test, g		Silica		1010.4	1017.8	7.4	Silica		1017.8	1024.3	6.5	Silica		888.7	897.6	8.9
Volume Water Collected, ml.	(Vlc)	59.6					46.1					52.1				
Standard Water Volume, ft³	(Vwstd)	2.810					2.174					2.457				
Moisture Fraction Measured	(BWS)	0.069					0.062					0.069				
Gas Molecular Weight, lb/lb-mole (dry)	(Md)	29.15					29.20					29.16				
DGM Calibration Check Value	(Yqa)	-0.8					-0.5					0.7				

Alliance SOURCE TESTING

Run 2 - CEMS Data

Location: Koppers Naphthalene Distillation Plant - Cicero, IL
Source: TO-5 Outlet - Condition 2
Project No.: 2020-1351
Date: 9/29/20

Time Unit Status	O_2 - Outlet % dry Valid	CO_2 - Outlet % dry Valid	SO_2 - Outlet ppmvd Valid	VOM - Outlet ppmvw Valid
17:26	15.51	3.27	0.00	1.80
17:27	15.51	3.28	0.00	2.70
17:28	15.49	3.29	0.00	1.05
17:29	15.51	3.29	0.00	1.56
17:30	15.48	3.30	0.00	1.65
17:31	15.48	3.30	0.00	1.99
17:32	15.50	3.29	0.00	3.56
17:33	15.48	3.30	0.00	0.96
17:34	15.50	3.29	0.00	1.16
17:35	15.47	3.30	0.00	3.96
17:36	15.50	3.28	0.00	4.09
17:37	15.52	3.28	0.00	3.50
17:38	15.47	3.30	0.00	2.92
17:39	15.52	3.28	0.00	3.91
17:40	15.52	3.28	0.00	1.19
17:41	15.52	3.27	0.00	2.46
17:42	15.51	3.27	0.00	3.62
17:43	15.51	3.29	0.00	1.57
17:44	15.51	3.29	0.00	2.39
17:45	15.54	3.26	0.00	2.39
17:46	15.50	3.29	0.00	3.07
17:47	15.50	3.29	0.00	2.87
17:48	15.49	3.29	0.00	2.73
17:49	15.49	3.30	0.00	2.12
17:50	15.48	3.29	0.00	2.42
17:51	15.48	3.30	0.00	1.42
17:52	15.49	3.29	0.00	1.02
17:53	15.50	3.28	0.00	3.01
17:54	15.36	3.28	0.00	1.34
17:55	15.53	3.29	0.00	3.82
17:56	15.43	3.30	0.00	2.72
17:57	15.55	3.29	0.00	2.00
17:58	15.35	3.30	0.00	1.46
17:59	15.50	3.29	0.00	2.08
18:00	15.48	3.28	0.00	3.29
18:01	15.50	3.31	0.00	4.05
18:02	15.50	3.28	0.00	2.94
18:03	15.49	3.29	0.00	0.80
18:04	15.48	3.29	0.00	2.36
18:05	15.46	3.28	0.00	2.23
18:06	15.50	3.28	0.00	2.16
18:07	15.50	3.28	0.00	0.94
18:08	15.50	3.29	0.00	3.03
18:09	15.48	3.29	0.00	3.04
18:10	15.48	3.29	0.00	2.06
18:11	15.46	3.31	0.00	3.87
18:12	15.50	3.28	0.00	4.07
18:13	15.47	3.31	0.00	3.08
18:14	15.50	3.28	0.00	4.01
18:15	15.48	3.29	0.00	2.46
18:16	15.50	3.29	0.00	4.18
18:17	15.50	3.28	0.00	3.43
18:18	15.49	3.28	0.00	2.90
18:19	15.49	3.28	0.00	2.98
18:20	15.51	3.27	0.00	3.95
18:21	15.51	3.27	0.00	1.35
18:22	15.50	3.28	0.00	2.60
18:23	15.54	3.26	0.00	3.20
18:24	15.50	3.29	0.00	4.13
18:25	15.54	3.26	0.00	3.38

Parameter	O_2 - Outlet	CO_2 - Outlet	SO_2 - Outlet	VOM - Outlet
Uncorrected Run Average (C_{obs})	15.5	3.3	0.0	2.6
Cal Gas Concentration (C_{MA})	10.0	10.0	20.0	12.0
Pretest System Zero Response	0.00	0.00	0.09	-0.30
Posttest System Zero Response	0.00	0.00	0.03	0.10
Average Zero Response (Co)	0.0	0.0	0.1	-0.1
Pretest System Cal Response	9.90	10.00	19.57	11.60
Posttest System Cal Response	9.90	10.00	19.62	12.10
Average Cal Response (C_M)	9.9	10.0	19.6	11.9
Corrected Run Average (Corr)	15.6	3.3	0.0	2.7

Alliance SOURCE TESTING

Location: Koppers Naphthalene Distillation Plant - Cicero, IL
Source: TO-5 Outlet - Condition 2
Project No.: 2020-1351
Date: 9/30/20

Time Unit Status	O_2 - Outlet % dry Valid	CO_2 - Outlet % dry Valid	SO_2 - Outlet ppmvd Valid	VOM - Outlet ppmvw Valid
10:01	15.57	3.26	0.00	2.06
10:02	15.55	3.27	0.00	1.99
10:03	15.55	3.28	0.00	1.80
10:04	15.55	3.28	0.00	1.71
10:05	15.56	3.27	0.00	1.90
10:06	15.55	3.28	0.00	1.71
10:07	15.55	3.28	0.00	1.89
10:08	15.56	3.28	0.00	1.85
10:09	15.59	3.26	0.00	1.90
10:10	15.55	3.30	0.00	1.75
10:11	15.55	3.29	0.00	1.80
10:12	15.57	3.28	0.00	1.88
10:13	15.54	3.29	0.00	1.79
10:14	15.56	3.29	0.00	1.96
10:15	15.54	3.30	0.00	1.91
10:16	15.58	3.28	0.00	2.13
10:17	15.54	3.30	0.00	1.95
10:18	15.55	3.30	0.00	1.93
10:19	15.57	3.28	0.00	1.97
10:20	15.53	3.31	0.00	1.71
10:21	15.54	3.30	0.00	1.81
10:22	15.55	3.29	0.00	1.95
10:23	15.56	3.29	0.00	2.00
10:24	15.53	3.30	0.00	1.76
10:25	15.54	3.31	0.00	1.80
10:26	15.58	3.28	0.00	2.17
10:27	15.54	3.31	0.00	1.76
10:28	15.56	3.30	0.00	1.89
10:29	15.56	3.30	0.00	1.88
10:30	15.55	3.31	0.00	1.61
10:31	15.58	3.29	0.00	1.84
10:32	15.58	3.30	0.00	1.97
10:33	15.57	3.30	0.00	1.93
10:34	15.57	3.30	0.00	1.73
10:35	15.58	3.30	0.00	1.96
10:36	15.59	3.29	0.00	1.99
10:37	15.57	3.30	0.00	1.86
10:38	15.56	3.32	0.00	1.64
10:39	15.56	3.32	0.00	1.67
10:40	15.59	3.30	0.00	2.04
10:41	15.56	3.33	0.00	1.66
10:42	15.58	3.31	0.00	1.79
10:43	15.59	3.31	0.00	1.81
10:44	15.58	3.32	0.00	1.91
10:45	15.58	3.33	0.00	1.70
10:46	15.55	4.29	0.00	1.59
10:47	15.53	4.29	0.00	1.51
10:48	15.55	4.27	0.00	1.51
10:49	15.54	4.28	0.00	1.54
10:50	15.58	4.26	0.00	1.61
11:56	15.56	4.27	0.00	1.52
11:57	15.54	4.29	0.00	1.32
11:58	15.54	4.29	0.00	1.33
11:59	15.59	4.26	0.00	1.64
12:00	15.55	4.29	0.00	1.48
12:01	15.53	4.30	0.00	1.37
12:02	15.56	4.27	0.00	1.53
12:03	15.56	4.27	0.00	1.49
12:04	15.53	4.19	0.00	1.32
12:05	15.58	4.10	0.00	1.67

Parameter	O_2 - Outlet	CO_2 - Outlet	SO_2 - Outlet	VOM - Outlet
Uncorrected Run Average (C_{obs})	15.6	3.5	0.0	1.8
Cal Gas Concentration (C_{MA})	10.0	10.0	20.0	12.0
Pretest System Zero Response	0.00	0.00	0.09	0.10
Posttest System Zero Response	0.00	0.00	0.20	0.00
Average Zero Response (Co)	0.0	0.0	0.1	0.1
Pretest System Cal Response	9.90	10.00	19.62	12.10
Posttest System Cal Response	10.00	9.90	19.65	12.20
Average Cal Response (C_M)	10.0	10.0	19.6	12.2
Corrected Run Average (Corr)	15.6	3.6	0.0	1.7

Alliance SOURCE TESTING

Location: Koppers Naphthalene Distillation Plant - Cicero, IL
Source: TO-5 Outlet - Condition 2
Project No.: 2020-1351
Date: 9/30/20

Time Unit Status	O_2 - Outlet % dry Valid	CO_2 - Outlet % dry Valid	SO_2 - Outlet ppmvd Valid	VOM - Outlet ppmvw Valid
14:08	15.60	3.47	0.00	1.64
14:09	15.61	3.41	0.00	1.32
14:10	15.61	3.38	0.00	1.24
14:11	15.64	3.36	0.00	1.12
14:12	15.61	3.40	0.00	0.98
14:13	15.61	3.39	0.00	1.04
14:14	15.61	3.41	0.00	1.08
14:15	15.59	3.41	0.00	0.90
14:16	15.61	3.40	0.00	1.01
14:17	15.62	3.37	0.00	1.02
14:18	15.58	3.41	0.00	1.04
14:19	15.62	3.38	0.00	1.13
14:20	15.60	3.43	0.00	0.91
14:21	15.59	3.46	0.00	0.85
14:22	15.60	3.46	0.00	0.79
14:23	15.59	3.47	0.00	0.89
14:24	15.58	3.47	0.00	0.71
14:25	15.58	3.43	0.00	0.89
14:26	15.60	3.42	0.00	0.74
14:27	15.57	3.41	0.00	0.77
14:28	15.59	3.38	0.00	0.69
14:29	15.57	3.43	0.00	1.03
14:30	15.60	3.41	0.00	0.72
14:31	15.57	3.39	0.00	0.75
14:32	15.61	3.32	0.00	0.97
14:33	15.58	3.34	0.00	0.72
14:34	15.58	3.32	0.00	1.01
14:35	15.61	3.30	0.00	1.27
14:36	15.58	3.31	0.00	1.27
14:37	15.58	3.30	0.00	1.37
14:38	15.60	3.29	0.00	1.34
14:39	15.59	3.29	0.00	1.43
14:40	15.59	3.29	0.00	1.52
14:41	15.56	3.29	0.00	1.65
14:42	15.58	3.29	0.00	1.49
14:43	15.58	3.28	0.00	1.71
14:44	15.59	3.28	0.00	1.60
14:45	15.55	3.29	0.00	1.69
14:46	15.60	3.27	0.00	1.54
14:47	15.59	3.27	0.00	1.59
14:48	15.59	3.27	0.00	1.62
14:49	15.58	3.28	0.00	1.59
14:50	15.58	3.27	0.00	1.71
14:51	15.58	3.28	0.00	1.70
14:52	15.57	3.28	0.00	1.67
14:53	15.59	3.27	0.00	1.40
14:54	15.60	3.27	0.00	1.57
14:55	15.61	3.26	0.00	1.51
14:56	15.56	3.29	0.00	1.60
14:57	15.58	3.28	0.00	1.98
14:58	15.56	3.30	0.00	1.44
14:59	15.56	3.29	0.00	1.68
15:00	15.59	3.27	0.00	1.85
15:01	15.53	3.32	0.00	1.66
15:02	15.57	3.29	0.00	1.50
15:03	15.57	3.29	0.00	1.82
15:04	15.57	3.29	0.00	1.71
15:05	15.56	3.30	0.00	1.53
15:06	15.60	3.28	0.00	1.58
15:07	15.60	3.28	0.00	1.87

Parameter	O_2 - Outlet	CO_2 - Outlet	SO_2 - Outlet	VOM - Outlet
Uncorrected Run Average (C_{obs})	15.6	3.3	0.0	1.3
Cal Gas Concentration (C_{MA})	10.0	10.0	20.0	12.0
Pretest System Zero Response	0.00	0.00	0.09	0.00
Posttest System Zero Response	0.00	0.00	0.06	0.00
Average Zero Response (Co)	0.0	0.0	0.1	0.0
Pretest System Cal Response	10.00	9.90	19.65	12.20
Posttest System Cal Response	10.00	10.00	19.66	12.10
Average Cal Response (C_M)	10.0	10.0	19.7	12.2
Corrected Run Average (Corr)	15.6	3.4	0.0	1.3

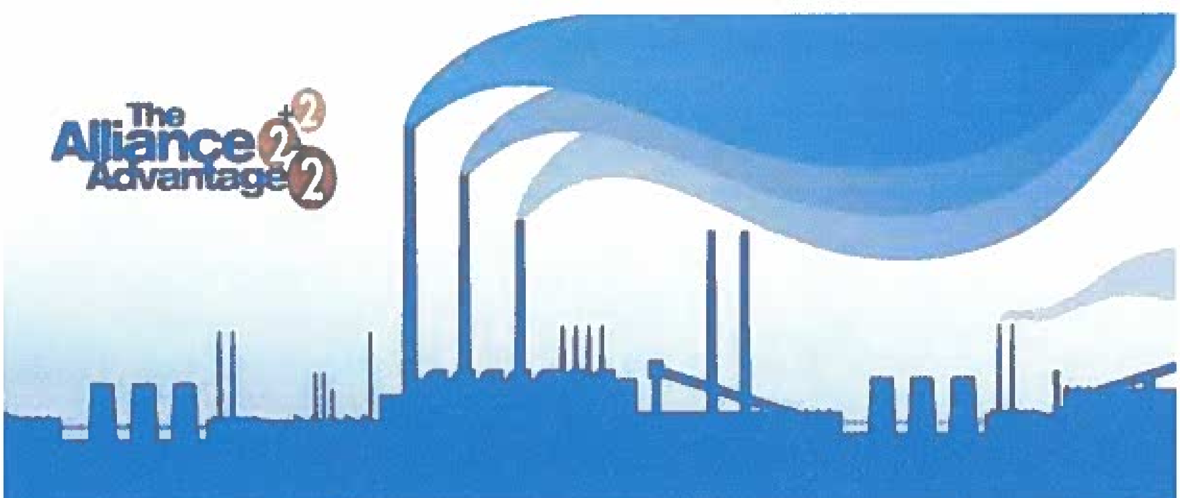
Appendix C

Alliance Source Testing, LLC
Lab Services
5530 Marshall St.
Arvada, CO 80002
(720) 457-9504
www.stacktest.com

Analytical Laboratory Report

Koppers, Inc.
3900 South Laramie Avenue
Cicero, IL 60804

Project No. 2020-1351-A-2



Version No. LT 2020-00_20.0

Certification Statement

Alliance Source Testing, LLC (AST) has completed the analysis as described in this report. Results apply only to the source(s) tested and operating condition(s) for the specific test date(s) and time(s) identified within this report. All results are intended to be considered in their entirety, and AST is not responsible for use of less than the complete test report without written consent. This report shall not be reproduced in full or in part without written approval from the customer.

To the best of my knowledge and abilities, all information, facts and test data are correct. Data presented in this report has been checked for completeness and is accurate, error-free and legible. Any deviations or problems are detailed in the relevant sections on the test report.

This document was prepared in portable document format (.pdf) and contains pages as identified in the bottom footer of this document.

Validation Signature

The analytical data and all QC contained within this report was reviewed and validated by the following individual.

James Davidson
Laboratory Manager

10/21/20
Date

Analytical Method(s):	Method 5 - Determination of Particulate Matter Emissions From Stationary Sources Method 202 - Dry Impinger Method for Determining Condensable Particulate Matter Emissions From Stationary Sources
Filterable	The filter(s) were either oven dried and/or desiccated per the method until a final weight was obtained. The liquid fractions were extracted if required, evaporated and cooled until a final weight was obtained. These fractions were summed together to provide the total Particulate Matter collected.
Condensable	The filter(s) were extracted per the method. The organic extract was added to the organic rinse, and the inorganic extract was added to the inorganic rinse. The inorganic fraction was extracted with solvent per the method. Extracts were combined with the organic rinse. The organic and inorganic fractions were evaporated and desiccated until a final weight was obtained.
MDL	The Minimum Detection Level (MDL) is 0.5 mg per fraction. If the measured result for a fraction is less than the MDL, the MDL was used in ensuing calculations.
Blank Correction	If blank correction is performed, only blank values returned higher than the MDL are used. If a blank returns a value less than the MDL, no correction is included.
Custody:	The samples were received by James Davidson on 10/7/20 in Arvada, CO. The samples were received in good condition with proper Chain-of-Custody documentation. No apparent container problems were noted upon receipt. Prior to analysis, the samples were kept secure with access limited to authorized personnel of AST.
Number of Samples:	39
Labeling:	Acceptable
Analyst:	Gaby De Los Santos- Laboratory Analyst
Equipment:	Mettler Toledo Balance ML-104, SN B217893065. This scale was used for analytical determinations of filters and rinse vessels. Denver Instruments Balance TB-6201, SN 17904189. This scale was used to measure the total mass of rinse collected for blank correction. Analysis was performed on the same balance as the associated tare.
Lab Reagents:	Acetone Lot Number: 197207 Hexane Lot Number: 194731
QC Notes:	The samples met the minimum criteria established by the relevant method. A blank correction was applied per the method.

Client	Koppers, Inc.
City, State	Cicero, IL 60804
Project No.	2020-1351-A
Method	EPA Method 5

Front Half Filter

Lab ID	D15646		D15647		D15648		D15649	
Field ID	M5 Cont 1 Caustic Scrubber (CD-2) Outlet Run 1		M5 Cont 1 Caustic Scrubber (CD-2) Outlet Run 2		M5 Cont 1 Caustic Scrubber (CD-2) Outlet Run 3		M5 Cont 1 Caustic Scrubber (CD-2) Outlet Run 4	
Filter ID	13205		13206		14113		13228	
Filter Tare Weight, g	0.4596		0.4693		0.3354		0.4650	
Date - Dessicator	10/13/20		10/13/20		10/13/20		10/13/20	
Time - Dessicator	7:52		7:52		7:52		7:52	
Date of Weighing	10/14/20	10/15/20	10/14/20	10/15/20	10/14/20	10/15/20	10/14/20	10/15/20
Time of Weighing	8:26	7:47	8:26	7:48	8:24	7:45	8:26	7:48
Filter Weight, g	0.3403	0.3405	0.3459	0.3457	0.3350	0.3350	0.3402	0.3397
Measured Filter Mass, mg	-119.2		-123.5		-0.4		-125.1	
Filter PM Mass, mg*	0.5		0.5		0.5		0.5	

Front Half Rinse

Lab ID	D15650		D15651		D15652		D15653	
Field ID	M5 Cont 2 Caustic Scrubber (CD-2) Outlet Run 1		M5 Cont 2 Caustic Scrubber (CD-2) Outlet Run 2		M5 Cont 2 Caustic Scrubber (CD-2) Outlet Run 3		M5 Cont 2 Caustic Scrubber (CD-2) Outlet Run 4	
Beaker ID	28975		28976		28987		28988	
Beaker tare, g	89.4312		90.3898		65.9458		75.7853	
Beaker with Acetone, g	175.5		178.3		129.0		167.6	
Acetone Mass, g	86.1		87.9		63.1		91.8	
Date - Dessicator	10/12/20		10/12/20		10/12/20		10/12/20	
Time - Dessicator	8:08		8:08		8:08		8:08	
Date of Weighing	10/14/20	10/15/20	10/14/20	10/15/20	10/14/20	10/15/20	10/14/20	10/15/20
Time of Weighing	8:04	7:38	8:04	7:39	8:05	7:40	8:05	7:41
Weight, g	89.5461	89.5463	90.3926	90.3927	65.9472	65.9476	75.7873	75.7874
Measured Rinse Mass, mg	115.0		2.9		1.6		2.0	
Rinse PM Mass, mg*	115.0		2.9		1.6		2.0	
Blank Corrected	Yes							
Residue from Blank (mg/g)	0.0165		0.0165		0.0165		0.0165	
Amount Subtracted for Blank (mg)	0.9		0.9		0.6		0.9	
Total PM Mass, mg	114.6		1.9		1.1		1.0	

*The total results have been calculated based on MDL values for any sample fractions which were below the MDL.

Client	Koppers, Inc.
City, State	Cicero, IL 60804
Project No.	2020-1351-A
Method	EPA Method 202

Teflon Filter								
Lab ID	D15662		D15663		D15664		D15665	
Field ID	M202 Cont 3 Caustic Scrubber (CD-2) Outlet Run 1		M202 Cont 3 Caustic Scrubber (CD-2) Outlet Run 2		M202 Cont 3 Caustic Scrubber (CD-2) Outlet Run 3		M202 Cont 3 Caustic Scrubber (CD-2) Outlet Run 4	
Organic Fraction								
Lab ID	D15658		D15659		D15660		D15661	
Field ID	M202 Cont 2 Caustic Scrubber (CD-2) Outlet Run 1		M202 Cont 2 Caustic Scrubber (CD-2) Outlet Run 2		M202 Cont 2 Caustic Scrubber (CD-2) Outlet Run 3		M202 Cont 2 Caustic Scrubber (CD-2) Outlet Run 4	
Beaker ID	29059		29066		29069		29077	
Beaker tare, g	64.6108		65.5651		65.6141		65.6911	
Beaker Solvent, g	255.3		238.3		254.3		243.6	
Solvent Mass, g	190.7		172.7		188.7		177.9	
Date - Dessicator	10/16/20		10/16/20		10/16/20		10/16/20	
Time - Dessicator	9:43		9:43		9:43		9:43	
Date of Weighing	10/19/20	10/19/20	10/19/20	10/19/20	10/19/20	10/19/20	10/19/20	10/19/20
Time of Weighing	7:26	13:41	7:31	13:46	7:32	13:46	7:32	13:46
Weight, g	64.6141	64.6145	65.5698	65.5702	65.6247	65.6251	65.7047	65.7050
Measured Organic Mass, mg	3.5		4.9		10.8		13.7	
Organic PM Mass, mg*	3.5		4.9		10.8		13.7	
Inorganic Fraction								
Lab ID	D15654		D15655		D15656		D15657	
Field ID	M202 Cont 1 Caustic Scrubber (CD-2) Outlet Run 1		M202 Cont 1 Caustic Scrubber (CD-2) Outlet Run 2		M202 Cont 1 Caustic Scrubber (CD-2) Outlet Run 3		M202 Cont 1 Caustic Scrubber (CD-2) Outlet Run 4	
Beaker ID	29065		29071		29072		29079	
Beaker tare, g	65.6948		65.2287		64.9410		65.9596	
Beaker Water, g	582.4		597.3		563.6		601.3	
Water Mass, g	516.7		532.1		498.7		535.3	
Date - Dessicator	10/16/20		10/16/20		10/16/20		10/16/20	
Time - Dessicator	14:44		14:44		14:44		14:44	
Date of Weighing	10/19/20	10/19/20	10/19/20	10/19/20	10/19/20	10/19/20	10/19/20	10/19/20
Time of Weighing	6:31	13:20	6:41	13:21	6:41	13:22	6:43	13:25
Weight, g	65.6967	65.6971	65.2311	65.2315	64.9437	64.9437	65.9613	65.9617
Measured Inorganic Mass, mg	2.1		2.6		2.7		1.9	
Inorganic Mass, mg*	2.1		2.6		2.7		1.9	
Blank Corrected	Yes							
Total PM Mass, mg	3.6		5.5		11.5		13.6	

*All fractions were analyzed and returned values greater than the MDL of 0.5 mg.

Client	Koppers, Inc.
City, State	Cicero, IL 60804
Project No.	2020-1351-A
Method	EPA Method 5

Alliance SOURCE TESTING

Acetone Blank		
Lab ID	D15669	
Field ID	M5 Acetone Blank	
Beaker ID	29001	
Beaker tare, g	75.8839	
Beaker with Acetone, g	145.68	
Acetone Mass, g	69.80	
Date - Dessicator	10/12/20	
Time - Dessicator	8:08	
Date of Weighing	10/14/20	10/15/20
Time of Weighing	8:06	7:42
Weight, g	75.8853	75.8848
Measured Blank Mass, mg	**1.2**	
Blank Mass, mg*	**1.2**	
Blank Mass, mg/g	**0.0165**	

Client	Koppers, Inc.
City, State	Cicero, IL 60804
Project No.	2020-1351-A
Method	EPA Method 202

Teflon Filter Blanks

	Field Train Blank	Proof Blank
Lab ID	D15668	N/A
Field ID	M202 FT Recovery Blank Cont 3	N/A

Organic Fraction Blanks

	Field Train Blank		Proof Blank	
Lab ID	D15667		None	
Field ID	M202 FT Recovery Blank Cont 2			
Beaker ID	29081			
Beaker tare, g	65.7527			
Beaker Solvent, g	214.1			
Solvent Mass, g	148.3		--	
Date - Dessicator	10/16/20			
Time - Dessicator	9:43			
Date of Weighing	10/19/20	10/19/20		
Time of Weighing	7:32	13:48		
Weight, g	65.7602	65.7600		
Measured Organic Mass, mg	**7.4**		--	
Organic Mass, mg*	**2.0**		--	

Inorganic Fraction Blanks

	Field Train Blank		Proof Blank	
Lab ID	D15666		None	
Field ID	M202 FT Recovery Blank Cont 1			
Beaker ID	29080			
Beaker tare, g	65.6401			
Beaker Water g	555.0			
Water Mass, g	489.4		--	
Date - Dessicator	10/16/20			
Time - Dessicator	14:44			
Date of Weighing	10/19/20	10/19/20		
Time of Weighing	6:57	13:26		
Weight, g	65.6423	65.6420		
Measured Inorganic Mass, mg	**2.0**		--	
Inorganic Mass, mg*	**2.0**		--	

Alliance

Chain-Of-Custody

Version No. LT 2019-01_19.0

Sample ID	Number of Containers	Date Collected	Time Recovered	Collected By		Method 5: Filter Number - 83mm Quartz	Method 5: Probe/Nozzle Rinse - Acetone	Method 17: Filter Number - 47 mm Quartz	Method 17: Nozzle Rinse - Acetone	[illegible]: Filter Number	[illegible]: Probe/Nozzle Rinse - Acetone	Method 201A: Filter Number - 47mm Quartz	Method 201A: PM10 Rinse - Acetone	Method 201A: PM2.5 Rinse - Acetone	Method 201A: PM2.5 Rinse - Acetone	Method 202: Filter - 83mm Teflon	Method 202: Condensate Catch - DI/LF	Method 202: Solvent Rinse - Acetone/Hexane
[illegible]		10/1	11:30	BRB		13940	✓									✓	✓	✓
[illegible]		10/1	14:15	BRB		13934	✓									✓	✓	✓
[illegible]		10/1	17:15	BRB		13929	✓									✓	✓	✓
[illegible]		10/1	12:30	BRB														
[illegible]		10/1	12:30	BRB												✓	✓	✓
[illegible]		9/29	18:00	BRB		13205	✓									✓	✓	✓
[illegible]		9/29	20:45	BRB		13206	✓									✓	✓	✓
[illegible]		9/30	14:30	BRB		1413-C	✓									✓	✓	✓
[illegible]		9/30	17:30	BRB		13225	✓									✓	✓	✓

Relinquished By: [signature] Date: 10/2

Received By: [signature] Date: 10/7

Calibration Certificate ID
NA1548-060-022420-ACC-USL

METTLER TOLEDO

Mettler Toledo, LLC
1900 Polaris Parkway
Columbus, OH 43240
1.800.METTLER

Accredited by the American Association for Laboratory Accreditation (A2LA)
CALIBRATION CERT #1788.01

ISO 17025 Accredited
ANSI/NCSL Z540-1 Accredited

Accuracy Calibration Certificate

Customer

Company:	Alliance Source Testing		
Address:	5530 Marshall St		
City:	Arvada	Contact:	Jim Davidson
Zip / Postal:	80002-3108		
State / Province:	Colorado		

Weighing Device

Manufacturer:	Mettler Toledo	Instrument Type:	Weighing Instrument
Model:	ML104/03	Asset Number:	NA
Serial No.:	B217893065	Terminal Model:	NA
Building:	5520	Terminal Serial No.:	NA
Floor:	1	Terminal Asset No.:	NA
Room:	Lab		

Range	Max. Capacity	Readability (d)
1	120 g	0.0001 g

Procedure

Calibration Guideline:	EURAMET cg-18 v. 4.0 (11/2015)
METTLER TOLEDO Work Instruction:	30260953 Rev1.31

This calibration certificate contains measurements for As Found and As Left calibrations.

The sensitivity/span of the weighing instrument was adjusted before As Left calibration with a built-in weight.

	Temperature	
As Found	Start: 21.8 °C	End: 21.6 °C
As Left	Start: 21.7 °C	End: 21.6 °C

Environmental conditions have been verified to ensure the accuracy of the calibration.

This certificate is issued in accordance with the conditions of accreditation granted by A2LA, which is based on ISO/IEC 17025. A2LA has assessed the measurement capability of the laboratory and its traceability to recognized national standards.

As Found Calibration Date:	24-Feb-2020
As Left Calibration Date:	24-Feb-2020
Issue Date:	24-Feb-2020
Requested Next Calibration Date:	28-Feb-2021

Authorized A2LA Signatory:

Chris Carson

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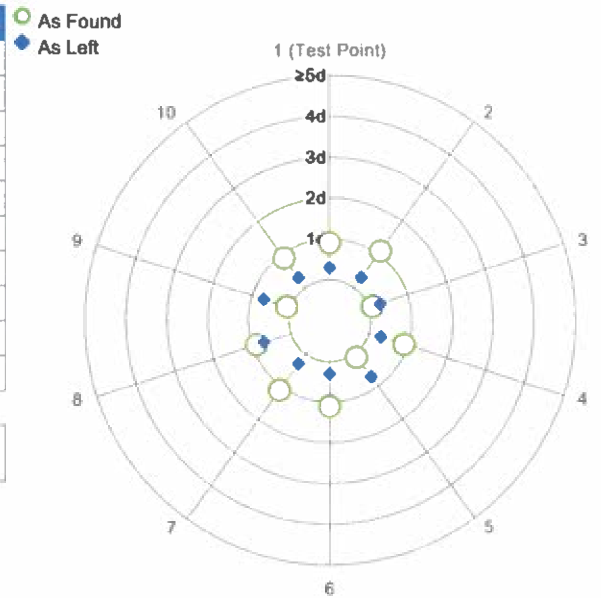
Measurement Results

Repeatability

Test Load: 100 g

	As Found	As Left
1	100.0004 g	100.0002 g
2	100.0002 g	100.0002 g
3	100.0003 g	100.0002 g
4	100.0004 g	100.0002 g
5	100.0003 g	100.0001 g
6	100.0002 g	100.0002 g
7	100.0002 g	100.0002 g
8	100.0004 g	100.0001 g
9	100.0003 g	100.0001 g
10	100.0004 g	100.0002 g
Standard Deviation	0.00009 g	0.00005 g



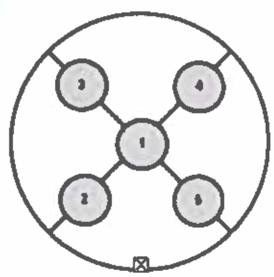
The "d" in the graph represents the readability of the range/interval in which the test was performed.

The results of this graph are based upon the absolute values of the differences from the mean value.

Eccentricity

Test Load: 50 g

Position	As Found	As Left
1	0.0000 g	0.0000 g
2	0.0000 g	0.0000 g
3	0.0000 g	0.0000 g
4	0.0000 g	0.0000 g
5	0.0000 g	0.0000 g
Maximum Deviation	0.0000 g	0.0000 g



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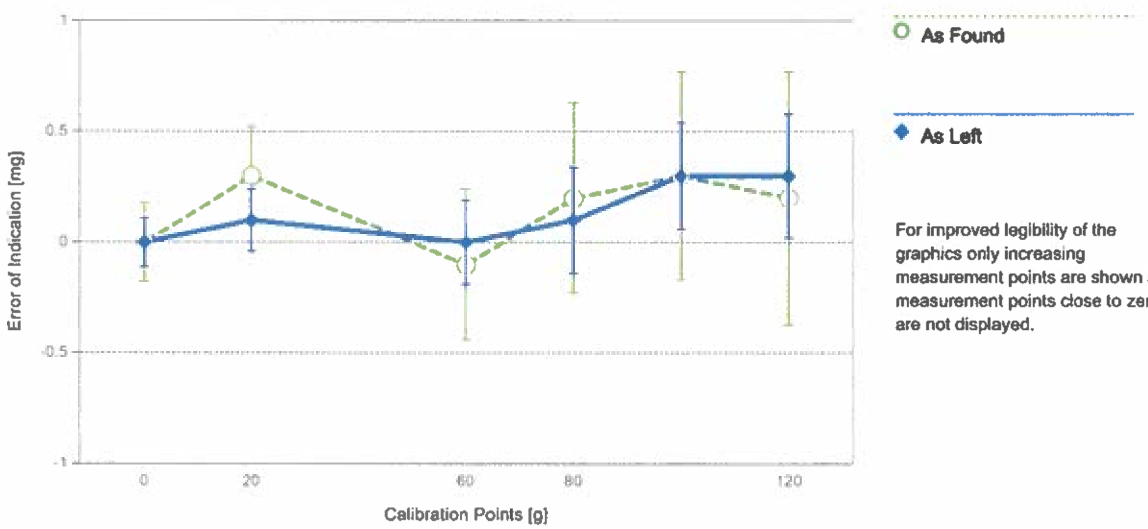
Error of Indication

As Found

	Tare Load	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	N/A	0.0000 g	0.0000 g	0.0000 g	0.18 mg	2
2	0 g	20.0001 g	20.0004 g	0.0003 g	0.22 mg	2
3	20 g	20.0001 g	20.0002 g	0.0001 g	0.22 mg	2
4	40 g	20.0001 g	20.0002 g	0.0001 g	0.22 mg	2
5	60 g	20.0001 g	20.0002 g	0.0001 g	0.22 mg	2
6	80 g	20.0001 g	20.0002 g	0.0001 g	0.22 mg	2
7	N/A	60.0001 g	60.0000 g	-0.0001 g	0.34 mg	2
8	N/A	80.0001 g	80.0003 g	0.0002 g	0.43 mg	2
9	N/A	100.0000 g	100.0003 g	0.0003 g	0.47 mg	2
10	N/A	120.0001 g	120.0003 g	0.0002 g	0.57 mg	2

As Left

	Tare Load	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	N/A	0.0000 g	0.0000 g	0.0000 g	0.11 mg	2
2	0 g	20.0001 g	20.0002 g	0.0001 g	0.14 mg	2
3	20 g	20.0001 g	20.0002 g	0.0001 g	0.14 mg	2
4	40 g	20.0001 g	20.0001 g	0.0000 g	0.14 mg	2
5	60 g	20.0001 g	20.0002 g	0.0001 g	0.14 mg	2
6	80 g	20.0001 g	20.0002 g	0.0001 g	0.14 mg	2
7	N/A	60.0001 g	60.0001 g	0.0000 g	0.19 mg	2
8	N/A	80.0001 g	80.0002 g	0.0001 g	0.24 mg	2
9	N/A	100.0000 g	100.0003 g	0.0003 g	0.24 mg	2
10	N/A	120.0001 g	120.0004 g	0.0003 g	0.28 mg	2



For improved legibility of the graphics only increasing measurement points are shown and measurement points close to zero are not displayed.

The uncertainty stated is the expanded uncertainty at calibration obtained by multiplying the standard combined uncertainty by the coverage factor k – which can be larger than 2 according to EURAMET cg-18. The value of the measurand lies within the assigned range of values with a probability of approximately 95%.

The user is responsible for maintaining environmental conditions and the settings of the weighing instrument when it was calibrated.

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METTLER TOLEDO Service

Test Equipment

All weights used for metrological testing are traceable to national or international standards. The weights were calibrated and certified by an accredited calibration laboratory.

Weight Set 1: OIML E2

Weight Set No.:	443	Date of Issue:	14-Jan-2020
Certificate Number:	01119376-1	Calibration Due Date:	31-Jan-2021

Remarks

N/A

End of Accredited Section

The information below and any attachments to this calibration certificate are not part of the accredited calibration.

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Measurement Uncertainty of the Weighing Instrument in Use

Stated is the expanded uncertainty with k=2 in use. The formula shall be used for the estimation of the uncertainty under consideration of the errors of indication. The value R represents the net load indication in the unit of measure of the device.

Temperature coefficient for the evaluation of the measurement uncertainty in use: $2.0 \cdot 10^{-6}$ / K

Temperature range on site for the evaluation of the measurement uncertainty in use: 4 K

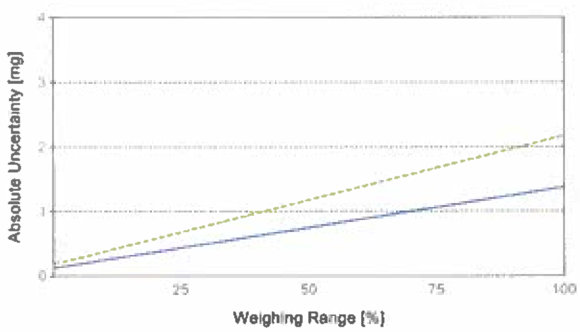
Linearization of Uncertainty Equation

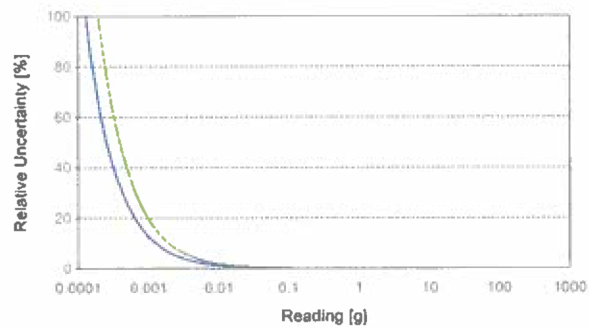
	Range	As Found	As Left
1	0 g - 120 g	U_1 = 0.19 mg + 0.0165 mg/g · R	U_1 = 0.13 mg + 0.0104 mg/g · R

To optimize the stability of the linearization, besides of the zero load only increasing measurement points with a test load of 5% of the measurement range or larger are taken for the calculation of the linear equation.

Absolute and Relative Measurement Uncertainty in Use for Various Net Indications (Examples)

Net Indication	As Found		As Left	
0.0120 g	0.19 mg	1.6%	0.13 mg	1.1%
0.1200 g	0.19 mg	0.16%	0.13 mg	0.11%
1.2000 g	0.21 mg	0.017%	0.14 mg	0.012%
12.0000 g	0.39 mg	0.0032%	0.25 mg	0.0021%
120.0000 g	2.2 mg	0.0018%	1.4 mg	0.0011%





As Found .... As Left ——

METTLER TOLEDO Service

Manufacturer Tolerance Assessment

The measurements from the attached calibration certificate were assessed against METTLER TOLEDO tolerances defined in SOP 'Test and Measurement Procedures for METTLER TOLEDO balances, Document: 10000018502.

	As Found	As Left
Overall	✓	✓
Repeatability	✓	✓
Eccentricity	✓	✓
Linearity	✓	✓
Sensitivity	N/A	✓

Measurement Results

Repeatability

Test Load: 100 g

	As Found	As Left
1	100.0004 g	100.0002 g
2	100.0002 g	100.0002 g
3	100.0003 g	100.0002 g
4	100.0004 g	100.0002 g
5	100.0003 g	100.0001 g
6	100.0002 g	100.0002 g
7	100.0002 g	100.0002 g
8	100.0004 g	100.0001 g
9	100.0003 g	100.0001 g
10	100.0004 g	100.0002 g

Standard Deviation	0.00009 g	0.00005 g
Tolerance	0.00010 g ✓	0.00010 g ✓

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METTLER TOLEDO Service

Eccentricity

Test Load: 50 g

Position	As Found	As Left
1	0.0000 g	0.0000 g
2	0.0000 g	0.0000 g
3	0.0000 g	0.0000 g
4	0.0000 g	0.0000 g
5	0.0000 g	0.0000 g

Maximum Deviation	**0.0000 g**	**0.0000 g**
Tolerance	**0.00030 g** ✓	**0.00030 g** ✓

The maximum deviation is determined as the absolute value of the largest deviation from the center.

Linearity - Differential Method

As Found

	Preload	Reference Value	Indication	Deviation
2	0 g	20.0001 g	20.0004 g	0.00016 g
3	20 g	20.0001 g	20.0002 g	0.00012 g
4	40 g	20.0001 g	20.0002 g	0.00008 g
5	60 g	20.0001 g	20.0002 g	0.00004 g
6	80 g	20.0001 g	20.0002 g	0.00000 g
9	N/A	100.0000 g	100.0003 g	0.00000 g

Linearity Deviation	**0.00016 g**
Linearity Tolerance	**0.0002 g** ✓

Sensitivity Deviation	**0.0003 g**
Sensitivity Tolerance	**N/A**

The As Found Sensitivity Tolerance is only valid if the device has been adjusted before the test.

As Left

	Preload	Reference Value	Indication	Deviation
2	0 g	20.0001 g	20.0002 g	0.00002 g
3	20 g	20.0001 g	20.0002 g	0.00004 g
4	40 g	20.0001 g	20.0001 g	-0.00004 g
5	60 g	20.0001 g	20.0002 g	-0.00002 g
6	80 g	20.0001 g	20.0002 g	0.00000 g
9*	N/A	100.0000 g	100.0003 g	0.00000 g

Linearity Deviation	**0.00004 g**
Linearity Tolerance	**0.0002 g** ✓

Sensitivity Deviation	**0.0003 g**
Sensitivity Tolerance	**0.0008 g** ✓

The values in column "Deviation" and the "Linearity Deviation" are zero point offset and sensitivity error compensated.

* This point was used to satisfy the sensitivity requirement.

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Calibration Certificate ID
NA1548-061-022420-ACC-USL

Mettler Toledo, LLC
1900 Polaris Parkway
Columbus, OH 43240
1.800.METTLER

METTLER TOLEDO

Accredited by the American Association for Laboratory Accreditation (A2LA)
CALIBRATION CERT #1788.01
ISO 17025 Accredited
ANSI/NCSL Z540-1 Accredited

Accuracy Calibration Certificate

Customer

Company:	Alliance Source Testing		
Address:	5530 Marshall St		
City:	Arvada	**Contact:**	Jim Davidson
Zip / Postal:	80002-3108		
State / Province:	Colorado		

Weighing Device

Manufacturer:	SARTORIUS	**Instrument Type:**	Weighing Instrument
Model:	TB-6201	**Asset Number:**	N/A
Serial No.:	17904189	**Terminal Model:**	N/A
Building:	5520	**Terminal Serial No.:**	N/A
Floor:	1	**Terminal Asset No.:**	N/A
Room:	Lab		

Range	Max. Capacity	Readability (d)
1	6200 g	0.1 g

Procedure

Calibration Guideline:	EURAMET cg-18 v. 4.0 (11/2015)
METTLER TOLEDO Work Instruction:	30260953 Rev1.31

This calibration certificate contains measurements for As Found and As Left calibrations.

The sensitivity/span of the weighing instrument was adjusted before As Left calibration with a built-in weight.

In accordance with EURAMET cg-18 (11/2015), the test loads were selected to reflect the specific use of the weighing device or to accommodate specific calibration conditions.

	Temperature	
As Found	Start: 21.5 °C	End: 21.2 °C
As Left	Start: 21.1 °C	End: 21.0 °C

Environmental conditions have been verified to ensure the accuracy of the calibration.

This certificate is issued in accordance with the conditions of accreditation granted by A2LA, which is based on ISO/IEC 17025. A2LA has assessed the measurement capability of the laboratory and its traceability to recognized national standards.

As Found Calibration Date:	24-Feb-2020
As Left Calibration Date:	24-Feb-2020
Issue Date:	24-Feb-2020
Requested Next Calibration Date:	28-Feb-2021

Authorized A2LA Signatory:

Chris Carson

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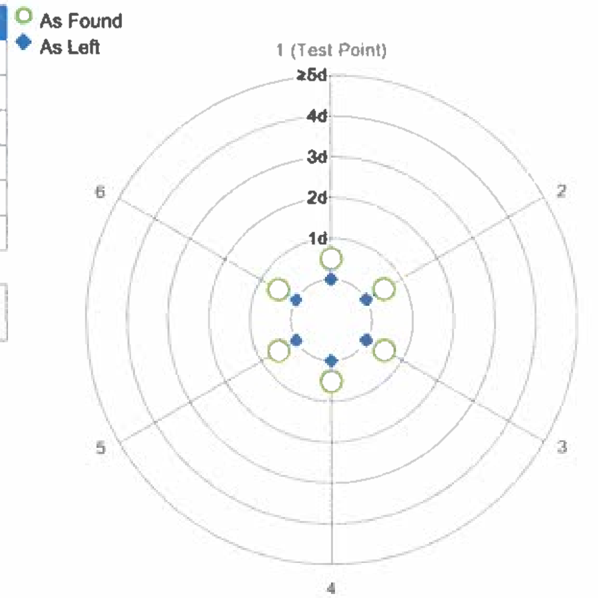
Measurement Results

Repeatability

Test Load: 2000 g

	As Found	As Left
1	1999.9 g	2000.0 g
2	1999.8 g	2000.0 g
3	1999.8 g	2000.0 g
4	1999.8 g	2000.0 g
5	1999.9 g	2000.0 g
6	1999.9 g	2000.0 g
Standard Deviation	0.05 g	0.00 g



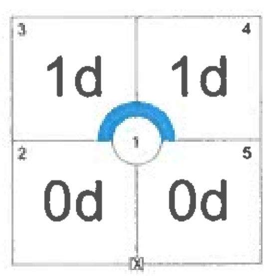
The "d" in the graph represents the readability of the range/interval in which the test was performed.

The results of this graph are based upon the absolute values of the differences from the mean value.

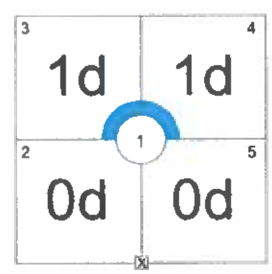
Eccentricity

Test Load: 2000 g

Position	As Found	As Left
1	0.0 g	0.0 g
2	0.0 g	0.0 g
3	-0.1 g	-0.1 g
4	-0.1 g	-0.1 g
5	0.0 g	0.0 g
Maximum Deviation	0.1 g	0.1 g



As Found



As Left

The "d" in the graph represents the readability of the range/interval in which the test was performed.

Error of Indication

As Found

	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.0 g	0.0 g	0.0 g	0.15 g	2.37
2	1000.0 g	999.9 g	-0.1 g	0.16 g	2.28
3	3000.0 g	2999.8 g	-0.2 g	0.17 g	2.13
4	4000.0 g	3999.7 g	-0.3 g	0.19 g	2.13
5	6000.0 g	5999.6 g	-0.4 g	0.23 g	2.05

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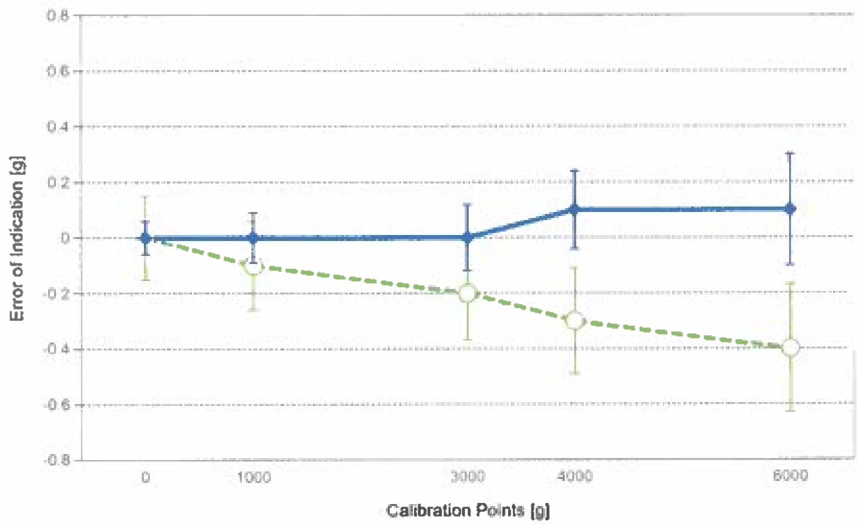
As Left

	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.0 g	0.0 g	0.0 g	0.06 g	2
2	1000.0 g	1000.0 g	0.0 g	0.09 g	2
3	3000.0 g	3000.0 g	0.0 g	0.12 g	2
4	4000.0 g	4000.1 g	0.1 g	0.14 g	2
5	6000.0 g	6000.1 g	0.1 g	0.20 g	2



For improved legibility of the graphics only increasing measurement points are shown and measurement points close to zero are not displayed.

The uncertainty stated is the expanded uncertainty at calibration obtained by multiplying the standard combined uncertainty by the coverage factor k – which can be larger than 2 according to EURAMET cg-18. The value of the measurand lies within the assigned range of values with a probability of approximately 95%.

The user is responsible for maintaining environmental conditions and the settings of the weighing instrument when it was calibrated.

Test Equipment

All weights used for metrological testing are traceable to national or international standards. The weights were calibrated and certified by an accredited calibration laboratory.

Weight Set 1: OIML F1

Weight Set No.:	677	Date of Issue:	21-Jan-2019
Certificate Number:	01055053-1	Calibration Due Date:	31-Jan-2021

Remarks

N/A

End of Accredited Section

The information below and any attachments to this calibration certificate are not part of the accredited calibration.

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Measurement Uncertainty of the Weighing Instrument in Use

Stated is the expanded uncertainty with k=2 in use. The formula shall be used for the estimation of the uncertainty under consideration of the errors of indication. The value R represents the net load indication in the unit of measure of the device.

Temperature coefficient for the evaluation of the measurement uncertainty in use: $6.0 \cdot 10^{-6}$ / K

Temperature range on site for the evaluation of the measurement uncertainty in use: 6 K

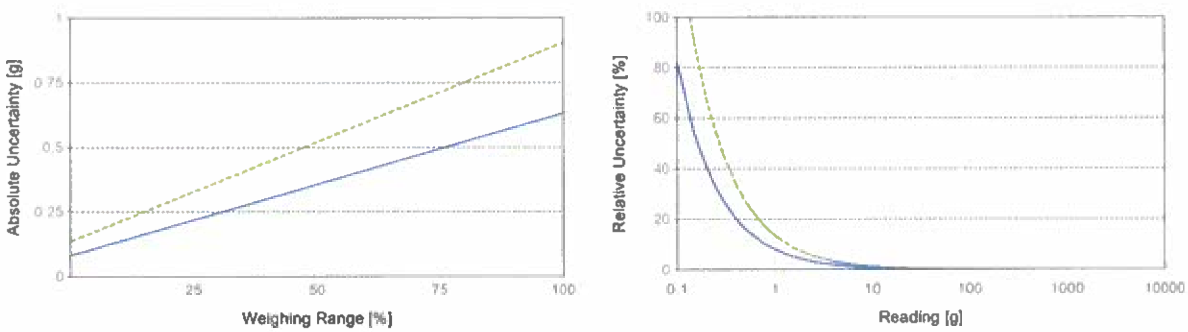
Linearization of Uncertainty Equation

	Range	As Found	As Left
1	0 g - 6200 g	U_1 = 137 mg + 0.124 mg/g · R	U_1 = 82 mg + 0.0887 mg/g · R

To optimize the stability of the linearization, besides of the zero load only increasing measurement points with a test load of 5% of the measurement range or larger are taken for the calculation of the linear equation.

Absolute and Relative Measurement Uncertainty in Use for Various Net Indications (Examples)

Net Indication	As Found		As Left	
6.2 g	0.14 g	2.2%	0.083 g	1.3%
62.0 g	0.14 g	0.23%	0.087 g	0.14%
620.0 g	0.21 g	0.034%	0.14 g	0.022%
3100.0 g	0.52 g	0.017%	0.36 g	0.012%
6200.0 g	0.91 g	0.015%	0.63 g	0.010%



As Found
As Left

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METTLER TOLEDO Service

Custom Tolerance Assessment

One or more of the measurements from the attached calibration certificate were assessed against customer-defined tolerances.

	As Found	As Left
Overall	✓	✓
Repeatability	✓	✓
Eccentricity	✓	✓
Error of Indication	✓	✓

Measurement Results

Repeatability

Test Load: 2000 g

	As Found	As Left
1	1999.9 g	2000.0 g
2	1999.8 g	2000.0 g
3	1999.8 g	2000.0 g
4	1999.8 g	2000.0 g
5	1999.9 g	2000.0 g
6	1999.9 g	2000.0 g

Standard Deviation	0.05 g	0.00 g
Tolerance	0.10 g ✓	0.10 g ✓

Eccentricity

Test Load: 2000 g

Position	As Found	As Left
1	0.0 g	0.0 g
2	0.0 g	0.0 g
3	-0.1 g	-0.1 g
4	-0.1 g	-0.1 g
5	0.0 g	0.0 g

Maximum Deviation	0.1 g	0.1 g
Tolerance	0.3 g ✓	0.3 g ✓

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METTLER TOLEDO Service

Error of Indication

As Found

	Reference Value	Indication	Error of Indication	Tolerance	
1	0.0 g	0.0 g	0.0 g	0.1 g	✓
2	1000.0 g	999.9 g	-0.1 g	0.4 g	✓
3	3000.0 g	2999.8 g	-0.2 g	1.2 g	✓
4	4000.0 g	3999.7 g	-0.3 g	1.6 g	✓
5	6000.0 g	5999.6 g	-0.4 g	2.4 g	✓

As Left

	Reference Value	Indication	Error of Indication	Tolerance	
1	0.0 g	0.0 g	0.0 g	0.1 g	✓
2	1000.0 g	1000.0 g	0.0 g	0.4 g	✓
3	3000.0 g	3000.0 g	0.0 g	1.2 g	✓
4	4000.0 g	4000.1 g	0.1 g	1.6 g	✓
5	6000.0 g	6000.1 g	0.1 g	2.4 g	✓

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Appendix D

Alliance
SOURCE TESTING

Location Koppers Naphthalene Distillation Plant - Cicero, IL
Source Reboiler/SCR Outlet - Condition 2
Project No. 20-1351
Parameter(s): VFR

Date	Pitot ID	Evidence of damage?	Evidence of mis-alignment?	Calibration or Repair required?
9/29/20	PT-605-2	no	no	no

Date	Probe ID	Reference Temp. (°F)	Indicated Temp. (°F)	Difference	Criteria
9/29/20	PT-605-2	74.0	74.9	0.2%	± 1.5 % (absolute)

Field Balance Check			
Date	09/29/20	09/30/20	
Balance ID:	PHIBAL-1	PHIBAL-1	
Test Weight ID:	PHI1KG-1	PHI1KG-1	
Certifieid Weight (g):	1000.0	1000.0	
Measured Weight (g):	1000.3	1000.4	
Weight Difference (g):	-0.3	-0.4	–

Acceptable Balance Tolerance is measurement within +/- 0.5g of certified weight

Date	Barometric Pressure	Evidence of damage?	Reading Verified	Calibration or Repair required?	Weather Station Location
9/29/20	Weather Station	NA	NA	NA	Cicero, IL

Date	Meter Box ID	Positive Pressure Leak Check
9/29/20	T9B	Pass

Alliance
SOURCE TESTING

QA/QC Data

Location Koppers Naphthalene Distillation Plant - Cicero, IL
Source Main Stack - Condition 2 Natural Gas
Project No. 2020-1351
Parameter PM/CPM

Date	Nozzle ID	Nozzle Diameter (in.) #1	#2	#3	Dn (Average)	Difference	Criteria	Material
9/29/20	SS-602-4	0.520	0.520	0.520	0.520	0.000	≤ 0.004 in.	SS

Date	Pitot ID	Evidence of damage?	Evidence of mis-alignment?	Calibration or Repair required?
9/29/20	PT-606-0	no	no	no

Date	Probe ID	Reference Temp. (°F)	Indicated Temp. (°F)	Difference	Criteria	Probe Length
9/29/20	PR-606-0	150.0	148.8	0.2%	± 1.5 % (absolute)	6'

Date	Barometric Pressure	Evidence of damage?	Reading Verified	Calibration or Repair required?	Weather Station Location
9/29/20	Weather Station	NA	NA	NA	Cicero, IL

Date	Meter Box ID	Positive Pressure Leak Check
9/29/20	5828	Pass

Alliance
SOURCE TESTING

Location Koppers Naphthalene Distillation Plant - Cicero, IL
Source TO-5 Inlet - Condition 2
Project No. 2020-1351
Parameter(s): VFR

Date	Pitot ID	Evidence of damage?	Evidence of mis-alignment?	Calibration or Repair required?	
9/29/20	PT203-2	no	no	no	
Date	**Probe ID**	**Reference Temp. (°F)**	**Indicated Temp. (°F)**	**Difference**	**Criteria**
9/29/20	PT203-2	68.0	67.7	0.1%	± 1.5 % (absolute)

Field Balance Check			
Date	**09/29/20**	**09/30/20**	
Balance ID:	**PHIBAL-1**	**PHIBAL-1**	
Test Weight ID:	**PHI1KG-1**	**PHI1KG-1**	
Certifieid Weight (g):	**1000.0**	**1000.0**	
Measured Weight (g):	**1000.3**	**1000.4**	
Weight Difference (g):	**-0.3**	**-0.4**	–

Acceptable Balance Tolerance is measurement within +/- 0.5g of certified weight

Date	Barometric Pressure	Evidence of damage?	Reading Verified	Calibration or Repair required?	Weather Station Location
9/29/20	Weather Station	NA	NA	NA	Cicero,IL

Date	Meter Box ID	Positive Pressure Leak Check
9/29/20	2026	Pass

Alliance
SOURCE TESTING

Location Koppers Naphthalene Distillation Plant - Cicero, IL
Source TO-5 Outlet - Condition 2
Project No. 2020-1351
Parameter(s): VFR

Date	Pitot ID	Evidence of damage?	Evidence of mis-alignment?	Calibration or Repair required?	
9/29/20	Pt-604-1	no	no	no	
Date	**Barometric Pressure**	**Evidence of damage?**	**Reading Verified**	**Calibration or Repair required?**	**Weather Station Location**
9/29/20	Weather Station	NA	NA	NA	Cicero, IL
Date	**Meter Box ID**	**Positive Pressure Leak Check**			
9/29/20	1369	Pass			

Alliance Source Testing	Name	Console Calibration (Std)		
	Version No.	16.0	Effective Date	6/30/20

Equipment Detail - Dry Gas Meter

Console ID: T9B
Meter S/N:
Critical Orifice S/N: CO-1667s

Calibration Detail

Initial Barometric Pressure, in. Hg	(Pb_I)	29.95		
Final Barometric Pressure, in. Hg	(Pb_F)	29.95		
Average Barometric Pressure, in. Hg	(Pb)	29.95		
Critifcal Orifice ID	(Y)	1667s-28	1667s-19	1667s-7
K' Factor, $ft^3 \cdot R^{1/2}$ / in. WC·min	(K')	0.7684	0.5111	0.1839
Vacuum Pressure, in. Hg	(V_P)	20.0	22.5	26.0
Initial DGM Volume, ft^3	(Vm_I)	0.000	0.000	0.000
Final DGM Volume, ft^3	(Vm_f)	9.979	6.670	2.916
Total DGM Volume, ft^3	(Vm)	9.979	6.670	2.916
Ambient Temperature, °F	(Ta)	75	75	75
Initial DGM Temperature, °F	(Tm_I)	71	73	75
Final DGM Temperature, °F	(Tm_F)	72	74	75
Average DGM Temperature, °F	(Tm)	72	74	75
Elapsed Time	(Θ)	10.0	10.0	12.0
Meter Orifice Pressure, in. WC	(ΔH)	3.20	1.40	0.19
Standard Meter volume, ft^3	(Vmstd)	10.0030	6.6318	2.8826
Standard Critical Orifice Volume, ft^3	(Vcr)	9.9525	6.6199	2.8583
Meter Correction Factor	(Y)	0.995	0.998	0.992
Tolerance	--	0.000	0.003	0.003
Orifice Calibration Value	(ΔH @)	1.822	1.787	1.862
Tolerance	--	0.002	0.037	0.039
Meter Correction Factor	**(Y)**	**0.995**		
Orifice Calibration Value	**(ΔH @)**	**1.823**		

Equipment Detail - Thermocouple Sensor

Reference Calibrator Make:
Reference Calibrator Model:
Reference Calibrator S/N:

Calibration Detail

Reference Temp.		Display Temp.		Accuracy	Difference
°F	°R	°F	°R	%	°F
0	460		-	-	-
68	528		-	-	-
100	560		-	-	-
223	683		-	-	-
248	708		-	-	-
273	733		-	-	-
300	760		-	-	-
400	860		-	-	-
500	960		-	-	-
600	1,060		-	-	-
700	1,160		-	-	-
800	1,260		-	-	-
900	1,360		-	-	-
1,000	1,460		-	-	-
1,100	1,560		-	-	-
1,200	1,660		-	-	-

Personnel

Calibration By: Josh Carr
Calibration Date: 6/30/20
Expiration Date: 12/20/20

Alliance
SOURCE TESTING

Dry Gas Meter Calibration				
Console ID	--	MB-606		
Meter S/N	--	5828		
Critical Orifice S/N	--	1588s		
Initial Barometric Pressure, in. Hg	(Pb_I)	29.85		
Final Barometric Pressure, in. Hg	(Pb_F)	29.85		
Average Barometric Pressure, in. Hg	(Pb)	29.85		
Critifcal Orifice ID	(Y)	7	19	31
K' Factor, $ft^3 \cdot R^{1/2}$ / in. WC·min	(K')	0.1820	0.5265	0.8545
Vacuum Pressure, in. Hg	(V_P)	24.0	20.5	17.0
Initial DGM Volume, ft^3	(Vm_I)	349.800	358.000	367.100
Final DGM Volume, ft^3	(Vm_F)	357.170	366.150	374.190
Total DGM Volume, ft^3	(Vm)	7.370	8.150	7.090
Ambient Temperature, °F	(Ta)	73	74	74
Initial DGM Temperature, °F	(Tm_I)	73	75	76
Final DGM Temperature, °F	(Tm_F)	76	75	75
Average DGM Temperature, °F	(Tm)	75	75	76
Elapsed Time	(Θ)	31.0	12.0	6.5
Meter Orifice Pressure, in. WC	(ΔH)	0.15	1.30	3.50
Standard Meter volume, ft^3	(Vmstd)	7.2673	8.0517	7.0357
Standard Critical Orifice Volume, ft^3	(Vcr)	7.2969	8.1636	7.1767
Meter Correction Factor	(Y)	1.004	1.014	1.020
Tolerance	--	0.009	0.001	0.007
Orifice Calibration Value	(ΔH @)	1.502	1.561	1.603
Tolerance	--	0.053	0.006	0.048
Meter Correction Factor	**(Y)**	**1.013**		
Orifice Calibration Value	**(ΔH @)**	**1.555**		

Thermocouple Sensor Calibration					
Reference Calibrator Make		Piecal			
Reference Calibrator Model		520 B			
Reference Calibrator S/N		128210			
Reference Temp.		Display Temp.		Accuracy	Difference
°F	°R	°F	°R	%	°F
0	460	1	461	-0.2	1
68	528	67	527	0.2	1
100	560	99	559	0.2	1
223	683	224	684	-0.1	1
248	708	249	709	-0.1	1
273	733	274	734	-0.1	1
300	760	301	761	-0.1	1
400	860	400	860	0.0	0
500	960	499	959	0.1	1
600	1,060	601	1,061	-0.1	1
700	1,160	703	1,163	-0.3	3
800	1,260	803	1,263	-0.2	3
900	1,360	903	1,363	-0.2	3
1,000	1,460	1,004	1,464	-0.3	4
1,100	1,560	1,105	1,565	-0.3	5
1,200	1,660	1,205	1,665	-0.3	5

Calibration Performed By CJB

Date 6/22/20

Alliance
SOURCE TESTING

Dry Gas Meter Calibration				
Console ID	--	2026		
Meter S/N	--	17485119		
Critical Orifice S/N	--	CO-1667s		
Initial Barometric Pressure, in. Hg	(Pb_I)	29.00		
Final Barometric Pressure, in. Hg	(Pb_F)	29.00		
Average Barometric Pressure, in. Hg	(Pb)	29		
Critifcal Orifice ID	(Y)	7	19	28
K' Factor, $ft^3 \cdot R^{1/2}$ / in. WC·min	(K')	0.1839	0.5111	0.7684
Vacuum Pressure, in. Hg	(V_P)	18.0	18.0	17.0
Initial DGM Volume, ft^3	(Vm_I)	57.100	49.500	42.600
Final DGM Volume, ft^3	(Vm_F)	62.910	56.180	49.090
Total DGM Volume, ft^3	(Vm)	5.810	6.680	6.490
Ambient Temperature, °F	(Ta)	77	77	77
Initial DGM Temperature, °F	(Tm_I)	77	78	76
Final DGM Temperature, °F	(Tm_F)	79	78	78
Average DGM Temperature, °F	(Tm)	78	78	77
Elapsed Time	(Θ)	24.0	10.0	6.5
Meter Orifice Pressure, in. WC	(ΔH)	0.18	1.35	3.05
Standard Meter volume, ft^3	(Vmstd)	5.5301	6.3771	6.2340
Standard Critical Orifice Volume, ft^3	(Vcr)	5.5250	6.3980	6.2523
Meter Correction Factor	(Y)	0.999	1.003	1.003
Tolerance	--	0.003	0.002	0.001
Orifice Calibration Value	(ΔH @)	1.768	1.771	1.781
Tolerance	--	0.005	0.002	0.008
Meter Correction Factor	**(Y)**	**1.002**		
Orifice Calibration Value	**(ΔH @)**	**1.773**		

Thermocouple Sensor Calibration					
Reference Calibrator Make		Omega			
Reference Calibrator Model		CL3512A			
Reference Calibrator S/N		13000701			
Reference Temp.		Display Temp.		Accuracy	Difference
°F	°R	°F	°R	%	°F
0	460	0	460	0.0	0
68	528	66	526	0.4	2
100	560	98	558	0.4	2
223	683	223	683	0.0	0
248	708	249	709	-0.1	1
273	733	275	735	-0.3	2
300	760	301	761	-0.1	1
400	860	400	860	0.0	0
500	960	500	960	0.0	0
600	1,060	602	1,062	-0.2	2
700	1,160	705	1,165	-0.4	5
800	1,260	805	1,265	-0.4	5
900	1,360	905	1,365	-0.4	5
1,000	1,460	1,006	1,466	-0.4	6
1,100	1,560	1,108	1,568	-0.5	8
1,200	1,660	1,208	1,668	-0.5	8

Calibration Performed By Kenji Kinoshita

Date 7/21/20

Alliance SOURCE TESTING

Dry Gas Meter Calibration				
Console ID	--	MB-603		
Meter S/N	--	1369		
Critical Orifice S/N	--	1588s		
Initial Barometric Pressure, in. Hg	(Pb_I)	30.23		
Final Barometric Pressure, in. Hg	(Pb_F)	30.23		
Average Barometric Pressure, in. Hg	(Pb)	30.23		
Critifcal Orifice ID	(Y)	7	19	31
K' Factor, $ft^3 \cdot R^{1/2}$ / in. WC·min	(K')	0.1820	0.5265	0.8545
Vacuum Pressure, in. Hg	(V_P)	21.0	16.0	9.0
Initial DGM Volume, ft^3	(Vm_I)	893.300	887.500	900.000
Final DGM Volume, ft^3	(Vm_F)	899.350	893.030	906.540
Total DGM Volume, ft^3	(Vm)	6.050	5.530	6.540
Ambient Temperature, °F	(Ta)	83	83	84
Initial DGM Temperature, °F	(Tm_I)	84	84	85
Final DGM Temperature, °F	(Tm_F)	84	84	85
Average DGM Temperature, °F	(Tm)	84	84	85
Elapsed Time	(Θ)	25.0	8.0	6.0
Meter Orifice Pressure, in. WC	(ΔH)	0.19	1.60	3.60
Standard Meter volume, ft^3	(Vmstd)	5.9366	5.4450	6.4588
Standard Critical Orifice Volume, ft^3	(Vcr)	5.9044	5.4658	6.6470
Meter Correction Factor	(Y)	0.995	1.004	1.029
Tolerance	--	0.015	0.005	0.020
Orifice Calibration Value	(ΔH @)	1.880	1.898	1.629
Tolerance	--	0.077	0.096	0.173
Meter Correction Factor	**(Y)**	**1.009**		
Orifice Calibration Value	**(ΔH @)**	**1.803**		

Thermocouple Sensor Calibration					
Reference Calibrator Make		Piecal			
Reference Calibrator Model		520 B			
Reference Calibrator S/N		128210			
Reference Temp.		Display Temp.		Accuracy	Difference
°F	°R	°F	°R	%	°F
0	460	0	460	0.0	0
68	528	66	526	0.4	2
100	560	98	558	0.4	2
223	683	223	683	0.0	0
248	708	248	708	0.0	0
273	733	273	733	0.0	0
300	760	300	760	0.0	0
400	860	399	859	0.1	1
500	960	500	960	0.0	0
600	1,060	601	1,061	-0.1	1
700	1,160	703	1,163	-0.3	3
800	1,260	803	1,263	-0.2	3
900	1,360	905	1,365	-0.4	5
1,000	1,460	1,000	1,460	0.0	0
1,100	1,560	1,100	1,560	0.0	0
1,200	1,660	1,200	1,660	0.0	0

Calibration Performed By CJB

Date 6/12/20

Alliance SOURCE TESTING

QA Data

Location Koppers Naphthalene Distillation Plant - Cicero, IL
Source Reboiler/SCR Outlet - Condition 2
Project No. 2020-1351

Parameter	O_2 - Outlet	CO_2 - Outlet	NOx - Outlet	SO_2 - Outlet
Make	Servomex	Servomex	CAI	Thermo
Model	4900	4900	700	43C
S/N	100384	100384	2001023	43C-3
Operating Range	0-25%	0-25%	0-1000	0-100
Cylinder ID				
Zero	NA	NA	NA	NA
Low	NA	NA	NA	NA
Mid	SX33378	SX33378	EB0100198	SX45692
High	SX33378	SX33378	EB0100198	SX45692

Alliance
SOURCE TESTING

Calibration Data

Location: Koppers Naphthalene Distillation Plant - Cicero, IL
Source: Reboiler/SCR Outlet - Condition 2
Project No.: 2020-1351
Date: 9/29/20

Parameter	O_2 - Outlet	CO_2 - Outlet	NOx - Outlet	SO_2 - Outlet
Expected Average Concentration	18.0	2.0	100.0	10.0
Span Between				
Low	18.0	2.0	100.0	10.0
High	90.0	10.0	500.0	50.0
Desired Span	19.97	19.82	250.0	50.0
Low Range Gas				
Low	NA	NA	NA	NA
High	NA	NA	NA	NA
Mid Range Gas				
Low	8.0	7.9	100.0	20.0
High	12.0	11.9	150.0	30.0
High Range Gas				
Low	NA	NA	NA	NA
High	NA	NA	NA	NA
Actual Concentration (% or ppm)				
Zero	0.00	0.00	0.00	0.00
Low	NA	NA	NA	NA
Mid	10.00	10.00	125.0	25.0
High	19.97	19.82	250.0	50.0
Response Time (seconds)	60.0	60.0	60.0	80.0
Upscale Calibration Gas (C_{MA})	Mid	Low	Mid	Mid
Instrument Response (% or ppm)				
Zero	0.00	0.00	0.19	0.00
Low	NA	NA	NA	NA
Mid	9.96	9.89	125.23	25.30
High	19.92	19.82	250.14	50.27
Performance (% of Span or Cal. Gas Conc.)				
Zero	0.0	0.0	0.1	0.0
Low	NA	NA	NA	NA
Mid	0.2	0.6	0.1	0.6
High	0.3	0.0	0.1	0.5
Status				
Zero	PASS	PASS	PASS	PASS
Low	NA	NA	NA	NA
Mid	PASS	PASS	PASS	PASS
High	PASS	PASS	PASS	PASS

Alliance
SOURCE TESTING

Calibration Data

Location: Koppers Naphthalene Distillation Plant - Cicero, IL
Source: Reboiler/SCR Outlet - Condition 2
Project No.: 2020-1351
Date: 9/30/20

Parameter	O_2 - Outlet	CO_2 - Outlet	NOx - Outlet	SO_2 - Outlet
Expected Average Concentration	18.0	2.0	100.0	10.0
Span Between				
Low	18.0	2.0	100.0	10.0
High	90.0	10.0	500.0	50.0
Desired Span	19.97	19.82	250.0	50.0
Low Range Gas				
Low	NA	NA	NA	NA
High	NA	NA	NA	NA
Mid Range Gas				
Low	8.0	7.9	100.0	20.0
High	12.0	11.9	150.0	30.0
High Range Gas				
Low	NA	NA	NA	NA
High	NA	NA	NA	NA
Actual Concentration (% or ppm)				
Zero	0.00	0.00	0.00	1.00
Low	NA	NA	NA	NA
Mid	10.00	10.00	125.0	25.0
High	19.97	19.82	250.0	50.0
Response Time (seconds)	60.0	60.0	60.0	80.0
Upscale Calibration Gas (C_{MA})	Mid	Low	Mid	Mid
Instrument Response (% or ppm)				
Zero	0.00	0.04	0.19	0.00
Low	NA	NA	NA	NA
Mid	9.92	9.89	125.24	25.40
High	19.96	19.81	250.31	50.51
Performance (% of Span or Cal. Gas Conc.)				
Zero	0.0	0.2	0.1	2.0
Low	NA	NA	NA	NA
Mid	0.4	0.6	0.1	0.8
High	0.1	0.1	0.1	1.0
Status				
Zero	PASS	PASS	PASS	PASS
Low	NA	NA	NA	NA
Mid	PASS	PASS	PASS	PASS
High	PASS	PASS	PASS	PASS

Alliance
SOURCE TESTING

Bias/Drift Determinations

Location: Koppers Naphthalene Distillation Plant - Cicero, IL
Source: Reboiler/SCR Outlet - Condition 2
Project No.: 2020-1351

Parameter	O_2 - Outlet	CO_2 - Outlet	NOx - Outlet	SO_2 - Outlet
Run 2 Date 9/29/20				
Span Value	20.0	19.8	250.0	50.0
Instrument Zero Cal Response	0.0	0.0	0.2	0.0
Instrument Mid Cal Response	10.0	9.9	125.2	25.3
Pretest System Zero Response	0.1	0.0	0.2	0.0
Posttest System Zero Response	0.1	0.0	0.2	0.0
Pretest System Mid Response	10.0	9.9	124.8	25.3
Posttest System Mid Response	10.0	9.9	125.2	24.6
Bias (%)				
Pretest Zero	0.4	0.2	0.0	0.0
Posttest Zero	0.5	0.2	0.0	0.0
Pretest Span	0.1	0.0	0.2	0.0
Posttest Span	0.3	0.1	0.0	1.4
Drift (%)				
Zero	0.2	0.0	0.0	0.0
Mid	0.2	0.1	0.2	1.3
Run 3 Date 9/30/20				
Span Value	20.0	19.8	250.0	50.0
Instrument Zero Cal Response	0.0	0.0	0.2	0.0
Instrument Mid Cal Response	9.9	9.9	125.2	25.4
Pretest System Zero Response	0.1	0.1	0.2	0.0
Posttest System Zero Response	0.2	0.1	0.2	0.0
Pretest System Mid Response	10.0	9.7	124.8	25.0
Posttest System Mid Response	10.0	9.8	125.6	24.8
Bias (%)				
Pretest Zero	0.7	0.1	0.0	0.0
Posttest Zero	1.1	0.1	0.0	0.0
Pretest Span	0.6	0.8	0.2	0.7
Posttest Span	0.4	0.3	0.1	1.2
Drift (%)				
Zero	0.4	0.1	0.0	0.0
Mid	0.2	0.6	0.3	0.5

Alliance SOURCE TESTING

Bias/Drift Determinations

Location: Koppers Naphthalene Distillation Plant - Cicero, IL
Source: Reboiler/SCR Outlet - Condition 2
Project No.: 2020-1351

Parameter	O_2 - Outlet	CO_2 - Outlet	NOx - Outlet	SO_2 - Outlet
Run 4 Date 9/30/20				
Span Value	20.0	19.8	250.0	50.0
Instrument Zero Cal Response	0.0	0.0	0.2	0.0
Instrument Mid Cal Response	9.9	9.9	125.2	25.4
Pretest System Zero Response	0.2	0.1	0.2	0.0
Posttest System Zero Response	0.2	0.1	0.1	0.1
Pretest System Mid Response	10.0	9.8	125.6	24.8
Posttest System Mid Response	10.0	9.9	124.7	24.5
Bias (%)				
Pretest Zero	1.1	0.1	0.0	0.0
Posttest Zero	1.0	0.2	0.0	0.2
Pretest Span	0.4	0.3	0.1	1.2
Posttest Span	0.2	0.1	0.2	1.9
Drift (%)				
Zero	0.2	0.1	0.0	0.2
Mid	0.2	0.2	0.4	0.7

Alliance
SOURCE TESTING

QA Data

Location Koppers Naphthalene Distillation Plant - Cicero, IL
Source Main Stack - Condition 2 Natural Gas
Project No. 2020-1351

Parameter	O_2 - Outlet	CO_2 - Outlet	CO - Outlet	NOx - Outlet	SO_2 - Outlet	VOM - Outlet
Make	CAI	CAI	CAI	CAI	Western Research	VIG
Model	600	600	600	700	900	20
S/N	F05003-M	F05003-M	F05003-M	1901011	AB-921-9159-1	2590306
Operating Range	0-25	0-20	0-500	0-300	0-50	0-100
Cylinder ID						
Zero	NA	NA	NA	NA	NA	NA
Low	NA	NA	NA	NA	NA	CC344620
Mid	CC177385	CC177385	SX56541	SX39335D	SX39263	CC344620
High	CC177385	CC177385	EB0100198	SX39335D	SX39263	CC344620

Alliance SOURCE TESTING

Calibration Data

Location: Koppers Naphthalene Distillation Plant - Cicero, IL
Source: Main Stack - Condition 2 Natural Gas
Project No.: 2020-1351
Date: 9/29/20

Parameter	O_2 - Outlet	CO_2 - Outlet	CO - Outlet	NOx - Outlet	SO_2 - Outlet	VOM - Outlet
Expected Average Concentration	10.0	10.0	50.0	45.0	20.0	12.0
Span Between						
Low	10.0	10.0	50.0	45.0	20.0	18.0
High	50.0	50.0	250.0	225.0	100.0	30.0
Desired Span	19.99	19.81	100.0	100.0	40.0	25.0
Low Range Gas						
Low	NA	NA	NA	NA	NA	6.3
High	NA	NA	NA	NA	NA	8.8
Mid Range Gas						
Low	8.0	7.9	40.0	40.0	16.0	11.3
High	12.0	11.9	60.0	60.0	24.0	13.8
High Range Gas						
Low	NA	NA	NA	NA	NA	20.0
High	NA	NA	NA	NA	NA	22.5
Actual Concentration (% or ppm)						
Zero	0.00	0.00	0.00	0.00	0.00	0.00
Low	NA	NA	NA	NA	NA	8.00
Mid	10.00	10.00	50.00	50.00	20.00	12.00
High	19.99	19.81	100.00	100.00	40.00	21.00
Response Time (seconds)	30.0	30.0	30.0	30.0	30.0	30.0
Upscale Calibration Gas (C_{MA})	Mid	Mid	Mid	Mid	Mid	Mid
Instrument Response (% or ppm)						
Zero	-0.05	0.03	-1.00	0.00	0.00	0.10
Low	NA	NA	NA	NA	NA	7.90
Mid	9.82	9.88	50.00	50.60	20.00	11.80
High	19.77	19.98	100.00	100.00	40.10	20.99
Performance (% of Span or Cal. Gas Conc.)						
Zero	0.3	0.2	1.0	0.0	0.0	0.0
Low	NA	NA	NA	NA	NA	2.0
Mid	0.9	0.6	0.0	0.6	0.0	2.0
High	1.1	0.9	0.0	0.0	0.3	0.0
Status						
Zero	PASS	PASS	PASS	PASS	PASS	PASS
Low	NA	NA	NA	NA	NA	PASS
Mid	PASS	PASS	PASS	PASS	PASS	PASS
High	PASS	PASS	PASS	PASS	PASS	PASS

Alliance
SOURCE TESTING

Calibration Data

Location: Koppers Naphthalene Distillation Plant - Cicero, IL
Source: Main Stack - Condition 2 Natural Gas
Project No.: 2020-1351
Date: 9/30/20

Parameter	O_2 - Outlet	CO_2 - Outlet	CO - Outlet	NOx - Outlet	SO_2 - Outlet	VOM - Outlet
Expected Average Concentration	10.0	10.0	50.0	45.0	20.0	12.0
Span Between						
Low	10.0	10.0	50.0	45.0	20.0	18.0
High	50.0	50.0	250.0	225.0	100.0	30.0
Desired Span	19.99	19.81	100.0	100.0	40.0	25.0
Low Range Gas						
Low	NA	NA	NA	NA	NA	6.3
High	NA	NA	NA	NA	NA	8.8
Mid Range Gas						
Low	8.0	7.9	40.0	40.0	16.0	11.3
High	12.0	11.9	60.0	60.0	24.0	13.8
High Range Gas						
Low	NA	NA	NA	NA	NA	20.0
High	NA	NA	NA	NA	NA	22.5
Actual Concentration (% or ppm)						
Zero	0.00	0.00	0.00	0.00	0.00	0.00
Low	NA	NA	NA	NA	NA	8.00
Mid	10.00	10.00	50.00	50.00	20.00	12.00
High	19.99	19.81	100.00	100.00	40.00	21.00
Response Time (seconds)	30.0	30.0	30.0	30.0	30.0	30.0
Upscale Calibration Gas (C_{MA})	Mid	Mid	Mid	Mid	Mid	Mid
Instrument Response (% or ppm)						
Zero	0.00	0.00	0.00	0.00	0.00	0.10
Low	NA	NA	NA	NA	NA	7.90
Mid	9.82	9.88	50.00	50.60	20.00	11.80
High	19.77	19.98	100.00	100.00	40.10	20.99
Performance (% of Span or Cal. Gas Conc.)						
Zero	0.0	0.0	0.0	0.0	0.0	0.0
Low	NA	NA	NA	NA	NA	-2.0
Mid	0.9	0.6	0.0	0.6	0.0	-2.0
High	1.1	0.9	0.0	0.0	0.3	0.0
Status						
Zero	PASS	PASS	PASS	PASS	PASS	PASS
Low	NA	NA	NA	NA	NA	PASS
Mid	PASS	PASS	PASS	PASS	PASS	PASS
High	PASS	PASS	PASS	PASS	PASS	PASS

Alliance SOURCE TESTING

Bias/Drift Determinations

Location: Koppers Naphthalene Distillation Plant - Cicero, IL
Source: Main Stack - Condition 2 Natural Gas
Project No.: 2020-1351

Parameter	O_2 - Outlet	CO_2 - Outlet	CO - Outlet	NOx - Outlet	SO_2 - Outlet	VOM - Outlet
Run 2 Date 9/29/20						
Span Value	20.0	19.8	100.0	100.0	40.0	25.0
Instrument Zero Cal Response	-0.1	0.0	-1.0	0.0	0.0	0.1
Instrument Mid Cal Response	9.8	9.9	50.0	50.6	20.0	11.8
Pretest System Zero Response	0.0	0.0	-0.7	0.4	0.2	-0.1
Posttest System Zero Response	0.0	0.0	1.8	0.2	0.3	-0.8
Pretest System Mid Response	9.9	9.8	49.2	50.1	19.8	11.9
Posttest System Mid Response	9.9	9.7	52.1	48.7	19.9	12.0
Bias (%)						
Pretest Zero	0.4	0.1	0.3	0.4	0.5	NA
Posttest Zero	0.3	0.2	2.8	0.2	0.7	NA
Pretest Span	0.2	0.4	0.8	0.5	0.5	NA
Posttest Span	0.3	0.7	2.1	1.9	0.3	NA
Drift (%)						
Zero	0.1	0.1	2.5	0.2	0.2	2.8
Mid	0.1	0.3	2.9	1.4	0.2	0.4
Run 3 Date 9/30/20						
Span Value	20.0	19.8	100.0	100.0	40.0	25.0
Instrument Zero Cal Response	0.0	0.0	0.0	0.0	0.0	0.1
Instrument Mid Cal Response	9.8	9.9	50.0	50.6	20.0	11.8
Pretest System Zero Response	0.0	0.0	0.0	0.0	0.4	0.2
Posttest System Zero Response	0.0	0.0	0.6	0.1	0.2	0.3
Pretest System Mid Response	9.9	9.9	50.0	47.8	19.8	11.9
Posttest System Mid Response	10.0	9.8	50.0	49.9	19.6	11.9
Bias (%)						
Pretest Zero	0.0	0.0	0.0	0.0	1.0	NA
Posttest Zero	0.0	0.0	0.6	0.1	0.5	NA
Pretest Span	0.4	0.1	0.0	2.8	0.5	NA
Posttest Span	0.9	0.4	0.0	0.7	1.0	NA
Drift (%)						
Zero	0.0	0.0	0.6	0.1	0.5	0.4
Mid	0.5	0.5	0.0	2.1	0.5	0.0

Alliance SOURCE TESTING

Bias/Drift Determinations

Location: Koppers Naphthalene Distillation Plant - Cicero, IL
Source: Main Stack - Condition 2 Natural Gas
Project No.: 2020-1351

Parameter	O_2 - Outlet	CO_2 - Outlet	CO - Outlet	NOx - Outlet	SO_2 - Outlet	VOM - Outlet
Run 4 Date 9/30/20						
Span Value	20.0	19.8	100.0	100.0	40.0	25.0
Instrument Zero Cal Response	0.0	0.0	0.0	0.0	0.0	0.1
Instrument Mid Cal Response	9.8	9.9	50.0	50.6	20.0	11.8
Pretest System Zero Response	0.0	0.0	0.6	0.4	0.2	0.3
Posttest System Zero Response	0.0	0.0	0.7	0.1	0.6	0.5
Pretest System Mid Response	10.0	9.8	50.0	49.9	19.6	11.9
Posttest System Mid Response	10.1	9.8	50.7	49.9	19.6	11.8
Bias (%)						
Pretest Zero	0.0	0.0	0.6	0.4	0.5	NA
Posttest Zero	0.0	0.0	0.7	0.1	1.5	NA
Pretest Span	0.9	0.4	0.0	0.7	1.0	NA
Posttest Span	1.3	0.4	0.7	0.7	1.0	NA
Drift (%)						
Zero	0.0	0.0	0.1	0.3	1.0	0.8
Mid	0.4	0.0	0.7	0.0	0.0	0.4

Alliance SOURCE TESTING

QA Data

Location Koppers Naphthalene Distillation Plant - Cicero, IL
Source TO-5 Inlet - Condition 2
Project No. 2020-1351

Parameter	O_2 - Inlet	CO_2 - Inlet	VOM - Inlet
Make	Servomex	Servomex	VIG
Model	4900	4900	20/2
S/N	100385	100385	7400118
Operating Range	0-25%	0-25%	0-1000
Cylinder ID			
Zero	NA	NA	NA
Low	NA	NA	SX62746
Mid	SX33378	SX33378	SX62746
High	SX33378	SX33378	SX62746

Alliance SOURCE TESTING

Calibration Data

Location: Koppers Naphthalene Distillation Plant - Cicero, IL
Source: TO-5 Inlet - Condition 2
Project No.: 2020-1351
Date: 9/29/20

Parameter	O_2 - Inlet	CO_2 - Inlet	VOM - Inlet
Expected Average Concentration	18.0	2.0	200.0
Span Between			
Low	18.0	2.0	300.0
High	90.0	10.0	500.0
Desired Span	19.97	19.82	500.0
Low Range Gas			
Low	NA	NA	125.0
High	NA	NA	175.0
Mid Range Gas			
Low	8.0	7.9	225.0
High	12.0	11.9	275.0
High Range Gas			
Low	NA	NA	400.0
High	NA	NA	450.0
Actual Concentration (% or ppm)			
Zero	0.00	0.00	0.00
Low	NA	NA	125.00
Mid	10.00	9.90	250.00
High	19.97	19.82	500.00
Response Time (seconds)	60.0	60.0	60.0
Upscale Calibration Gas (C_{MA})	Mid	Mid	Mid
Instrument Response (% or ppm)			
Zero	0.00	0.00	0.09
Low	NA	NA	123.17
Mid	9.97	9.90	249.72
High	19.97	19.82	498.94
Performance (% of Span or Cal. Gas Conc.)			
Zero	0.0	0.0	0.0
Low	NA	NA	1.3
Mid	0.2	0.0	0.1
High	0.0	0.0	0.0
Status			
Zero	PASS	PASS	PASS
Low	NA	NA	PASS
Mid	PASS	PASS	PASS
High	PASS	PASS	PASS

Alliance
SOURCE TESTING

Calibration Data

Location: Koppers Naphthalene Distillation Plant - Cicero, IL
Source: TO-5 Inlet - Condition 2
Project No.: 2020-1351
Date: 9/30/20

Parameter	O_2 - Inlet	CO_2 - Inlet	VOM - Inlet
Expected Average Concentration	18.0	2.0	200.0
Span Between			
Low	18.0	2.0	300.0
High	90.0	10.0	500.0
Desired Span	19.97	19.82	500.0
Low Range Gas			
Low	NA	NA	125.0
High	NA	NA	175.0
Mid Range Gas			
Low	8.0	7.9	225.0
High	12.0	11.9	275.0
High Range Gas			
Low	NA	NA	400.0
High	NA	NA	450.0
Actual Concentration (% or ppm)			
Zero	0.00	0.00	0.00
Low	NA	NA	125.00
Mid	10.00	9.90	250.00
High	19.97	19.82	500.00
Response Time (seconds)	60.0	60.0	60.0
Upscale Calibration Gas (C_{MA})	Mid	Mid	Mid
Instrument Response (% or ppm)			
Zero	0.01	0.00	0.25
Low	NA	NA	124.82
Mid	9.97	9.90	250.55
High	19.98	19.81	498.66
Performance (% of Span or Cal. Gas Conc.)			
Zero	0.1	0.0	0.0
Low	NA	NA	0.0
Mid	0.2	0.0	0.4
High	0.1	0.1	0.0
Status			
Zero	PASS	PASS	PASS
Low	NA	NA	PASS
Mid	PASS	PASS	PASS
High	PASS	PASS	PASS

Alliance SOURCE TESTING

Bias/Drift Determinations

Location: Koppers Naphthalene Distillation Plant - Cicero, IL
Source: TO-5 Inlet - Condition 2
Project No.: 2020-1351

Parameter	O_2 - Inlet	CO_2 - Inlet	VOM - Inlet
Run 2 Date 9/29/20			
Span Value	20.0	19.8	500.0
Instrument Zero Cal Response	0.0	0.0	0.1
Instrument Mid Cal Response	10.0	9.9	249.7
Pretest System Zero Response	0.0	0.0	0.3
Posttest System Zero Response	0.1	0.0	1.2
Pretest System Mid Response	9.9	9.8	124.3
Posttest System Mid Response	9.9	9.8	126.6
Bias (%)			
Pretest Zero	0.1	0.0	NA
Posttest Zero	0.3	0.0	NA
Pretest Span	0.2	0.5	NA
Posttest Span	0.2	0.7	NA
Drift (%)			
Zero	0.2	0.0	0.2
Mid	0.1	0.3	0.5
Run 3 Date 9/30/20			
Span Value	20.0	19.8	500.0
Instrument Zero Cal Response	0.0	0.0	0.3
Instrument Mid Cal Response	10.0	9.9	250.6
Pretest System Zero Response	0.1	0.0	0.3
Posttest System Zero Response	0.1	0.0	1.2
Pretest System Mid Response	10.0	9.9	126.6
Posttest System Mid Response	9.9	9.9	124.5
Bias (%)			
Pretest Zero	0.3	0.0	NA
Posttest Zero	0.5	0.0	NA
Pretest Span	0.1	0.3	NA
Posttest Span	0.2	0.3	NA
Drift (%)			
Zero	0.2	0.0	0.2
Mid	0.1	0.0	0.4

Alliance SOURCE TESTING

Bias/Drift Determinations

Location: Koppers Naphthalene Distillation Plant - Cicero, IL
Source: TO-5 Inlet - Condition 2
Project No.: 2020-1351

Parameter	O_2 - Inlet	CO_2 - Inlet	VOM - Inlet
Run 4 Date 9/30/20			
Span Value	20.0	19.8	500.0
Instrument Zero Cal Response	0.0	0.0	0.3
Instrument Mid Cal Response	10.0	9.9	250.6
Pretest System Zero Response	0.1	0.0	1.2
Posttest System Zero Response	0.2	0.0	0.8
Pretest System Mid Response	9.9	9.9	124.5
Posttest System Mid Response	10.0	9.9	124.8
Bias (%)			
Pretest Zero	0.5	0.0	NA
Posttest Zero	0.8	0.0	NA
Pretest Span	0.2	0.3	NA
Posttest Span	0.3	0.2	NA
Drift (%)			
Zero	0.3	0.0	0.1
Mid	0.5	0.4	0.1

Alliance SOURCE TESTING

Calibration Data

Location: Koppers Naphthalene Distillation Plant - Cicero, IL
Source: TO-5 Outlet - Condition 2
Project No.: 2020-1351
Date: 9/29/20

Parameter	O_2 - Outlet	CO_2 - Outlet	SO_2 - Outlet	VOM - Outlet
Expected Average Concentration	10.0	10.0	20.0	12.0
Span Between				
Low	10.0	10.0	20.0	18.0
High	50.0	50.0	100.0	30.0
Desired Span	19.99	19.81	40.0	25.0
Low Range Gas				
Low	NA	NA	NA	6.3
High	NA	NA	NA	8.8
Mid Range Gas				
Low	8.0	7.9	16.0	11.3
High	12.0	11.9	24.0	13.8
High Range Gas				
Low	NA	NA	NA	20.0
High	NA	NA	NA	22.5
Actual Concentration (% or ppm)				
Zero	0.00	0.00	0.00	0.00
Low	NA	NA	NA	8.00
Mid	10.00	10.00	20.00	12.00
High	19.99	19.81	40.00	21.00
Response Time (seconds)	30.0	30.0	30.0	30.0
Upscale Calibration Gas (C_{MA})	Mid	Mid	Mid	Mid
Instrument Response (% or ppm)				
Zero	0.00	0.10	0.00	0.00
Low	NA	NA	NA	7.90
Mid	10.00	10.00	20.20	11.80
High	20.00	19.80	39.90	21.10
Performance (% of Span or Cal. Gas Conc.)				
Zero	0.0	0.5	0.0	0.0
Low	NA	NA	NA	1.7
Mid	0.0	0.0	0.5	2.2
High	0.1	0.1	0.3	0.0
Status				
Zero	PASS	PASS	PASS	PASS
Low	NA	NA	NA	PASS
Mid	PASS	PASS	PASS	PASS
High	PASS	PASS	PASS	PASS

Alliance SOURCE TESTING

Calibration Data

Location: Koppers Naphthalene Distillation Plant - Cicero, IL
Source: TO-5 Outlet - Condition 2
Project No.: 2020-1351
Date: 9/30/20

Parameter	O_2 - Outlet	CO_2 - Outlet	SO_2 - Outlet	VOM - Outlet
Expected Average Concentration	10.0	10.0	20.0	12.0
Span Between				
Low	10.0	10.0	20.0	18.0
High	50.0	50.0	100.0	30.0
Desired Span	19.99	19.81	40.0	25.0
Low Range Gas				
Low	NA	NA	NA	6.3
High	NA	NA	NA	8.8
Mid Range Gas				
Low	8.0	7.9	16.0	11.3
High	12.0	11.9	24.0	13.8
High Range Gas				
Low	NA	NA	NA	20.0
High	NA	NA	NA	22.5
Actual Concentration (% or ppm)				
Zero	0.00	0.00	0.00	0.00
Low	NA	NA	NA	8.00
Mid	10.00	10.00	20.00	12.00
High	19.99	19.81	40.00	21.00
Response Time (seconds)	30.0	30.0	30.0	30.0
Upscale Calibration Gas (C_{MA})	Mid	Mid	Mid	Mid
Instrument Response (% or ppm)				
Zero	0.00	0.00	0.00	0.00
Low	NA	NA	NA	7.90
Mid	9.90	9.90	20.20	11.90
High	20.00	19.80	39.90	21.10
Performance (% of Span or Cal. Gas Conc.)				
Zero	0.0	0.0	0.0	0.0
Low	NA	NA	NA	-1.7
Mid	0.5	0.5	0.5	-1.3
High	0.1	0.1	0.3	0.0
Status				
Zero	PASS	PASS	PASS	PASS
Low	NA	NA	NA	PASS
Mid	PASS	PASS	PASS	PASS
High	PASS	PASS	PASS	PASS

Alliance SOURCE TESTING

Bias/Drift Determinations

Location: Koppers Naphthalene Distillation Plant - Cicero, IL
Source: TO-5 Outlet - Condition 2
Project No.: 2020-1351

Parameter	O_2 - Outlet	CO_2 - Outlet	SO_2 - Outlet	VOM - Outlet
Run 2 Date 9/29/20				
Span Value	20.0	19.8	40.0	25.0
Instrument Zero Cal Response	0.0	0.1	0.0	0.0
Instrument Mid Cal Response	10.0	10.0	20.2	11.8
Pretest System Zero Response	0.0	0.0	0.1	-0.3
Posttest System Zero Response	0.0	0.0	0.0	0.1
Pretest System Mid Response	9.9	10.0	19.6	11.6
Posttest System Mid Response	9.9	10.0	19.6	12.1
Bias (%)				
Pretest Zero	0.0	0.5	0.2	NA
Posttest Zero	0.0	0.5	0.1	NA
Pretest Span	0.5	0.0	1.6	NA
Posttest Span	0.5	0.0	1.5	NA
Drift (%)				
Zero	0.0	0.0	0.1	1.6
Mid	0.0	0.0	0.1	2.0
Run 3 Date 9/30/20				
Span Value	20.0	19.8	40.0	25.0
Instrument Zero Cal Response	0.0	0.0	0.0	0.0
Instrument Mid Cal Response	9.9	9.9	20.2	11.9
Pretest System Zero Response	0.0	0.0	0.1	0.1
Posttest System Zero Response	0.0	0.0	0.2	0.0
Pretest System Mid Response	9.9	10.0	19.6	12.1
Posttest System Mid Response	10.0	9.9	19.7	12.2
Bias (%)				
Pretest Zero	0.0	0.0	0.2	NA
Posttest Zero	0.0	0.0	0.5	NA
Pretest Span	0.0	0.5	1.5	NA
Posttest Span	0.5	0.0	1.4	NA
Drift (%)				
Zero	0.0	0.0	0.3	0.4
Mid	0.5	0.5	0.1	0.4

Alliance SOURCE TESTING

Bias/Drift Determinations

Location: Koppers Naphthalene Distillation Plant - Cicero, IL
Source: TO-5 Outlet - Condition 2
Project No.: 2020-1351

Parameter	O_2 - Outlet	CO_2 - Outlet	SO_2 - Outlet	VOM - Outlet
Run 4 Date 9/30/20				
Span Value	20.0	19.8	40.0	25.0
Instrument Zero Cal Response	0.0	0.0	0.0	0.0
Instrument Mid Cal Response	9.9	9.9	20.2	11.9
Pretest System Zero Response	0.0	0.0	0.1	0.0
Posttest System Zero Response	0.0	0.0	0.1	0.0
Pretest System Mid Response	10.0	9.9	19.7	12.2
Posttest System Mid Response	10.0	10.0	19.7	12.1
Bias (%)				
Pretest Zero	0.0	0.0	0.2	NA
Posttest Zero	0.0	0.0	0.2	NA
Pretest Span	0.5	0.0	1.4	NA
Posttest Span	0.5	0.5	1.4	NA
Drift (%)				
Zero	0.0	0.0	0.1	0.0
Mid	0.0	0.5	0.0	0.4

MATHESON
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1700 Scepter Rd
Waverly, TN 37185
931-296-3357

Certificate of Analysis - EPA Protocol Mixtures

Customer: MATHESON VALLEY
903 THOMPSON RUN RD
WEST MIFFLIN, PA 15122

Customer PO #: K56-1616

Part #: G2688369

Protocol: G1: Oxygen
G2: Carbon Dioxide

Reference #: 763889-002

Lot#: 9300607510

Cylinder Number: SX33378
Cylinder Pressure: 1700 psia
Last Analysis Date: 3/19/2020
Expiration Date: 3/19/2028

DO NOT USE THIS CYLINDER WHEN THE PRESSURE FALLS BELOW 100 PSIG

REPLICATE RESPONSES

Component: Carbon Dioxide — Date: 3/19/2020

Certified Conc: 19.82 % +/- 0.07 % ABS

Replicate responses: 19.82, 19.83, 19.82

Component: Oxygen — Date: 3/19/2020

Certified Conc: 19.97 % +/- 0.04 % ABS

Replicate responses: 19.98, 19.96, 19.98

BALANCE GAS: Nitrogen

REFERENCE STANDARDS:

Component:	Carbon Dioxide	Component:	Oxygen
Reference Standard:	NTRM	Reference Standard:	SRM
Cylinder #:	AM11350	Cylinder #:	CAL016956
Concentration:	19.405 +/- 0.058 % ABS	Concentration:	9.918 +/- 0.022 % ABS
Exp. Date:	12/9/2022	Exp. Date:	2/3/2024
SRM #:	NTRM	SRM #:	2658a
NIST Sample #:	171101	NIST Sample #:	72-D-41

CERTIFICATION INSTRUMENTS

Component:	Carbon Dioxide	Component:	Oxygen
Make/Model:	CAI 700	Make/Model:	HORIBA MPA 510
Serial Number:	1805006	Serial Number:	SGU27SC4
Measurement Principle:	NDIR	Measurement Principle:	PARAMAGNETIC
Last Calibration:	2/19/2020	Last Calibration:	3/3/2020

Notes:

The certification was performed according to EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards May 2012, using procedure G1 and/or G2. U.S EPA Vendor ID Number: D62020, PGVP Participation Date: 01/01/20, PGVP Renewal Date: 01/01/21. The expanded uncertainty listed for each component was calculated at a coverage factor of k=2 and at a level of confidence of 95%.

Analyst: *Cathy Swaw*
Cathy Swaw

Accredited by: ANAB

ANAB ACCREDITED TESTING LABORATORY

Date: 03/19/2020

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1700 Scepter Rd
Waverly, TN 37185
931-296-3357

Certificate of Analysis - EPA Protocol Mixtures

Customer: MATHESON VALLEY
903 THOMPSON RUN RD
WEST MIFFLIN, PA 15122

Customer PO#: K56-1578

Part #: G2688366

Protocol: G1

Reference #: 759914-005

Lot#: 9309604776

Cylinder Number: EB0100198

Cylinder Pressure: 1900 psig

Last Analysis Date: 1/9/2020

Expiration Date: 1/9/2027

DO NOT USE THIS CYLINDER WHEN THE PRESSURE FALLS BELOW 100 PSIG

REPLICATE RESPONSES

Component: Carbon Monoxide — Date: 1/9/2020: 490, 491, 491

Certified Conc: 491 ppm +/- 2 ppm ABS

Component: Nitric Oxide — Date: 1/2/2020: 486.5, 486.5, 486.7 — Date: 1/9/2020: 486.7, 486.8, 487.1

Certified Conc: 486.8 ppm +/- 1.1 ppm ABS

NOx: 487.1 ppm Reference Only

BALANCE GAS: Nitrogen

REFERENCE STANDARDS:

Component:	Carbon Monoxide	Component:	Nitric Oxide
Reference Standard:	SRM	Reference Standard:	SRM
Cylinder #:	FF20673	Cylinder #:	FF20726
Concentration:	993.1+/-2.1 ppm ABS	Concentration:	251.5+/-0.8 ppm ABS
Exp. Date:	09/26/21	Exp. Date:	06/29/23
SRM #:	1681b	SRM #:	1685b
NIST Sample #:	1-L-41	NIST Sample #:	43-M-38

CERTIFICATION INSTRUMENTS

Component:	Carbon Monoxide	Component:	Nitric Oxide
Make/Model:	CAI 700	Make/Model:	HORIBA CLA-510SS
Serial Number:	1805006	Serial Number:	FM1JMBMS
Measurement Principle:	NDIR	Measurement Principle:	CHEMI
Last Calibration:	12/27/19	Last Calibration:	12/30/19

Notes:

The certification was performed according to EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards May 2012, using procedure G1 and/or G2. U.S EPA Vendor ID Number: D62020, PGVP Participation Date: 01/01/20, PGVP Renewal Date: 01/01/21
The expanded uncertainty listed for each component was calculated at a coverage factor of k=2 and at a level of confidence of 95%.

Analyst: *Cathy Swaw*
Cathy Swaw

Accredited by: ANAB

ANAB ACCREDITED TESTING LABORATORY

Date: 01/09/2020

MATHESON
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1650 Enterprise Parkway
Twinsburg, OH 44087
215-648-4000

Certificate of Analysis – EPA Protocol Mixtures

Customer: Matheson Valley
Cylinder Number: SX- 45692
Cylinder Pressure: 1800 psig
Last Analysis Date: 6/20/2019
Expiration Date: 6/20/2027

Protocol:	Reference #:	Lot#:
G1	750597	109-96-41795

Part #: G 2676610

DO NOT USE THIS CYLINDER WHEN THE PRESSURE FALLS BELOW 100 PSIG

Component: Sulfur Dioxide

Certified Conc: 50.4 ppm +/- 0.3 ppm

REPLICATE RESPONSES

Date:	6/13/2019	Date:	6/20/2019
	50.4 ppm		50.4 ppm
	50.5 ppm		50.4 ppm
	50.5 ppm		50.5 ppm

BALANCE GAS: Nitrogen

REFERENCE STANDARDS:

Component: Sulfur Dioxide
SRM #: SRM-1693a
Sample #: 96-N-29
Cylinder #: FF28098
Concentration: 50.35 ppm

CERTIFICATION INSTRUMENTS

Component: Sulfur Dioxide
Make/Model: SO2 VIA-510 HIGH
Serial Number: BBP770XS
Measurement Principle: NDIR
Last Calibration: 6/13/2019

Notes:

The certification was performed according to EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards May 2012, using procedure G1 and/or G2. U.S EPA Vendor ID Number: D42019, PGVP Participation Date: 01/01/19, PGVP Renewal Date: 01/01/20. The expanded uncertainty listed for each component was calculated at a coverage factor of k=2 and at a level of confidence of 95%.

Analyst: [signature] Date 6/24/2019

Accredited By:
ANAB

ANAB ACCREDITED TESTING LABORATORY

MATHESON

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1700 Scepter Rd
Waverly, TN 37185
931-296-3357

Certificate of Analysis - EPA Protocol Mixtures

Customer: Matheson Linweld
9920 Deer Park Rd
PO Box 190
Waverly, NE 68462

Customer PO #: 3135814

Part #: G2688369

Protocol: G1: Oxygen
G2: Carbon Dioxide

Reference #: 763742-01

Lot#: 9300606713

Cylinder Number: CC177385

Cylinder Pressure: 1700 psia

Last Analysis Date: 3/11/2020

Expiration Date: 3/11/2028

DO NOT USE THIS CYLINDER WHEN THE PRESSURE FALLS BELOW 100 PSIG

				REPLICATE RESPONSES
Component:	Carbon Dioxide			Date: 3/11/2020
				19.81
Certified Conc:	19.81 %	+/- 0.05 %	ABS	19.80
				19.80
Component:	Oxygen			Date: 3/11/2020
				20.00
Certified Conc:	19.99 %	+/- 0.06 %	ABS	20.05
				19.93

BALANCE GAS: Nitrogen

REFERENCE STANDARDS:

Component:	Carbon Dioxide	Component:	Oxygen
Reference Standard:	NTRM	Reference Standard:	SRM
Cylinder #:	AM11350	Cylinder #:	CAL016956
Concentration:	19.405 +/- 0.058 % ABS	Concentration:	9.918 +/- 0.022 % ABS
Exp. Date:	12/9/2022	Exp. Date:	2/3/2024
SRM #:	NTRM	SRM #:	2658a
NIST Sample #:	171101	NIST Sample #:	72-D-41

CERTIFICATION INSTRUMENTS

Component:	Carbon Dioxide	Component:	Oxygen
Make/Model:	CAI 700	Make/Model:	HORIBA MPA 510
Serial Number:	1805006	Serial Number:	SGU27SC4
Measurement Principle:	NDIR	Measurement Principle:	PARAMAGNETIC
Last Calibration:	2/19/2020	Last Calibration:	3/3/2020

Notes:

The certification was performed according to EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards May 2012, using procedure G1 and/or G2. U.S EPA Vendor ID Number: D62020, PGVP Participation Date: 01/01/20, PGVP Renewal Date: 01/01/21. The expanded uncertainty listed for each component was calculated at a coverage factor of k=2 and at a level of confidence of 95%.

Analyst: Ashley Smallwood
Ashley Smallwood

Accredited by: ANAB

ANAB ACCREDITED TESTING LABORATORY

Date: 3/11/2020

MATHESON

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1700 Scepter Rd
Waverly, TN 37185
931-296-3357

Certificate of Analysis - EPA Protocol Mixtures

Customer: MATHESON LINWELD
9920 DEER PARK RD
P O BOX 190
WAVERLY, NE 68462

Customer PO#: 2843307

Part # G2679980

Protocol: G1

Reference #: 747621-02

Lot#: 9309600351

Cylinder Number: SX56541

Cylinder Pressure: 1900 psig

Last Analysis Date: 4/17/2019

Expiration Date: 4/17/2027

DO NOT USE THIS CYLINDER WHEN THE PRESSURE FALLS BELOW 100 PSIG

Component: Carbon Monoxide

Certified Conc: 50.01 ppm +/- 0.19 ppm ABS

REPLICATE RESPONSES
Date: 4/17/2019
50.05
50.03
49.96

BALANCE GAS: Nitrogen

REFERENCE STANDARDS:

Component: Carbon Monoxide
Reference Standard: NTRM
Cylinder #: ND22562
Concentration: 49.68 ppm +/- 0.25 ppm (abs)
Exp Date: 8/7/2021
SRM #: NTRM
NIST Sample #: 9/13/2313

CERTIFICATION INSTRUMENTS

Component: Carbon Monoxide
Make/Model: HORIBA VIA-510
Serial Number: XT4F064G
Measurement Principle: NDIR
Last Calibration: 3/18/2019

Notes:

The certification was performed according to EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards May 2012, using procedure G1 and/or G2. U.S EPA Vendor ID Number: D62019, PGVP Participation Date: 01/01/19, PGVP Renewal Date: 01/01/20
The expanded uncertainty listed for each component was calculated at a coverage factor of k=2 and at a level of confidence of 95%.

Analyst: Cierra Freed
Cierra Freed

Date: 4/19/2019

MATHESON
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1700 Scepter Rd
Waverly, TN 37185
931-296-3357

Certificate of Analysis - EPA Protocol Mixtures

Customer: Matheson Linweld
9920 Deer Park Rd.
P O Box 190
Waverly, NE 68462

Customer PO#: 2843307

Part # G2677261

Protocol: G1

Reference #: 747621-1

Lot#: 9309600350

Cylinder Number: SX39335D

Cylinder Pressure: 1900 Psig

Last Analysis Date: 4/23/2019

Expiration Date: 4/23/2027

DO NOT USE THIS CYLINDER WHEN THE PRESSURE FALLS BELOW 100 PSIG

Component: Nitric Oxide

Certified Conc: 500.1 ppm +/- 0.9 ppm ABS

NOx: 500.9 ppm Reference Only

BALANCE GAS: Nitrogen

REPLICATE RESPONSES

Date: 4/17/2019	Date: 4/25/2019
498.2	500.1
499.3	501.5
498.3	502.1

REFERENCE STANDARDS:

Component: Nitric Oxide
Reference Standard: PRM
Cylinder #: 5604608
Concentration: 990.3 ppm +/- 2.0 ppm (abs)
Exp Date: 4/28/2020
SRM #: VSL PRIMARY
NIST Sample #: VSL PRIMARY

CERTIFICATION INSTRUMENTS

Component: Nitric Oxide
Make/Model: Antaris IGS
Serial Number: AFV1710289
Measurement Principle: FTIR
Last Calibration: 4/23/2019

Notes:

The certification was performed according to EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards May 2012, using procedure G1 and/or G2. U.S EPA Vendor ID Number: D62019, PGVP Participation Date: 01/01/19, PGVP Renewal Date: 01/01/20
The expanded uncertainty listed for each component was calculated at a coverage factor of k=2 and at a level of confidence of 95%.

Analyst: Roman Khidekel

Date: 4/30/2019

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1700 Scepter Rd
Waverly, TN 37185
931-296-3357

Certificate of Analysis - EPA Protocol Mixtures

Customer: Matheson Linweld
9920 Deer Park Rd.
P O Box 190
Waverly, NE 68462

Customer PO#: 2845196 Part # G2676610

Protocol: G1 Reference #: 749494-5 Lot#: 9309638347

Cylinder Number: SX39263
Cylinder Pressure: 1900 psig
Last Analysis Date: 6/10/2019
Expiration Date: 6/10/2023

DO NOT USE THIS CYLINDER WHEN THE PRESSURE FALLS BELOW 100 PSIG

Component: Sulfur Dioxide

Certified Conc: 48.1 ppm +/- 0.3 ppm ABS

REPLICATE RESPONSES

Date: 6/1/2019	Date: 6/10/2019
48.0	48.0
48.2	48.1
48.2	48.1

BALANCE GAS: Nitrogen

REFERENCE STANDARDS:

Component: Sulfur Dioxide
Reference Standard: SRM
Cylinder #: CAL016669
Concentration: 98.57 ppm +/- 0.98 ppm (abs)
Exp Date: 4/5/2022
SRM #: 1694a
NIST Sample #: 95-J-35

CERTIFICATION INSTRUMENTS

Component: Sulfur Dioxide
Make/Model: Horiba VIA-510
Serial Number: WBET5PK2
Measurement Principle: NDIR
Last Calibration: 5/31/2019

Notes:

The certification was performed according to EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards May 2012, using procedure G1 and/or G2. U.S EPA Vendor ID Number: 062019, PGVP Participation Date: 01/01/19, PGVP Renewal Date: 01/01/20
The expanded uncertainty listed for each component was calculated at a coverage factor of k=2 and at a level of confidence of 95%.

Analyst: Roman Khidekel Date: 6/18/2019

Airgas

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number:	E02NI99E15A0412	Reference Number:	54-124534616-1
Cylinder Number:	CC344620	Cylinder Volume:	144.4 CF
Laboratory:	ASG - Chicago - IL	Cylinder Pressure:	2015 PSIG
PGVP Number:	B12016	Valve Outlet:	350
Gas Code:	PPN,BALN	Certification Date:	Jan 21, 2016

Expiration Date: Jan 21, 2024

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
PROPANE	55.00 PPM	55.34 PPM	G1	+/- 0.6% NIST Traceable	01/21/2016
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	09061732	CC303832	97.82 PPM PROPANE/AIR	+/- 0.5%	Jun 05, 2019

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet 6700 AHR0801332	FTIR	Dec 28, 2015

Triad Data Available Upon Request

Signature on file

Approved for Release

MATHESON
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1650 Enterprise Parkway
Twinsburg, OH 44087
215-648-4000

Certificate of Analysis – EPA Protocol Mixtures

Customer: MATHESON VALLEY
Cylinder Number: SX-62746
Cylinder pressure: 2000 psig
Last Analysis date: 4/22/2019
Expiration Date: 4/22/2027

Protocol:	Reference #	Lot #
G1	747265	109-96-04037

DO NOT USE THIS CYLINDER WHEN THE PRESSURE FALLS BELOW 100 PSIG

REPLICATE RESPONSES

Date: 4/22/2019 Date:
505 PPM
503 PPM
504 PPM

Component : Propane

Certified Conc: 504 PPM ± 2 PPM

BALANCE GAS: Nitrogen

REFERENCE STANDARDS

Component: Propane
SRM #: SRM-1669b
Sample #: 81-J-12
Cylinder #: FF-55638
Concentration: 496.7 ppm

CERTIFICATION INSTRUMENTS

Component: Propane
Make/Model: Agilent 7890B FID
Serial Number: CN16053036
Measurement Principle: FID
Last Calibration: 4/18/2019

Notes: G2686565

The certification was performed according to EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards May 2012, using procedure G1 and/or G2. U.S EPA Vendor ID Number: D42019, PGVP Participation Date: 01/01/19, PGVP Renewal Date: 01/01/20. The expanded uncertainty listed for each component was calculated at a coverage factor of k=2 and at a level of confidence of 95%.

Analyst Philip D. Marto Date 4/23/2019

Alliance SOURCE TESTING

NOx Converter Efficiency Check

Location: Koppers Naphthalene Distillation Plant - Cicero, IL
Project No.: 2020-1351

NO_2 Converter Check - Outlet					
Analyzer Make	CAI				
Analyzer Model	700				
Serial Number	2001023				
Cylinder ID Number	EB0123592	Post-Test Date	9/30/20	Time	15:34
Cylinder Exp. Date	5/1/22	Post-Test Concentration, ppm			43.52
Cylinder Concentration, ppm	47.3	Post-Test Efficiency, %			92

**Required Efficiency is ≥ 90 %.*

Alliance
SOURCE TESTING

NOx Converter Efficiency Check

Location: Koppers Naphthalene Distillation Plant - Cicero, IL
Project No.: 2020-1351

NO_2 Converter Check - Outlet					
Analyzer Make	CAI	**Pre-Test Date**	9/29/20	**Time**	7:30
Analyzer Model	700	**Pre-Test Concentration, ppm**			47.6
Serial Number	1901011	**Pre-Test Efficiency, %**			96
Cylinder ID Number	EB0118431	**Post-Test Date**	9/29/20	**Time**	16:35
Cylinder Exp. Date	5/13/22	**Post-Test Concentration, ppm**			47.5
Cylinder Concentration, ppm	49.8	**Post-Test Efficiency, %**			95

**Required Efficiency is ≥ 90 %.*

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1700 Scepter Rd
Waverly, TN 37185
931-296-3357

Certificate of Analysis - EPA Protocol Mixtures

Customer: Matheson Valley

Customer PO #:

Part #
G2688472

Protocol: G1

Reference #: T256016-1

Lot#: 9009400481

Cylinder Number: EB0123592
Cylinder Pressure: 2000 psig
Last Analysis Date: 5/1/2019
Expiration Date: 5/1/2022

DO NOT USE THIS CYLINDER WHEN THE PRESSURE FALLS BELOW 100 PSIG

Component: Nitrogen Dioxide

Certified Conc: 47.3 ppm +/- 0.9 ppm ABS

REPLICATE RESPONSES

Date:	4/24/2019	Date:	5/1/2019
	47.4		47.2
	47.5		47.2
	47.3		47.3

BALANCE GAS: AIR

REFERENCE STANDARDS:

Component: Nitrogen Dioxide
Reference Standard: PRM
Cylinder #: D562925
Concentration: 75.0 +/- 1.1 ppm ABS
Exp. Date: 2/2/2019
NIST Sample #: VSL PRIMARY

Reference Standard: GMIS
Cylinder #: EB0097397
Concentration: 47.8 +/- 0.8 ppm ABS
Exp. Date: 9/21/2021

CERTIFICATION INSTRUMENTS

Component: Nitrogen Dioxide
Make/Model: CAI / 600
Serial Number: Y09003
Measurement Principle: CHEMI
Last Calibration: 5/1/2019

Notes:

The certification was performed by Global Calibration Gases, LLC, Sarasota, FL and according to EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards May 2012, using procedure G1 and/or G2. U.S EPA PGVP Vendor ID Number: N22019.
The expanded uncertainty listed for each component was calculated at a coverage factor of k=2 and at a level of confidence of 95%.

Analyst: Signature on File Date: 5/1/2019

QA: Roman Khidekel Date: 5/15/2019

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1700 Scepter Rd
Waverly, TN 37185
931-296-3357

Certificate of Analysis - EPA Protocol Mixtures

Customer: Matheson Linweld
9920 Deer Park Rd.
P O Box 190
Waverly, NE 68462

Customer PO #: 2843307

Part # G2696495

Protocol: G1

Reference #: 747621-3

Lot#: 9009400554

Cylinder Number: EB0118431

Cylinder Pressure: 2000 psig

Last Analysis Date: 5/13/2019

Expiration Date: 5/13/2022

DO NOT USE THIS CYLINDER WHEN THE PRESSURE FALLS BELOW 100 PSIG

Component: Nitrogen Dioxide

Certified Conc: 49.8 ppm +/- 0.9 ppm ABS

REPLICATE RESPONSES

Date:	5/6/2019	Date:	5/13/2019
	49.7		49.9
	49.7		49.7
	49.9		49.9

BALANCE GAS: Nitrogen

REFERENCE STANDARDS:

Component: Nitrogen Dioxide
Reference Standard: PRM
Cylinder #: D562925
Concentration: 75.0 +/- 1.1 ppm ABS
Exp. Date: 2/2/2019
NIST Sample #: VSL PRIMARY

Reference Standard: GMIS
Cylinder #: EB0097397
Concentration: 47.8 +/- 0.8 ppm ABS
Exp. Date: 9/21/2021

CERTIFICATION INSTRUMENTS

Component: Nitrogen Dioxide
Make/Model: CAI / 600
Serial Number: Y09003
Measurement Principle: CHEMI
Last Calibration: 5/13/2019

Notes:

The certification was performed by Global Calibration Gases, LLC, Sarasota, FL and according to EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards May 2012, using procedure G1 and/or G2. U.S EPA PGVP Vendor ID Number: N22019.
The expanded uncertainty listed for each component was calculated at a coverage factor of k=2 and at a level of confidence of 95%.

Analyst: Signature on File — Date: 5/13/2019

QA: [signature] Roman Khidekel — Date: 5/20/2019

Alliance SOURCE TESTING

EPA Method 205
Field Calibration of Dilution System

Location: Koppers Naphthalene Distillation Plant - Cicero, IL
Source: Reboiler/SCR Outlet - Condition 2
Project No.: 2020-1351
Date 9/30/20

Analyzer Make: CAI
Analyzer Model: 700 CLD
Analyzer SN: 2001023
Environics ID: 6096
Component/Balance Gas: Nox/N2
Cylinder Gas ID (Dilution): EB0100198
Cylinder Gas Concentration (Dilution), ppm: 486.8
Cylinder Gas ID (Mid-Level): SX60669
Cylinder Gas Concentration (Mid-Level), ppm: 49.44

Target Mass Flow Contollers	Target Dilution (%)	Target Flow Rate lpm	Target Concentration (ppm)	Actual Concentration (ppm)	Injection 1 Analyzer Concentration (ppm)	Injection 2 Analyzer Concentration (ppm)	Injection 3 Analyzer Concentration (ppm)	Average Analyzer Concentration (ppm)	Difference (ppm)	Average Error (± 2 %)
10L/5L	80.0	5.0	389.4	389.40	389.77	389.11	389.63	389.50	0.10	0.0%
10L/5L	50.0	5.0	243.4	243.40	244.37	243.78	243.77	243.97	0.57	0.2%
10L/1L	20.0	4.0	97.4	97.40	97.24	97.01	97.21	97.15	-0.25	-0.3%
10L/1L	10.0	4.0	48.7	48.70	48.29	48.28	48.30	48.29	-0.41	-0.8%

*Not all AST Environics Units have 2-10L Mass Flow Controllers. For these units the 90% @ 7lpm and 80% @ 7lpm injections will not be conducted.

Average Analyzer Concentration (ppm)	Injection 1 Error (± 2 %)	Injection 2 Error (± 2 %)	Injection 3 Error (± 2 %)
389.50	0.1%	-0.1%	0.0%
243.97	0.2%	-0.1%	-0.1%
97.15	0.1%	-0.1%	0.1%
48.29	0.0%	0.0%	0.0%

Mid-Level Supply Gas Calibration Direct to Analyzer

Calibration Gas Concentration (ppm)	Injection 1 Analyzer Concentration (ppm)	Injection 2 Analyzer Concentration (ppm)	Injection 3 Analyzer Concentration (ppm)	Average Analyzer Concentration (ppm)	Difference (ppm)	Average Error (± 2 %)
49.44	48.94	48.89	49.50	49.11	-0.33	-0.7%

Alliance SOURCE TESTING

EPA Method 205
Field Calibration of Dilution System

Location: Koppers Naphthalene Distillation Plant - Cicero, IL
Source: Main Stack - Condition 2 Natural Gas
Project No.: 2020-1351
Date 9/30/20

Analyzer Make: CAI
Analyzer Model: 700
Analyzer SN: 1901011
Environics ID: 8411
Component/Balance Gas: Nox/N2
Cylinder Gas ID (Dilution): SX39335D
Cylinder Gas Concentration (Dilution), ppm: 500.1
Cylinder Gas ID (Mid-Level): SX28083
Cylinder Gas Concentration (Mid-Level), ppm: 50.44

Target Mass Flow Contollers	Target Dilution (%)	Target Flow Rate lpm	Target Concentration (ppm)	Actual Concentration (ppm)	Injection 1 Analyzer Concentration (ppm)	Injection 2 Analyzer Concentration (ppm)	Injection 3 Analyzer Concentration (ppm)	Average Analyzer Concentration (ppm)	Difference (ppm)	Average Error (± 2 %)
10L/10L*	90.0	7.0	450.1	450.0	444.6	442.1	440.8	442.50	-7.50	-1.7%
10L/10L*	80.0	7.0	400.1	450.0	448.7	447.6	448.1	448.13	-1.87	-0.5%
10L/5L	80.0	5.0	400.1	400.0	394.6	395.8	398.2	396.20	-3.80	-0.9%
10L/5L	50.0	5.0	250.1	250.0	248.9	249.2	249.6	249.23	-0.77	-0.3%
10L/1L	20.0	4.0	100.0	100.0	99.1	99.6	99.8	99.50	-0.50	-0.5%
10L/1L	10.0	4.0	50.0	50.0	49.6	49.5	49.6	49.57	-0.43	-0.9%

*Not all AST Environics Units have 2-10L Mass Flow Controllers. For these units the 90% @ 7lpm and 80% @ 7lpm injections will not be conducted.

Average Analyzer Concentration (ppm)	Injection 1 Error (± 2 %)	Injection 2 Error (± 2 %)	Injection 3 Error (± 2 %)
442.50	0.5%	-0.1%	-0.4%
448.13	0.1%	-0.1%	0.0%
396.20	-0.4%	-0.1%	0.5%
249.23	-0.1%	0.0%	0.1%
99.50	-0.4%	0.1%	0.3%
49.57	0.1%	-0.1%	0.1%

Mid-Level Supply Gas Calibration Direct to Analyzer

Calibration Gas Concentration (ppm)	Injection 1 Analyzer Concentration (ppm)	Injection 2 Analyzer Concentration (ppm)	Injection 3 Analyzer Concentration (ppm)	Average Analyzer Concentration (ppm)	Difference (ppm)	Average Error (± 2 %)
50.44	49.9	50.2	50.3	50.13	-0.31	-0.6%

Alliance
SOURCE TESTING

Mass Flow Controller Calibration

Dilution System Make:	Environics
Dilution System Model:	4040
Dilution System S/N:	6096
Calibration Equipment Make:	Sensidyne
Calibration Equipment Model:	Gilibrator 2
Calibration Equipment S/N:	501128
Flow Cell S/N:	1002003-H
Flow Cell S/N:	0501057-S
Calibration Gas:	Nitrogen
Barometric Pressure, mmHg:	28.8
Ambient Temperature, °F:	65

Mass Flow Controller ID	#1			# 2			# 3		
Size, ccm:	10,000			5,000			1,000		
Make:	Hasting			Hasting			Hasting		
Model:	EFC-202-10L			EFC-202-5L			EFC-202-1L		
S/N:	47973001			36740001			36712002		
	Set Flow cc/min	**True Flow cc/min**	**Difference**	**Set Flow cc/min**	**True Flow cc/min**	**Difference**	**Set Flow cc/min**	**True Flow cc/min**	**Difference**
5%	500	576	15.3%	250	274	9.6%	50	52	4.5%
10%	1,000	1,085	8.5%	500	534	6.7%	100	105	4.7%
20%	2,000	2,134	6.7%	1,000	1,049	4.9%	200	210	5.1%
30%	3,000	3,103	3.4%	1,500	1,547	3.1%	300	317	5.6%
40%	4,000	4,082	2.1%	2,000	2,038	1.9%	400	417	4.3%
50%	5,000	5,132	2.6%	2,500	2,538	1.5%	500	521	4.3%
60%	6,000	6,167	2.8%	3,000	3,036	1.2%	600	621	3.5%
70%	7,000	7,145	2.1%	3,500	3,526	0.7%	700	722	3.1%
80%	8,000	8,177	2.2%	4,000	4,018	0.4%	800	826	3.2%
90%	9,000	9,253	2.8%	4,500	4,541	0.9%	900	929	3.2%
100%	10,000	10,380	3.8%	5,000	5,067	1.3%	1,000	1,031	3.1%

Note: The mass flow controller's calibration values are used by the dilution system's operating software to improve accuracy. These calibrations are not necessarily indicative of the systems overall performance. Performance is verified by conducting a Method 205 prior to each field use.

Calibration Performed By Leo Sullivan

Date 10/26/18

Alliance SOURCE TESTING

Mass Flow Controller Calibration

Dilution System Make:	Environics
Dilution System Model:	4040
Dilution System S/N:	8411
Calibration Equipment Make:	Alicat Scientific
Calibration Equipment Model:	M-10SLPD/5MM-D/5M, M-1SLPM-D/5M
Calibration Equipment S/N:	
Flow Cell S/N:	127208
Flow Cell S/N:	127206
Calibration Gas:	Nitrogen
Barometric Pressure, mmHg:	29.403
Ambient Temperature, °F:	70

Mass Flow Controller ID	#1			# 2			# 3		
Size, ccm:	10,000			10,000			1,000		
Make:	Environics			Environics			Environics		
Model:	EFC202			EFC202			EFC202		
S/N:	626687004			558416002			626685001		
	Set Flow cc/min	True Flow cc/min	Difference	Set Flow cc/min	True Flow cc/min	Difference	Set Flow cc/min	True Flow cc/min	Difference
5%	500	511	2.2%	500	546	9.3%	50	49	3.0%
10%	1,000	1,063	6.3%	1,000	1,089	8.9%	100	102	2.2%
20%	2,000	2,150	7.5%	2,000	2,139	6.9%	200	213	6.5%
30%	3,000	3,227	7.6%	3,000	3,160	5.3%	300	322	7.3%
40%	4,000	4,279	7.0%	4,000	4,162	4.1%	400	432	7.9%
50%	5,000	5,335	6.7%	5,000	5,154	3.1%	500	539	7.9%
60%	6,000	6,375	6.3%	6,000	6,135	2.3%	600	650	8.3%
70%	7,000	7,401	5.7%	7,000	7,114	1.6%	700	760	8.5%
80%	8,000	8,432	5.4%	8,000	8,079	1.0%	800	872	9.0%
90%	9,000	9,453	5.0%	9,000	9,040	0.4%	900	983	9.2%
100%	10,000	10,483	4.8%	10,000	10,001	0.0%	1,000	1,095	9.5%

Note: The mass flow controller's calibration values are used by the dilution system's operating software to improve accuracy. These calibrations are not necessarily indicative of the systems overall performance. Performance is verified by conducting a Method 205 prior to each field use.

Calibration Performed By James Holder

Date 12/18/19

MATHESON
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1650 Enterprise Parkway
Twinsburg, OH 44087
215-648-4000

Certificate of Analysis – EPA Protocol Mixtures

Customer:	Matheson Valley	Protocol:	Reference #:	Lot#:
Cylinder Number:	SX- 60669	G1	746957	109-96-41468
Cylinder Pressure:	1800 psig		Part #: G 2688367	
Last Analysis Date:	4/2/2019			
Expiration Date:	4/2/2027			

DO NOT USE THIS CYLINDER WHEN THE PRESSURE FALLS BELOW 100 PSIG

REPLICATE RESPONSES

Component:	Nitric Oxide	Date: 3/26/2019	Date: 4/2/2019
		49.25 ppm	49.70 ppm
Certified Conc:	49.44 ppm +/- 0.16 ppm	49.32 ppm	49.17 ppm
		49.25 ppm	49.45 ppm

Component:	Carbon Monoxide	Date: 4/2/2019
		50.1 ppm
Certified Conc:	50.0 ppm +/- 0.3 ppm	50.0 ppm
		50.0 ppm

BALANCE GAS: Nitrogen

REFERENCE STANDARDS:

Component:	Nitric Oxide	Carbon Monoxide
SRM #:	PRM-NO50	NTRM-081315
Sample #:	C1370010.01	151102
Cylinder #:	APEX1236650	ND43277
Concentration:	50.04 ppm	98.79 ppm

CERTIFICATION INSTRUMENTS

Component:	Nitric Oxide	Carbon Monoxide
Make/Model:	NOX CLA-510SS	CO Horiba VIA-510 HIGH
Serial Number:	XXFD0YW0	ML0E13T1
Measurement Principle:	Chemiluminescence	NDIR
Last Calibration:	3/4/2019	4/2/2019

Notes: Nox = 49.44 ppm REFERENCE VALUE ONLY

The certification was performed according to EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards May 2012, using procedure G1 and/or G2. U.S EPA Vendor ID Number: D42019, PGVP Participation Date: 01/01/19, PGVP Renewal Date: 01/01/20. The expanded uncertainty listed for each component was calculated at a coverage factor of k=2 and at a level of confidence of 95%.

Analyst: [signature] Date 4/24/2019

MATHESON
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1700 Scepter Rd
Waverly, TN 37185
931-296-3357

Certificate of Analysis - EPA Protocol Mixtures

Customer: MATHESON LINWELD
9920 DEER PARK RD
P O BOX 190
WAVERLY, NE 68462

Customer PO#: 3042936
Protocol: G1
Reference #: 758414-03
Part #: G2672670
Lot#: 9309604004

Cylinder Number: SX28083
Cylinder Pressure: 1900 psig
Last Analysis Date: 11/13/2019
Expiration Date: 11/13/2027

DO NOT USE THIS CYLINDER WHEN THE PRESSURE FALLS BELOW 100 PSIG

REPLICATE RESPONSES

		Date: 11/5/2019	Date: 11/13/2019
Component:	Nitric Oxide	50.29	50.38
		50.54	50.41
Certified Conc:	50.44 ppm +/- 0.13 ppm ABS	50.52	50.42

NOx: 50.51 ppm Reference Only

BALANCE GAS: Nitrogen

REFERENCE STANDARDS:

Component: Nitric Oxide
Reference Standard: PRM
Cylinder #: APEX1257585
Concentration: 49.02ppm +/- 0.20ppm (abs)
Exp Date: 5/24/2022
SRM #: VSL PRIMARY
NIST Sample #: VSL PRIMARY

CERTIFICATION INSTRUMENTS

Component: Nitric Oxide
Make/Model: CAI 700
Serial Number: 1707006
Measurement Principle: CHEMI
Last Calibration: 11/11/2019

Notes:

The certification was performed according to EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards May 2012, using procedure G1 and/or G2. U.S EPA Vendor ID Number: D62019, PGVP Participation Date: 01/01/19, PGVP Renewal Date: 01/01/20
The expanded uncertainty listed for each component was calculated at a coverage factor of k=2 and at a level of confidence of 95%.

Analyst: Cierra Freed
Cierra Freed

ANAB ACCREDITED TESTING LABORATORY

Date: 11/19/2019

Accredited by:
ANAB

Alliance SOURCE TESTING

QA Data
Stratification Check

Location: Koppers Naphthalene Distillation Plant - Cicero, IL
Source: Reboiler/SCR Outlet - Condition 2
Project No.: 2020-1351
Date: 9/29/2020

Traverse Point	Time	NOx (ppm)	SO_2 (ppm)	O_2 (%)	CO_2 (%)
A-1	14:33	54.7	0.1	7.7	7.9
2	14:36	55.0	0.1	7.7	7.9
3	14:39	54.9	0.1	7.7	7.9
Average		54.9	0.1	7.7	7.9
Criteria Met		Single Point	Single Point	Single Point	Single Point

Alliance SOURCE TESTING

QA Data
Stratification Check

Location: Koppers Naphthalene Distillation Plant - Cicero, IL
Source: Main Stack - Condition 2 Natural Gas
Project No.: 2020-1351
Date: 9/29/2020

Traverse Point	Time	NOx (ppm)	CO (ppm)	SO_2 (ppm)
A-1	8:00	45.8	24.6	0.0
2	8:01	45.6	24.9	0.0
3	8:02	45.2	25.2	0.0
Average		45.5	24.9	0.0
Criteria Met		Single Point	Single Point	Single Point

Alliance SOURCE TESTING

QA Data
Stratification Check

Location: Koppers Naphthalene Distillation Plant - Cicero, IL
Source: TO-5 Outlet - Condition 2
Project No.: 2020-1351
Date: 9/30/2020

Traverse Point	Time	SO_2 (ppm)	O_2 (%)	CO_2 (%)
A-1	8:00	0.0	15.5	3.5
2	8:01	0.0	15.5	3.5
3	8:02	0.0	15.5	3.5
Average		0.0	15.5	3.5
Criteria Met		Single Point	Single Point	Single Point

Location	Koppers Naphthalene Distillation Plant - Cicero, IL
Source(s)	Reboiler/SCR Outlet
Project No.	2020-1351
Date(s)	9/29-30/20
Ethylene Cylinder ID	RR00136
Concentration (ppmv)	99.4
Instrument ID	MKS 4 (Serial #016758067)

CTS 1	99.34	CTS 7	--	AVERAGE	99.11
CTS 2	99.37	CTS 8	--	MAX	99.37
CTS 3	98.87	CTS 9	--	deviation	0.26
CTS 4	98.86	CTS 10	--	MIN	98.86
CTS 5	--	CTS 11	--	deviation	0.25
CTS 6	--	CTS 12	--		

Greatest Deviation from average
0.26%

Agreement with Assumed Pathlength
99.71%
within 5% no correction required

CTS 1

Date	Time	File	Temperature (C	Pressure	Ethylene
9/29/20	7:34:00	MKS4_0101.LAB	191.3	0.989	99.35
9/29/20	7:35:03	MKS4_0102.LAB	191.2	0.989	99.77
9/29/20	7:36:05	MKS4_0103.LAB	191.3	0.983	98.91

CTS 2

Date	Time	File	Temperature (C	Pressure	Ethylene
9/29/20	20:05:46	MKS4_0818.LAB	190.5	0.984	99.19
9/29/20	20:06:48	MKS4_0819.LAB	190.4	0.984	99.46
9/29/20	20:07:51	MKS4_0820.LAB	190.5	0.984	99.47

CTS 3

Date	Time	File	Temperature (C	Pressure	Ethylene
9/30/20	9:00:58	MKS4_1553.LAB	190.5	0.972	99.21
9/30/20	9:02:01	MKS4_1554.LAB	190.5	0.972	98.50
9/30/20	9:03:04	MKS4_1555.LAB	190.5	0.972	98.89

CTS 4

Date	Time	File	Temperature (C	Pressure	Ethylene
9/30/20	16:31:43	MKS4_1983.LAB	190.5	0.977	98.97
9/30/20	16:32:45	MKS4_1984.LAB	190.5	0.977	99.24
9/30/20	16:33:48	MKS4_1985.LAB	190.5	0.977	98.37

CTS 5

Date	Time	File	Temperature (C	Pressure	Ethylene

CTS 6

Date	Time	File	Temperature (C	Pressure	Ethylene

CTS 7

Date	Time	File	Temperature (C	Pressure	Ethylene

CTS 8

Date	Time	File	Temperature (C	Pressure	Ethylene

CTS 9

Date	Time	File	Temperature (C	Pressure	Ethylene

CTS 10

Date	Time	File	Temperature (C	Pressure	Ethylene

CTS 11

Date	Time	File	Temperature (C	Pressure	Ethylene

CTS 12

Date	Time	File	Temperature (C	Pressure	Ethylene

Location	Koppers Naphthalene Distillation Plant - Cicero, IL
Source	Reboiler/SCR Outlet
Project No.	2020-1351
Date	9/28-29/20

Spike Cylinder ID	RR00114	Component
Spike Gas concentration	297	Ammonia
Tracer Cylinder ID	RR00114	Component
Tracer Gas concentration	4.98	SF6
Instrument ID	MKS 4 (Serial #016758067)	

Direct Spike Values

Date	Time	File	Temperature (C)	Pressure	Spike (ppm)	Tracer (ppm)
09/28/20	18:58:41	MKS4__0018.LAB	190.9	0.819	260.84	4.695
09/28/20	18:59:44	MKS4__0019.LAB	190.8	0.819	263.37	4.699
09/28/20	19:00:47	MKS4__0020.LAB	190.8	0.819	264.87	4.696
09/28/20	19:01:50	MKS4__0021.LAB	190.8	0.818	265.65	4.699
09/28/20	19:02:53	MKS4__0022.LAB	190.9	0.819	267.00	4.697
09/28/20	19:03:56	MKS4__0023.LAB	190.8	0.818	267.57	4.696
				Average	**264.88**	**4.697**

Native Values

Date	Time	File	Temperature (C)	Pressure	Spike (ppm)	Tracer (ppm)
09/29/20	10:02:50	MKS4__0243.LAB	191.3	0.953	2.32	-0.013
09/29/20	10:03:53	MKS4__0244.LAB	191.3	0.953	2.24	-0.015
09/29/20	10:04:56	MKS4__0245.LAB	191.3	0.953	2.17	-0.014
09/29/20	10:05:59	MKS4__0246.LAB	191.3	0.953	2.14	-0.014
09/29/20	10:07:02	MKS4__0247.LAB	191.3	0.953	2.03	-0.011
09/29/20	10:08:04	MKS4__0248.LAB	191.2	0.922	1.76	-0.007
09/29/20	10:09:07	MKS4__0249.LAB	191.3	0.906	1.31	-0.005
				Average	**2.00**	**-0.011**

Spiked values

Date	Time	File	Temperature (C)	Pressure	Spike (ppm)	Tracer (ppm)
09/29/20	8:36:53	MKS4__0161.LAB	191.1	0.903	28.07	0.459
09/29/20	8:37:56	MKS4__0162.LAB	191.1	0.903	24.31	0.454
09/29/20	8:38:59	MKS4__0163.LAB	191.2	0.903	23.43	0.457
09/29/20	8:40:02	MKS4__0164.LAB	191.2	0.903	23.42	0.457
09/29/20	8:41:05	MKS4__0165.LAB	191.2	0.903	24.34	0.454
09/29/20	8:42:08	MKS4__0166.LAB	191.2	0.903	25.75	0.454
09/29/20	8:43:11	MKS4__0167.LAB	191.2	0.903	26.42	0.455
				Average	**25.11**	**0.456**

Dilution Factor

9.9%

Calculated Spike

28.13

Spike Recovery

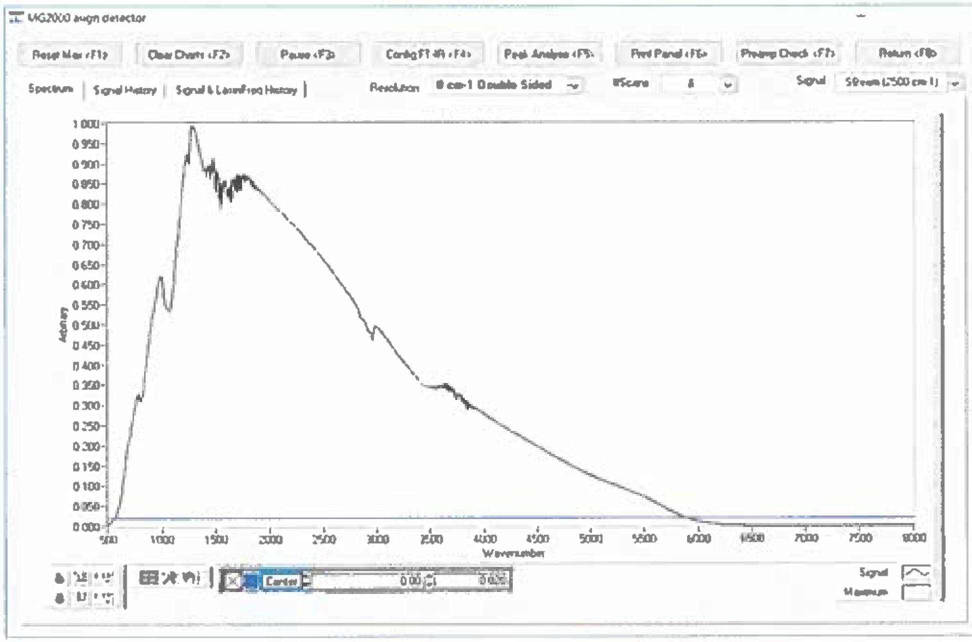
89.24%

Location	Koppers Naphthalene Distillation Plant - Cicero, IL
Project No.	2020-1351
Instrument	MKS 4 (Serial #016758067)

Summary of Spikes

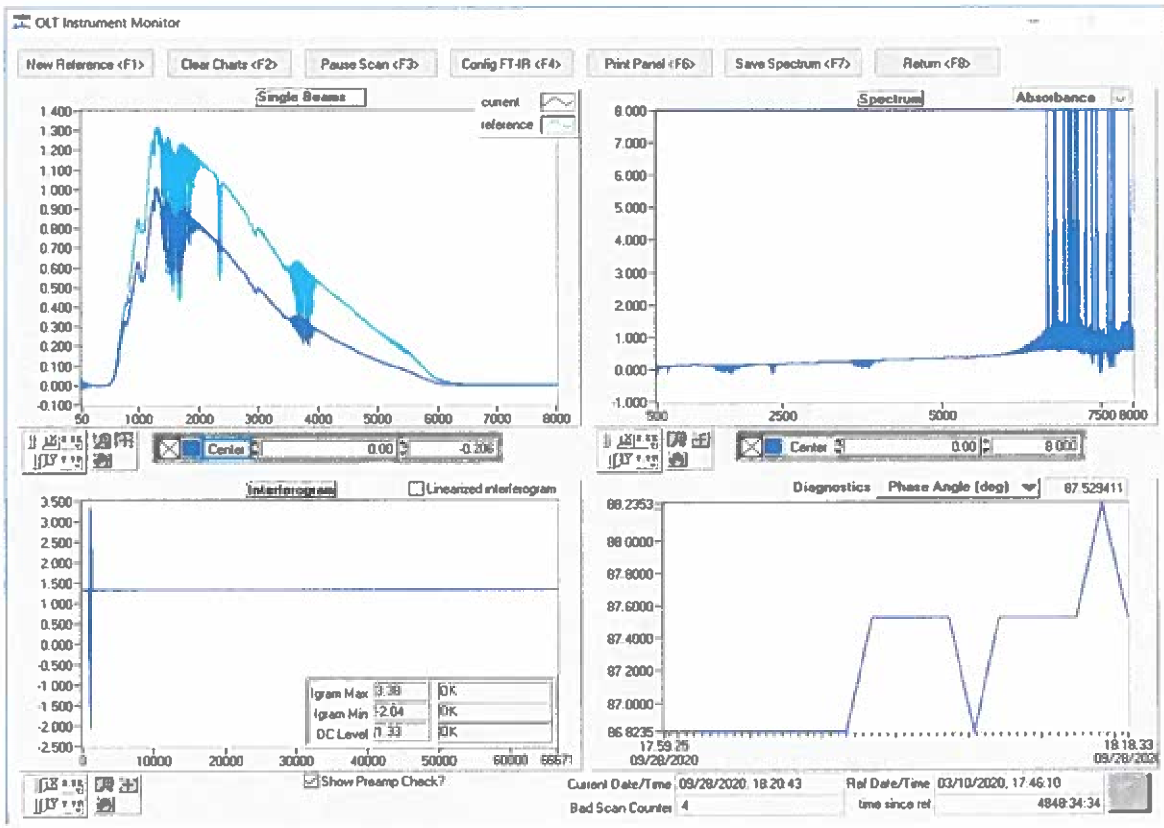
Source	Reboiler/SCR Outlet
Date	9/28-29/20
Time	8:36
Analyte	Ammonia
Direct	264.88
Native	2.00
Spiked	25.11
Dilution	9.9%
Recovery	89%
Result	PASS

Location	Koppers Naphthalene Distillation Plant - Cicero, IL
Source(s)	Reboiler/SCR Outlet
Project No.	2020-1351
Health Check Parameter	MKS - Single Beam (Pre-Test)
Instrument ID	MKS 4 (Serial #016758067)
Date	9/29/2020

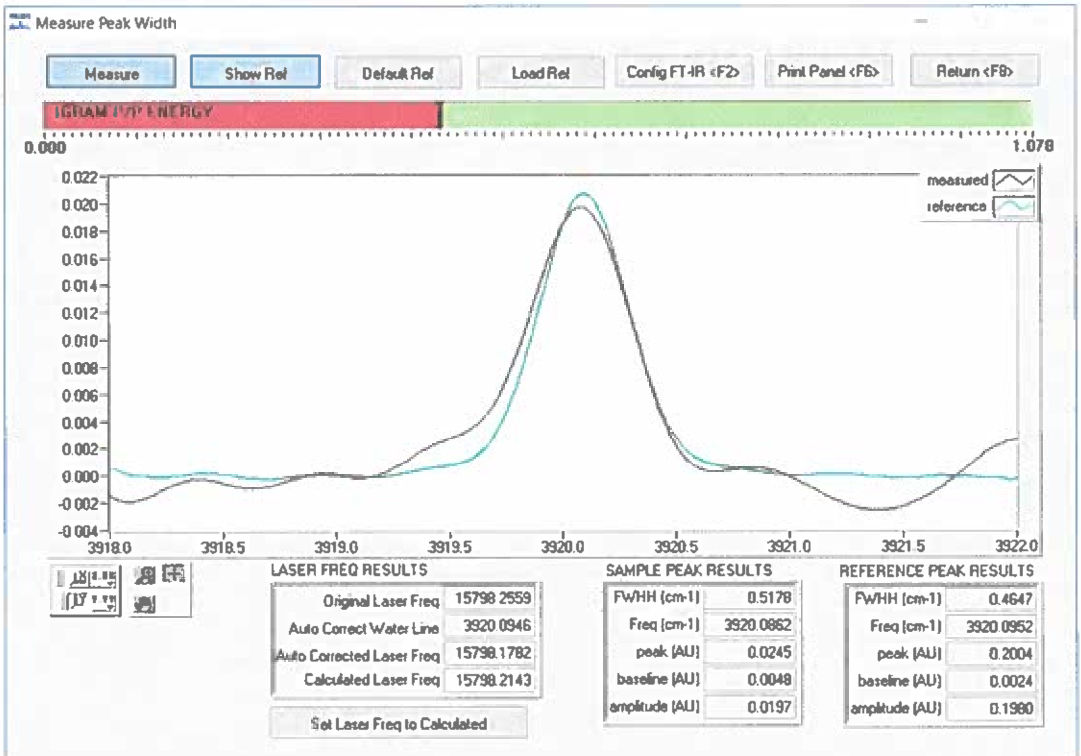


Location	Koppers Naphthalene Distillation Plant - Cicero, IL
Source(s)	Reboiler/SCR Outlet
Project No.	2020-1351
Health Check Parameter	MKS - Single Beam (Post-Test)
Instrument ID	MKS 4 (Serial #016758067)
Date	9/29/2020

Location	Koppers Naphthalene Distillation Plant - Cicero, IL
Source(s)	Reboiler/SCR Outlet
Project No.	2020-1351
Health Check Parameter	MKS - Detector Linearity
Instrument ID	MKS 4 (Serial #016758067)
Date	9/29/2020



Location	Koppers Naphthalene Distillation Plant - Cicero, IL
Source(s)	Reboiler/SCR Outlet
Project No.	2020-1351
Health Check Parameter	MKS - Peak Analysis
Instrument ID	MKS 4 (Serial #016758067)
Date	9/29/2020



Location	Koppers Naphthalene Distillation Plant - Cicero, IL
Source(s)	Reboiler/SCR Outlet
Project No.	2020-1351
Health Check Parameter	MKS - Signal to Noise Ratio
Instrument ID	MKS 4 (Serial #016758067)
Date	9/29/2020

Running SNR Test...

SNR Report, 9/28/2020, 6:22 PM
Number of Scans = 64
Resolution = .5 cm-1 Single Sided

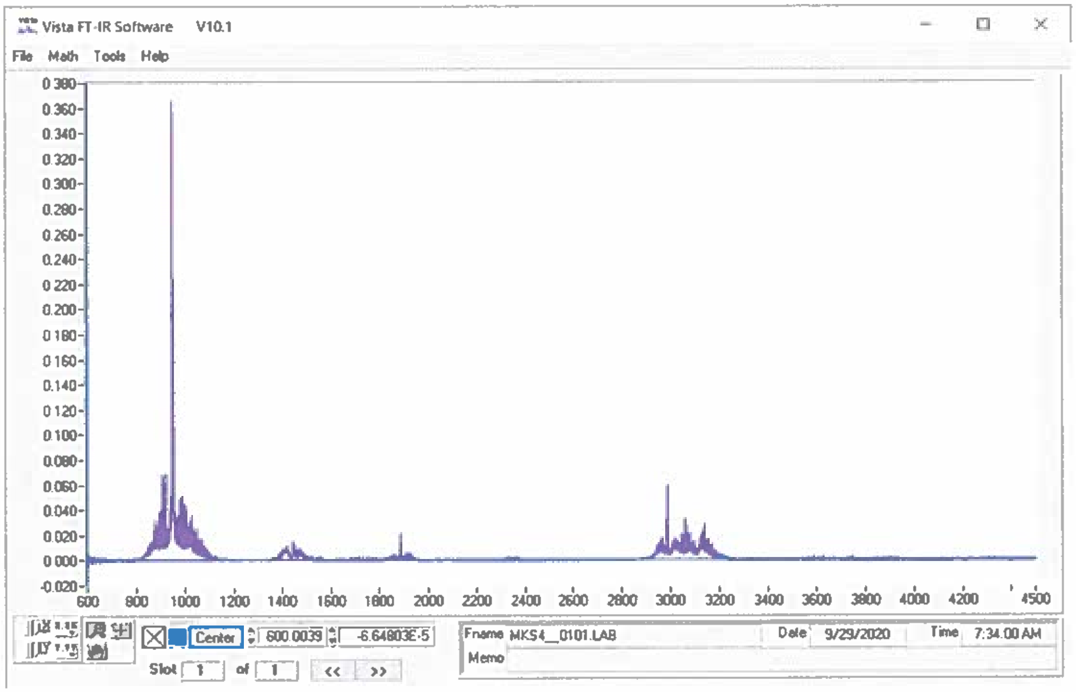
Pass 1
Range = 1000-1100 cm-1, RMS Noise=0.040317% (0.175060 mAU), SNR=2480
Range = 2100-2200 cm-1, RMS Noise=0.027596% (0.119845 mAU), SNR=3624

Pass 2
Range = 1000-1100 cm-1, RMS Noise=0.037796% (0.164136 mAU), SNR=2646
Range = 2100-2200 cm-1, RMS Noise=0.026732% (0.116095 mAU), SNR=3741

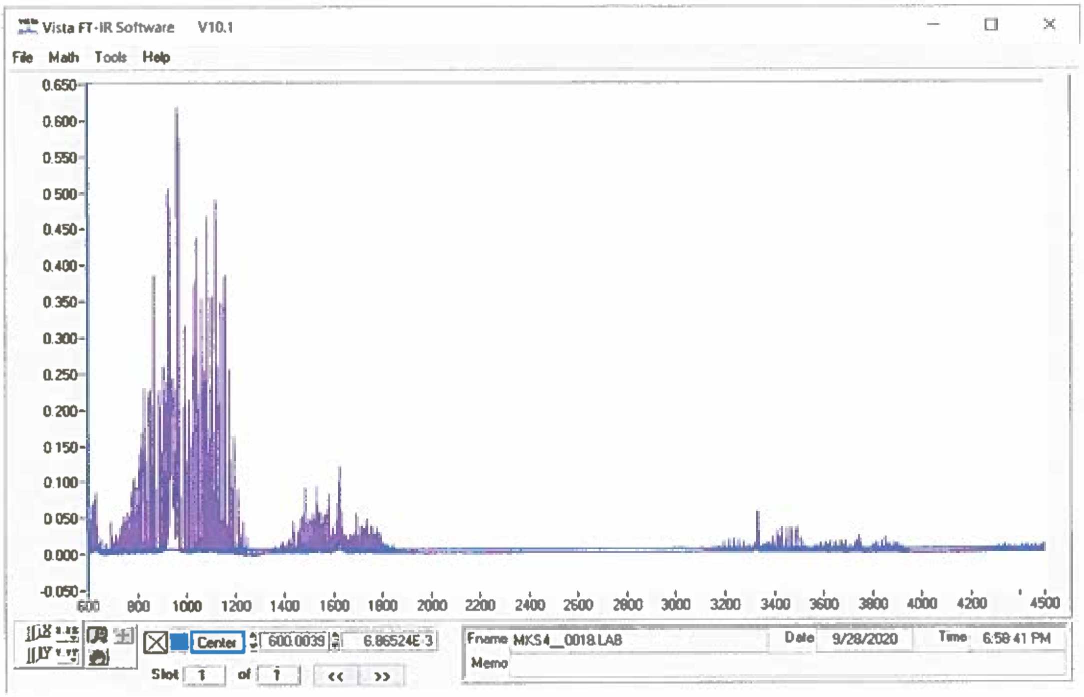
Pass 3
Range = 1000-1100 cm-1, RMS Noise=0.034667% (0.150549 mAU), SNR=2885
Range = 2100-2200 cm-1, RMS Noise=0.026192% (0.113749 mAU), SNR=3818

ABORT

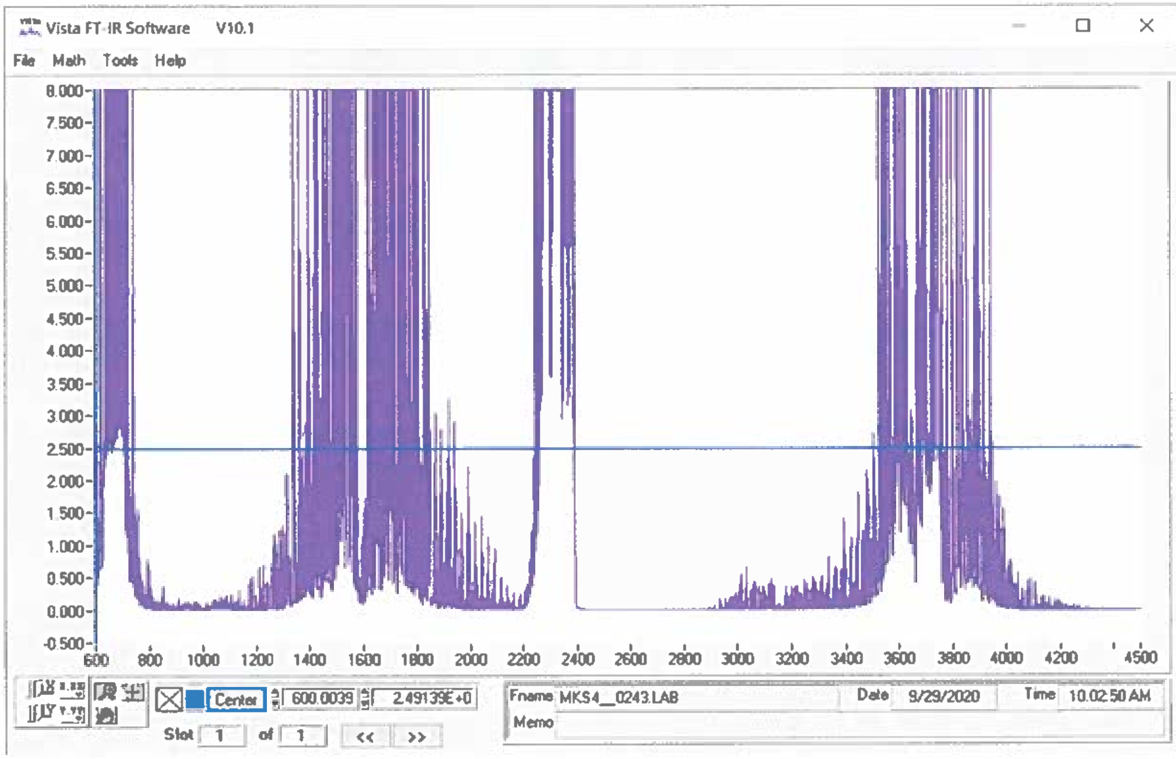
Location	Koppers Naphthalene Distillation Plant - Cicero, IL
Source(s)	Reboiler/SCR Outlet
Project No.	2020-1351
Spectra (CTS)	MKS4__0101.LAB
Date	9/29/2020
Time	7:34



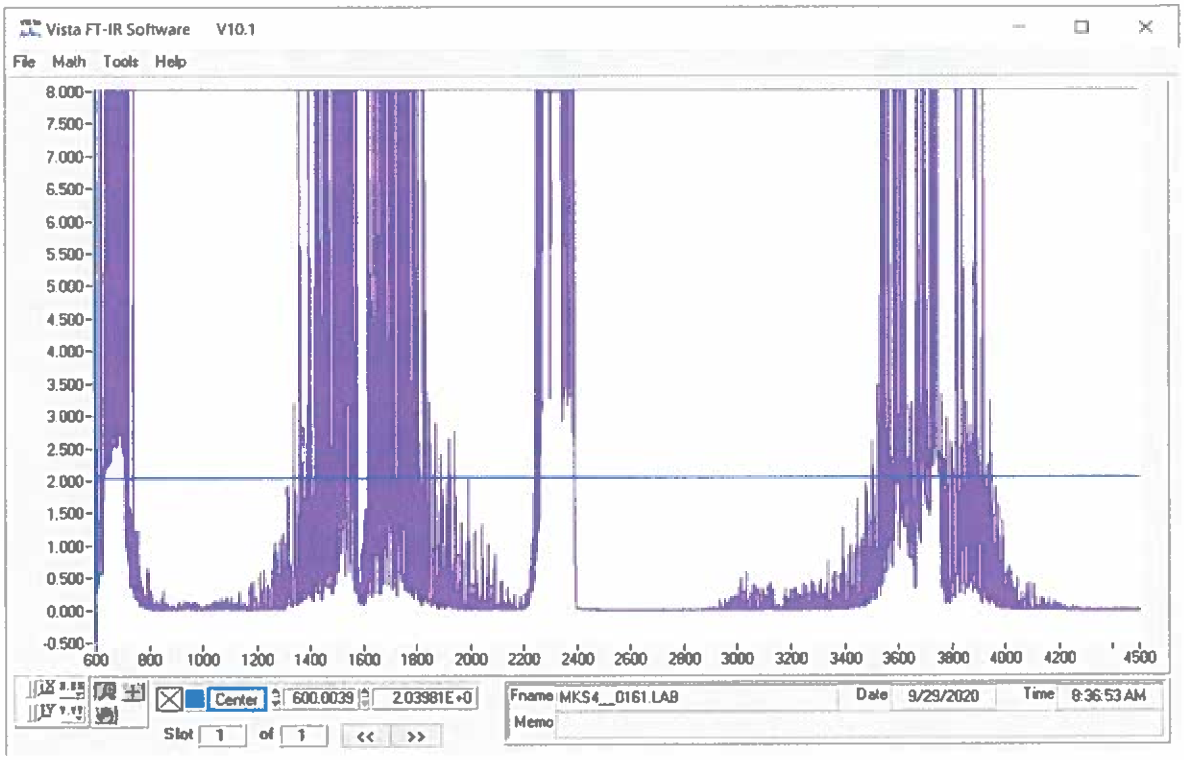
Location	Koppers Naphthalene Distillation Plant - Cicero, IL
Source(s)	Reboiler/SCR Outlet
Project No.	2020-1351
Spectra (Analyte Direct)	MKS4__0018.LAB
Date	9/28/2020
Time	18:58



Location	Koppers Naphthalene Distillation Plant - Cicero, IL
Source(s)	Reboiler/SCR Outlet
Project No.	2020-1351
Spectra (Native)	MKS4__0243.LAB
Date	9/29/2020
Time	10:02



Location	Koppers Naphthalene Distillation Plant - Cicero, IL
Source(s)	Reboiler/SCR Outlet
Project No.	2020-1351
Spectra (Spike)	MKS4_0161.LAB
Date	9/29/2020
Time	8:36



Hydrocarbon Laboratories

Date: 15-Jul-20

Customer: Alliance
931 Seaco Ct
Deer Park, TX 77536

PO#: James Holder
WO#: N/A
Part #: N/A
Date of Production: 07/15/20
Expiration Date: 07/15/21

Cylinder Number: RR00136
Cylinder Size: AL150
CGA: 350

Type: Gas
Make Units: Mole
Product Class: Certified

Pressure: 2000 PSIG
Dewpoint: 32 F

Component	Concentration Requested	Actual	Accuracy
Ethylene	100 PPM	99.4 PPM	5%
Nitrogen	Balance	Balance	

This mixture was manufactured gravimetrically on laboratory balances calibrated with N.I.S.T. traceable weights.

Certified by:

Ph: 281-840-0781 www.hydrocarbonlaboratories.com

Hydrocarbon Laboratories

Date: 27-Oct-20

Customer: Alliance
5757 Genoa Red Bluff
Pasadena, TX 77507

PO#: Dan L.
WO#: N/A
Part #: N/A
Date of Production: 07/18/19
Expiration Date: 10/27/21

Cylinder Number: RR00114
Cylinder Size: AL150
CGA: 705

Type: Gas
Make Units: Mole
Product Class: Certified - Recert

Pressure: 2000 PSIG
Dewpoint: 32 F

Component	Concentration Requested	Concentration Actual	Accuracy
Sulfur Hexafluoride	5 PPM	4.98 PPM	5%
Ammonia	300 PPM	297 PPM	5%
Nitrogen	Balance	Balance	

This mixture was manufactured gravimetrically on laboratory balances calibrated with N.I.S.T. traceable weights.

Certified by:

Ph: 281-840-0781 www.hydrocarbonlaboratories.com

Appendix E

				FIC-3600A RCO feed to Acid Washer (feed fed to feed pre-washing)			FIC-3615B AFO to V-610 Dehydrator (washed feed fed to main process)				FIC-3633 Naphthalene Product (main product)			FI-3633B NSR to Storage (residue product)		
Month	start	end	Total Hours	Avg KPPH	tons	LBS	Avg KPPH	Avg SG	tons	LBS	Avg KPPH	tons	LBS	Avg KPPH	tons	LBS
September-2020	8/31/20 7:00	9/30/20 7:00	720	14.11	7,314	14,628,587	14.15	1.0	7,327	14,654,868	7.28	3,772	7,543,646	5.09	2,640	5,279,998
August-2020	7/31/20 7:00	8/31/20 7:00	744	18.96	7,055	14,109,216	18.48	0.9	6,876	13,752,827	9.16	3,408	6,816,048	6.99	2,599	5,197,367
July-2020	6/30/20 7:00	7/31/20 7:00	744	12.38	4,604	9,207,158	12.80	0.9	4,762	9,524,256	6.35	2,362	4,723,369	4.59	1,707	3,414,984
June-2020	5/31/20 7:00	6/30/20 7:00	720	12.60	4,536	9,072,036	11.56	0.9	4,162	8,324,378	5.48	1,975	3,949,026	4.34	1,563	3,125,234
May-2020	4/30/20 7:00	5/31/20 7:00	744	13.40	4,983	9,966,050	12.76	0.9	4,745	9,489,792	5.87	2,185	4,370,933	4.78	1,776	3,552,686
April-2020	3/31/20 7:00	4/30/20 7:00	720	10.57	3,805	7,609,847	9.32	0.9	3,354	6,708,534	4.63	1,666	3,331,122	3.24	1,165	2,329,819
March-2020	2/29/20 7:00	3/31/20 7:00	744	10.81	4,021	8,041,301	10.66	1.0	3,964	7,928,754	4.99	1,857	3,714,670	4.42	1,645	3,290,681
February-2020	1/31/20 7:00	2/29/20 7:00	696	17.05	5,933	11,865,541	16.98	1.0	5,909	11,818,136	7.87	2,740	5,479,844	7.42	2,582	5,163,944
January-2020	12/31/19 7:00	1/31/20 7:00	744	5.70	2,121	4,242,481	5.48	0.9	2,039	4,077,729	2.64	983	1,966,996	0.70	260	519,650
December-2019	11/30/19 7:00	12/31/19 7:00	744	13.21	4,915	9,829,594	12.54	1.0	4,667	9,333,005	5.78	2,149	4,297,652	1.16	433	865,743
November-2019	10/31/19 7:00	11/30/19 7:00	720	4.88	1,758	3,515,160	4.57	0.9	1,644	3,288,691	2.29	824	1,647,027	1.73	623	1,246,351
October-2019	9/30/19 7:00	10/31/19 7:00	744	10.45	3,887	7,774,611	9.39	0.9	3,492	6,984,147	4.62	1,719	3,437,253	3.85	1,432	2,863,832
12 month total					54,931				52,943			25,639			18,425	
September-2019	8/31/19 7:00	9/30/19 7:00	720	14.33	5,160	10,319,906	14.56	0.972	5,242	10,483,617	7.38	2,656	5,311,514	5.49	1,975	3,949,917

	TI_2H01	5 min averages 760	FI-3640A		5 min averages
	Thermal Oxidizer Chamber Temp	°C	**Natural gas flow (for firing rate)**	**RSLinx Enterprise**	SCFH
9/29/20 11:00	9/29/20 12:00	759.06	9/29/20 11:00	9/29/20 12:00	10,049.7
9/29/20 12:00	9/29/20 13:00	760.05	9/29/20 12:00	9/29/20 13:00	27,488.0
9/29/20 13:00	9/29/20 14:00	760.00	9/29/20 13:00	9/29/20 14:00	25,046.7
9/29/20 14:00	9/29/20 15:00	759.98	9/29/20 14:00	9/29/20 15:00	27,524.3
9/29/20 15:00	9/29/20 16:00	759.90	9/29/20 15:00	9/29/20 16:00	27,425.2
9/29/20 16:00	9/29/20 17:00	760.06	9/29/20 16:00	9/29/20 17:00	27,501.5
9/29/20 17:00	9/29/20 18:00	760.03	9/29/20 17:00	9/29/20 18:00	27,670.4
9/29/20 18:00	9/29/20 19:00	760.00	9/29/20 18:00	9/29/20 19:00	27,723.6
9/29/20 19:00	9/29/20 20:00	760.04	9/29/20 19:00	9/29/20 20:00	27,778.2
9/29/20 20:00	9/29/20 21:00	759.98	9/29/20 20:00	9/29/20 21:00	27,854.8
9/29/20 21:00	9/29/20 22:00	760.01	9/29/20 21:00	9/29/20 22:00	27,946.6
9/29/20 22:00	9/29/20 23:00	760.00	9/29/20 22:00	9/29/20 23:00	27,544.7
9/29/20 23:00	9/30/20 0:00	331.13	9/29/20 23:00	9/30/20 0:00	28,393.8
9/30/20 0:00	9/30/20 1:00	90.69	9/30/20 0:00	9/30/20 1:00	28,454.2
9/30/20 1:00	9/30/20 2:00	51.19	9/30/20 1:00	9/30/20 2:00	28,491.2
9/30/20 2:00	9/30/20 3:00	35.15	9/30/20 2:00	9/30/20 3:00	28,557.8
9/30/20 3:00	9/30/20 4:00	26.63	9/30/20 3:00	9/30/20 4:00	28,561.9
9/30/20 4:00	9/30/20 5:00	498.84	9/30/20 4:00	9/30/20 5:00	28,218.1
9/30/20 5:00	9/30/20 6:00	760.87	9/30/20 5:00	9/30/20 6:00	15,943.4
9/30/20 6:00	9/30/20 7:00	656.84	9/30/20 6:00	9/30/20 7:00	2,604.8
9/30/20 7:00	9/30/20 8:00	759.16	9/30/20 7:00	9/30/20 8:00	26,802.2
9/30/20 8:00	9/30/20 9:00	759.99	9/30/20 8:00	9/30/20 9:00	27,229.1
9/30/20 9:00	9/30/20 10:00	760.01	9/30/20 9:00	9/30/20 10:00	26,892.1
9/30/20 10:00	9/30/20 11:00	696.75	9/30/20 10:00	9/30/20 11:00	26,891.9
9/30/20 11:00	9/30/20 12:00	662.81	9/30/20 11:00	9/30/20 12:00	26,868.6
9/30/20 12:00	9/30/20 13:00	760.02	9/30/20 12:00	9/30/20 13:00	26,659.8
9/30/20 13:00	9/30/20 14:00	759.95	9/30/20 13:00	9/30/20 14:00	26,549.0
9/30/20 14:00	9/30/20 15:00	759.95	9/30/20 14:00	9/30/20 15:00	26,584.3
9/30/20 15:00	9/30/20 16:00	760.02	9/30/20 15:00	9/30/20 16:00	26,774.0
9/30/20 16:00	9/30/20 17:00	762.15	9/30/20 16:00	9/30/20 17:00	26,842.9
9/30/20 17:00	9/30/20 18:00	778.65	9/30/20 17:00	9/30/20 18:00	26,946.9
9/30/20 18:00	9/30/20 19:00	779.98	9/30/20 18:00	9/30/20 19:00	27,120.5
9/30/20 19:00	9/30/20 20:00	780.04	9/30/20 19:00	9/30/20 20:00	27,364.2
9/30/20 20:00	9/30/20 21:00	781.56	9/30/20 20:00	9/30/20 21:00	27,352.4
9/30/20 21:00	9/30/20 22:00	785.00	9/30/20 21:00	9/30/20 22:00	27,450.6
9/30/20 22:00	9/30/20 23:00	785.05	9/30/20 22:00	9/30/20 23:00	27,583.6
9/30/20 23:00	10/1/20 0:00	784.98	9/30/20 23:00	10/1/20 0:00	27,674.9

	FIT-3693C	5 min averages
	Scrubber Flow	GPM
9/29/20 11:20	9/29/20 11:25	252.70
9/29/20 11:25	9/29/20 11:30	252.66
9/29/20 11:30	9/29/20 11:35	252.68
9/29/20 11:35	9/29/20 11:40	252.82
9/29/20 11:40	9/29/20 11:45	252.64
9/29/20 11:45	9/29/20 11:50	252.65
9/29/20 11:50	9/29/20 11:55	252.81
9/29/20 11:55	9/29/20 12:00	254.65
9/29/20 12:00	9/29/20 12:05	256.70
9/29/20 12:05	9/29/20 12:10	253.99
9/29/20 12:10	9/29/20 12:15	253.58
9/29/20 12:15	9/29/20 12:20	254.14
9/29/20 12:20	9/29/20 12:25	255.44
9/29/20 12:25	9/29/20 12:30	254.47
9/29/20 12:30	9/29/20 12:35	252.80
9/29/20 12:35	9/29/20 12:40	252.59
9/29/20 12:40	9/29/20 12:45	250.64
9/29/20 12:45	9/29/20 12:50	238.10
9/29/20 12:50	9/29/20 12:55	244.96
9/29/20 12:55	9/29/20 13:00	244.90
9/29/20 13:00	9/29/20 13:05	245.05
9/29/20 13:05	9/29/20 13:10	244.98
9/29/20 13:10	9/29/20 13:15	244.89
9/29/20 13:15	9/29/20 13:20	244.75
9/29/20 13:20	9/29/20 13:25	244.70
9/29/20 13:25	9/29/20 13:30	244.70
9/29/20 13:30	9/29/20 13:35	244.52
9/29/20 13:35	9/29/20 13:40	239.52
9/29/20 13:40	9/29/20 13:45	235.75
9/29/20 13:45	9/29/20 13:50	235.67
9/29/20 13:50	9/29/20 13:55	235.73
9/29/20 13:55	9/29/20 14:00	235.74
9/29/20 14:00	9/29/20 14:05	235.82
9/29/20 14:05	9/29/20 14:10	235.71
9/29/20 14:10	9/29/20 14:15	235.86
9/29/20 14:15	9/29/20 14:20	235.74
9/29/20 14:20	9/29/20 14:25	235.79
9/29/20 14:25	9/29/20 14:30	236.14
9/29/20 14:30	9/29/20 14:35	235.92
9/29/20 14:35	9/29/20 14:40	235.58
9/29/20 14:40	9/29/20 14:45	235.80
9/29/20 14:45	9/29/20 14:50	235.86
9/29/20 14:50	9/29/20 14:55	235.75
9/29/20 14:55	9/29/20 15:00	235.71
9/29/20 15:00	9/29/20 15:05	235.86
9/29/20 15:05	9/29/20 15:10	235.84
9/29/20 15:10	9/29/20 15:15	235.82

	TIT-3693E	5 min averages
	Outlet Water Blowdown Temp	°C
9/29/20 11:20	9/29/20 11:25	59.33
9/29/20 11:25	9/29/20 11:30	59.60
9/29/20 11:30	9/29/20 11:35	59.52
9/29/20 11:35	9/29/20 11:40	59.27
9/29/20 11:40	9/29/20 11:45	58.98
9/29/20 11:45	9/29/20 11:50	58.30
9/29/20 11:50	9/29/20 11:55	58.16
9/29/20 11:55	9/29/20 12:00	59.19
9/29/20 12:00	9/29/20 12:05	59.70
9/29/20 12:05	9/29/20 12:10	60.27
9/29/20 12:10	9/29/20 12:15	60.43
9/29/20 12:15	9/29/20 12:20	60.49
9/29/20 12:20	9/29/20 12:25	60.56
9/29/20 12:25	9/29/20 12:30	60.21
9/29/20 12:30	9/29/20 12:35	59.94
9/29/20 12:35	9/29/20 12:40	59.78
9/29/20 12:40	9/29/20 12:45	59.78
9/29/20 12:45	9/29/20 12:50	59.90
9/29/20 12:50	9/29/20 12:55	60.34
9/29/20 12:55	9/29/20 13:00	60.19
9/29/20 13:00	9/29/20 13:05	60.00
9/29/20 13:05	9/29/20 13:10	60.31
9/29/20 13:10	9/29/20 13:15	60.43
9/29/20 13:15	9/29/20 13:20	59.53
9/29/20 13:20	9/29/20 13:25	59.21
9/29/20 13:25	9/29/20 13:30	59.44
9/29/20 13:30	9/29/20 13:35	59.47
9/29/20 13:35	9/29/20 13:40	59.23
9/29/20 13:40	9/29/20 13:45	59.01
9/29/20 13:45	9/29/20 13:50	58.92
9/29/20 13:50	9/29/20 13:55	59.27
9/29/20 13:55	9/29/20 14:00	59.58
9/29/20 14:00	9/29/20 14:05	59.80
9/29/20 14:05	9/29/20 14:10	59.95
9/29/20 14:10	9/29/20 14:15	59.69
9/29/20 14:15	9/29/20 14:20	59.51
9/29/20 14:20	9/29/20 14:25	59.06
9/29/20 14:25	9/29/20 14:30	59.15
9/29/20 14:30	9/29/20 14:35	59.67
9/29/20 14:35	9/29/20 14:40	59.74
9/29/20 14:40	9/29/20 14:45	59.49
9/29/20 14:45	9/29/20 14:50	59.54
9/29/20 14:50	9/29/20 14:55	59.76
9/29/20 14:55	9/29/20 15:00	59.66
9/29/20 15:00	9/29/20 15:05	59.53
9/29/20 15:05	9/29/20 15:10	59.43
9/29/20 15:10	9/29/20 15:15	59.28

	TIT-3693F	5 min averages
	Scrubber Exhaust Temperature	°C
9/29/20 11:20	9/29/20 11:25	60.44
9/29/20 11:25	9/29/20 11:30	60.40
9/29/20 11:30	9/29/20 11:35	60.02
9/29/20 11:35	9/29/20 11:40	59.66
9/29/20 11:40	9/29/20 11:45	59.53
9/29/20 11:45	9/29/20 11:50	58.43
9/29/20 11:50	9/29/20 11:55	60.12
9/29/20 11:55	9/29/20 12:00	60.71
9/29/20 12:00	9/29/20 12:05	61.11
9/29/20 12:05	9/29/20 12:10	61.33
9/29/20 12:10	9/29/20 12:15	61.23
9/29/20 12:15	9/29/20 12:20	61.53
9/29/20 12:20	9/29/20 12:25	61.20
9/29/20 12:25	9/29/20 12:30	60.82
9/29/20 12:30	9/29/20 12:35	60.79
9/29/20 12:35	9/29/20 12:40	60.74
9/29/20 12:40	9/29/20 12:45	60.71
9/29/20 12:45	9/29/20 12:50	61.35
9/29/20 12:50	9/29/20 12:55	61.20
9/29/20 12:55	9/29/20 13:00	60.82
9/29/20 13:00	9/29/20 13:05	61.19
9/29/20 13:05	9/29/20 13:10	61.43
9/29/20 13:10	9/29/20 13:15	60.50
9/29/20 13:15	9/29/20 13:20	59.79
9/29/20 13:20	9/29/20 13:25	60.35
9/29/20 13:25	9/29/20 13:30	60.59
9/29/20 13:30	9/29/20 13:35	60.11
9/29/20 13:35	9/29/20 13:40	59.83
9/29/20 13:40	9/29/20 13:45	59.95
9/29/20 13:45	9/29/20 13:50	60.17
9/29/20 13:50	9/29/20 13:55	60.56
9/29/20 13:55	9/29/20 14:00	60.79
9/29/20 14:00	9/29/20 14:05	60.97
9/29/20 14:05	9/29/20 14:10	61.02
9/29/20 14:10	9/29/20 14:15	60.98
9/29/20 14:15	9/29/20 14:20	60.71
9/29/20 14:20	9/29/20 14:25	60.62
9/29/20 14:25	9/29/20 14:30	61.20
9/29/20 14:30	9/29/20 14:35	61.12
9/29/20 14:35	9/29/20 14:40	60.70
9/29/20 14:40	9/29/20 14:45	60.69
9/29/20 14:45	9/29/20 14:50	61.24
9/29/20 14:50	9/29/20 14:55	61.20
9/29/20 14:55	9/29/20 15:00	60.75
9/29/20 15:00	9/29/20 15:05	60.49
9/29/20 15:05	9/29/20 15:10	60.31
9/29/20 15:10	9/29/20 15:15	59.95

	FIT-3693B	5 min averages	
	Caustic additive Flow to Scrubber	GPM	GPD
9/29/20 11:20	9/29/20 11:25	0.018	26.082
9/29/20 11:25	9/29/20 11:30	0.000	0.000
9/29/20 11:30	9/29/20 11:35	0.000	0.000
9/29/20 11:35	9/29/20 11:40	0.082	118.471
9/29/20 11:40	9/29/20 11:45	0.000	0.000
9/29/20 11:45	9/29/20 11:50	0.000	0.000
9/29/20 11:50	9/29/20 11:55	0.000	0.000
9/29/20 11:55	9/29/20 12:00	0.000	0.000
9/29/20 12:00	9/29/20 12:05	0.000	0.000
9/29/20 12:05	9/29/20 12:10	0.000	0.000
9/29/20 12:10	9/29/20 12:15	0.000	0.000
9/29/20 12:15	9/29/20 12:20	0.000	0.000
9/29/20 12:20	9/29/20 12:25	0.000	0.000
9/29/20 12:25	9/29/20 12:30	0.000	0.000
9/29/20 12:30	9/29/20 12:35	0.000	0.000
9/29/20 12:35	9/29/20 12:40	0.000	0.000
9/29/20 12:40	9/29/20 12:45	0.000	0.000
9/29/20 12:45	9/29/20 12:50	0.000	0.000
9/29/20 12:50	9/29/20 12:55	0.000	0.000
9/29/20 12:55	9/29/20 13:00	0.000	0.000
9/29/20 13:00	9/29/20 13:05	0.000	0.000
9/29/20 13:05	9/29/20 13:10	0.000	0.000
9/29/20 13:10	9/29/20 13:15	0.000	0.000
9/29/20 13:15	9/29/20 13:20	0.000	0.000
9/29/20 13:20	9/29/20 13:25	0.000	0.000
9/29/20 13:25	9/29/20 13:30	0.000	0.000
9/29/20 13:30	9/29/20 13:35	0.000	0.000
9/29/20 13:35	9/29/20 13:40	0.000	0.000
9/29/20 13:40	9/29/20 13:45	0.000	0.000
9/29/20 13:45	9/29/20 13:50	0.000	0.000
9/29/20 13:50	9/29/20 13:55	0.000	0.000
9/29/20 13:55	9/29/20 14:00	0.000	0.000
9/29/20 14:00	9/29/20 14:05	0.000	0.000
9/29/20 14:05	9/29/20 14:10	0.000	0.000
9/29/20 14:10	9/29/20 14:15	0.000	0.000
9/29/20 14:15	9/29/20 14:20	0.000	0.000
9/29/20 14:20	9/29/20 14:25	0.000	0.000
9/29/20 14:25	9/29/20 14:30	0.000	0.000
9/29/20 14:30	9/29/20 14:35	0.000	0.000
9/29/20 14:35	9/29/20 14:40	0.000	0.000
9/29/20 14:40	9/29/20 14:45	0.000	0.000
9/29/20 14:45	9/29/20 14:50	0.000	0.000
9/29/20 14:50	9/29/20 14:55	0.000	0.000
9/29/20 14:55	9/29/20 15:00	0.000	0.000
9/29/20 15:00	9/29/20 15:05	0.000	0.000
9/29/20 15:05	9/29/20 15:10	0.000	0.000
9/29/20 15:10	9/29/20 15:15	0.000	0.000

FIT-3693C		5 min averages	TIT-3693E		5 min averages	TIT-3693F		5 min averages	FIT-3693B		5 min averages	
	Scrubber Flow	GPM		Outlet Water Blowdown Temp	°C		Scrubber Exhaust Temperature	°C		Caustic additive Flow to Scrubber	GPM	GPD
9/29/20 15:15	9/29/20 15:20	235.80	9/29/20 15:15	9/29/20 15:20	58.97	9/29/20 15:15	9/29/20 15:20	59.85	9/29/20 15:15	9/29/20 15:20	0.000	0.000
9/29/20 15:20	9/29/20 15:25	235.79	9/29/20 15:20	9/29/20 15:25	58.84	9/29/20 15:20	9/29/20 15:25	59.89	9/29/20 15:20	9/29/20 15:25	0.000	0.000
9/29/20 15:25	9/29/20 15:30	235.93	9/29/20 15:25	9/29/20 15:30	59.04	9/29/20 15:25	9/29/20 15:30	60.44	9/29/20 15:25	9/29/20 15:30	0.000	0.000
9/29/20 15:30	9/29/20 15:35	235.94	9/29/20 15:30	9/29/20 15:35	59.28	9/29/20 15:30	9/29/20 15:35	60.50	9/29/20 15:30	9/29/20 15:35	0.000	0.000
9/29/20 15:35	9/29/20 15:40	235.84	9/29/20 15:35	9/29/20 15:40	59.41	9/29/20 15:35	9/29/20 15:40	60.27	9/29/20 15:35	9/29/20 15:40	0.000	0.000
9/29/20 15:40	9/29/20 15:45	235.84	9/29/20 15:40	9/29/20 15:45	59.30	9/29/20 15:40	9/29/20 15:45	60.40	9/29/20 15:40	9/29/20 15:45	0.000	0.000
9/29/20 15:45	9/29/20 15:50	235.83	9/29/20 15:45	9/29/20 15:50	59.49	9/29/20 15:45	9/29/20 15:50	60.73	9/29/20 15:45	9/29/20 15:50	0.000	0.000
9/29/20 15:50	9/29/20 15:55	235.86	9/29/20 15:50	9/29/20 15:55	59.78	9/29/20 15:50	9/29/20 15:55	60.87	9/29/20 15:50	9/29/20 15:55	0.000	0.000
9/29/20 15:55	9/29/20 16:00	235.84	9/29/20 15:55	9/29/20 16:00	59.64	9/29/20 15:55	9/29/20 16:00	60.59	9/29/20 15:55	9/29/20 16:00	0.000	0.000
9/29/20 16:00	9/29/20 16:05	234.00	9/29/20 16:00	9/29/20 16:05	59.93	9/29/20 16:00	9/29/20 16:05	60.42	9/29/20 16:00	9/29/20 16:05	0.000	0.000
9/29/20 16:05	9/29/20 16:10	233.17	9/29/20 16:05	9/29/20 16:10	60.69	9/29/20 16:05	9/29/20 16:10	60.95	9/29/20 16:05	9/29/20 16:10	0.000	0.000
9/29/20 16:10	9/29/20 16:15	235.77	9/29/20 16:10	9/29/20 16:15	60.31	9/29/20 16:10	9/29/20 16:15	60.86	9/29/20 16:10	9/29/20 16:15	0.000	0.000
9/29/20 16:15	9/29/20 16:20	236.27	9/29/20 16:15	9/29/20 16:20	58.51	9/29/20 16:15	9/29/20 16:20	60.59	9/29/20 16:15	9/29/20 16:20	0.000	0.000
9/29/20 16:20	9/29/20 16:25	236.13	9/29/20 16:20	9/29/20 16:25	56.25	9/29/20 16:20	9/29/20 16:25	60.57	9/29/20 16:20	9/29/20 16:25	0.000	0.000
9/29/20 16:25	9/29/20 16:30	236.18	9/29/20 16:25	9/29/20 16:30	54.02	9/29/20 16:25	9/29/20 16:30	61.09	9/29/20 16:25	9/29/20 16:30	0.000	0.000
9/29/20 16:30	9/29/20 16:35	236.50	9/29/20 16:30	9/29/20 16:35	51.80	9/29/20 16:30	9/29/20 16:35	61.00	9/29/20 16:30	9/29/20 16:35	0.000	0.000
9/29/20 16:35	9/29/20 16:40	234.94	9/29/20 16:35	9/29/20 16:40	52.40	9/29/20 16:35	9/29/20 16:40	60.61	9/29/20 16:35	9/29/20 16:40	0.000	0.000
9/29/20 16:40	9/29/20 16:45	233.36	9/29/20 16:40	9/29/20 16:45	59.96	9/29/20 16:40	9/29/20 16:45	60.62	9/29/20 16:40	9/29/20 16:45	0.000	0.000
9/29/20 16:45	9/29/20 16:50	233.52	9/29/20 16:45	9/29/20 16:50	60.80	9/29/20 16:45	9/29/20 16:50	61.14	9/29/20 16:45	9/29/20 16:50	0.000	0.000
9/29/20 16:50	9/29/20 16:55	236.04	9/29/20 16:50	9/29/20 16:55	60.07	9/29/20 16:50	9/29/20 16:55	60.99	9/29/20 16:50	9/29/20 16:55	0.000	0.000
9/29/20 16:55	9/29/20 17:00	236.21	9/29/20 16:55	9/29/20 17:00	58.21	9/29/20 16:55	9/29/20 17:00	60.62	9/29/20 16:55	9/29/20 17:00	0.000	0.000
9/29/20 17:00	9/29/20 17:05	234.47	9/29/20 17:00	9/29/20 17:05	58.05	9/29/20 17:00	9/29/20 17:05	60.70	9/29/20 17:00	9/29/20 17:05	0.000	0.000
9/29/20 17:05	9/29/20 17:10	234.32	9/29/20 17:05	9/29/20 17:10	60.71	9/29/20 17:05	9/29/20 17:10	61.20	9/29/20 17:05	9/29/20 17:10	0.000	0.000
9/29/20 17:10	9/29/20 17:15	236.35	9/29/20 17:10	9/29/20 17:15	59.44	9/29/20 17:10	9/29/20 17:15	61.01	9/29/20 17:10	9/29/20 17:15	0.000	0.000
9/29/20 17:15	9/29/20 17:20	236.30	9/29/20 17:15	9/29/20 17:20	57.35	9/29/20 17:15	9/29/20 17:20	60.67	9/29/20 17:15	9/29/20 17:20	0.000	0.000
9/29/20 17:20	9/29/20 17:25	236.18	9/29/20 17:20	9/29/20 17:25	55.27	9/29/20 17:20	9/29/20 17:25	60.87	9/29/20 17:20	9/29/20 17:25	0.000	0.000
9/29/20 17:25	9/29/20 17:30	236.34	9/29/20 17:25	9/29/20 17:30	53.20	9/29/20 17:25	9/29/20 17:30	61.21	9/29/20 17:25	9/29/20 17:30	0.000	0.000
9/29/20 17:30	9/29/20 17:35	236.45	9/29/20 17:30	9/29/20 17:35	51.16	9/29/20 17:30	9/29/20 17:35	60.89	9/29/20 17:30	9/29/20 17:35	0.000	0.000
9/29/20 17:35	9/29/20 17:40	234.15	9/29/20 17:35	9/29/20 17:40	55.26	9/29/20 17:35	9/29/20 17:40	60.58	9/29/20 17:35	9/29/20 17:40	0.000	0.000
9/29/20 17:40	9/29/20 17:45	233.39	9/29/20 17:40	9/29/20 17:45	60.35	9/29/20 17:40	9/29/20 17:45	60.84	9/29/20 17:40	9/29/20 17:45	0.000	0.000
9/29/20 17:45	9/29/20 17:50	233.49	9/29/20 17:45	9/29/20 17:50	60.99	9/29/20 17:45	9/29/20 17:50	61.20	9/29/20 17:45	9/29/20 17:50	0.000	0.000
9/29/20 17:50	9/29/20 17:55	236.18	9/29/20 17:50	9/29/20 17:55	60.09	9/29/20 17:50	9/29/20 17:55	60.91	9/29/20 17:50	9/29/20 17:55	0.000	0.000
9/29/20 17:55	9/29/20 18:00	236.29	9/29/20 17:55	9/29/20 18:00	58.07	9/29/20 17:55	9/29/20 18:00	60.59	9/29/20 17:55	9/29/20 18:00	0.000	0.000
9/29/20 18:00	9/29/20 18:05	233.40	9/29/20 18:00	9/29/20 18:05	59.47	9/29/20 18:00	9/29/20 18:05	60.57	9/29/20 18:00	9/29/20 18:05	0.000	0.000
9/29/20 18:05	9/29/20 18:10	234.28	9/29/20 18:05	9/29/20 18:10	60.42	9/29/20 18:05	9/29/20 18:10	60.36	9/29/20 18:05	9/29/20 18:10	0.000	0.000
9/29/20 18:10	9/29/20 18:15	236.11	9/29/20 18:10	9/29/20 18:15	58.97	9/29/20 18:10	9/29/20 18:15	60.64	9/29/20 18:10	9/29/20 18:15	0.000	0.000
9/29/20 18:15	9/29/20 18:20	236.30	9/29/20 18:15	9/29/20 18:20	57.10	9/29/20 18:15	9/29/20 18:20	60.45	9/29/20 18:15	9/29/20 18:20	0.000	0.000
9/29/20 18:20	9/29/20 18:25	236.29	9/29/20 18:20	9/29/20 18:25	54.93	9/29/20 18:20	9/29/20 18:25	60.74	9/29/20 18:20	9/29/20 18:25	0.000	0.000
9/29/20 18:25	9/29/20 18:30	236.39	9/29/20 18:25	9/29/20 18:30	52.96	9/29/20 18:25	9/29/20 18:30	61.10	9/29/20 18:25	9/29/20 18:30	0.000	0.000
9/29/20 18:30	9/29/20 18:35	236.22	9/29/20 18:30	9/29/20 18:35	51.07	9/29/20 18:30	9/29/20 18:35	60.82	9/29/20 18:30	9/29/20 18:35	0.000	0.000
9/29/20 18:35	9/29/20 18:40	235.24	9/29/20 18:35	9/29/20 18:40	51.13	9/29/20 18:35	9/29/20 18:40	60.53	9/29/20 18:35	9/29/20 18:40	0.000	0.000
9/29/20 18:40	9/29/20 18:45	233.50	9/29/20 18:40	9/29/20 18:45	59.80	9/29/20 18:40	9/29/20 18:45	60.86	9/29/20 18:40	9/29/20 18:45	0.000	0.000
9/29/20 18:45	9/29/20 18:50	234.29	9/29/20 18:45	9/29/20 18:50	60.88	9/29/20 18:45	9/29/20 18:50	61.11	9/29/20 18:45	9/29/20 18:50	0.000	0.000
9/29/20 18:50	9/29/20 18:55	236.21	9/29/20 18:50	9/29/20 18:55	59.48	9/29/20 18:50	9/29/20 18:55	60.75	9/29/20 18:50	9/29/20 18:55	0.000	0.000
9/29/20 18:55	9/29/20 19:00	236.28	9/29/20 18:55	9/29/20 19:00	57.50	9/29/20 18:55	9/29/20 19:00	60.47	9/29/20 18:55	9/29/20 19:00	0.000	0.000
9/29/20 19:00	9/29/20 19:05	233.69	9/29/20 19:00	9/29/20 19:05	58.88	9/29/20 19:00	9/29/20 19:05	60.54	9/29/20 19:00	9/29/20 19:05	0.000	0.000
9/29/20 19:05	9/29/20 19:10	233.29	9/29/20 19:05	9/29/20 19:10	60.79	9/29/20 19:05	9/29/20 19:10	61.06	9/29/20 19:05	9/29/20 19:10	0.000	0.000

FIT-3693C		5 min averages	TIT-3693E		5 min averages	TIT-3693F		5 min averages	FIT-3693B		5 min averages	
	Scrubber Flow	GPM		Outlet Water Blowdown Temp	°C		Scrubber Exhaust Temperature	°C		Caustic additive Flow to Scrubber	GPM	GPD
9/29/20 19:10	9/29/20 19:15	235.81	9/29/20 19:10	9/29/20 19:15	60.48	9/29/20 19:10	9/29/20 19:15	60.95	9/29/20 19:10	9/29/20 19:15	0.000	0.000
9/29/20 19:15	9/29/20 19:20	236.18	9/29/20 19:15	9/29/20 19:20	58.61	9/29/20 19:15	9/29/20 19:20	60.58	9/29/20 19:15	9/29/20 19:20	0.000	0.000
9/29/20 19:20	9/29/20 19:25	235.43	9/29/20 19:20	9/29/20 19:25	57.04	9/29/20 19:20	9/29/20 19:25	60.54	9/29/20 19:20	9/29/20 19:25	0.000	0.000
9/29/20 19:25	9/29/20 19:30	233.36	9/29/20 19:25	9/29/20 19:30	60.43	9/29/20 19:25	9/29/20 19:30	61.10	9/29/20 19:25	9/29/20 19:30	0.000	0.000
9/29/20 19:30	9/29/20 19:35	236.28	9/29/20 19:30	9/29/20 19:35	60.20	9/29/20 19:30	9/29/20 19:35	60.63	9/29/20 19:30	9/29/20 19:35	0.000	0.000
9/29/20 19:35	9/29/20 19:40	236.32	9/29/20 19:35	9/29/20 19:40	58.24	9/29/20 19:35	9/29/20 19:40	59.96	9/29/20 19:35	9/29/20 19:40	0.000	0.000
9/29/20 19:40	9/29/20 19:45	236.33	9/29/20 19:40	9/29/20 19:45	56.09	9/29/20 19:40	9/29/20 19:45	59.84	9/29/20 19:40	9/29/20 19:45	0.000	0.000
9/29/20 19:45	9/29/20 19:50	236.36	9/29/20 19:45	9/29/20 19:50	53.83	9/29/20 19:45	9/29/20 19:50	60.30	9/29/20 19:45	9/29/20 19:50	0.000	0.000
9/29/20 19:50	9/29/20 19:55	236.16	9/29/20 19:50	9/29/20 19:55	51.67	9/29/20 19:50	9/29/20 19:55	60.17	9/29/20 19:50	9/29/20 19:55	0.000	0.000
9/29/20 19:55	9/29/20 20:00	236.40	9/29/20 19:55	9/29/20 20:00	49.74	9/29/20 19:55	9/29/20 20:00	59.82	9/29/20 19:55	9/29/20 20:00	0.000	0.000
9/29/20 20:00	9/29/20 20:05	236.41	9/29/20 20:00	9/29/20 20:05	47.96	9/29/20 20:00	9/29/20 20:05	59.88	9/29/20 20:00	9/29/20 20:05	0.000	0.000
9/29/20 20:05	9/29/20 20:10	236.49	9/29/20 20:05	9/29/20 20:10	46.27	9/29/20 20:05	9/29/20 20:10	60.33	9/29/20 20:05	9/29/20 20:10	0.000	0.000
9/29/20 20:10	9/29/20 20:15	236.44	9/29/20 20:10	9/29/20 20:15	44.72	9/29/20 20:10	9/29/20 20:15	60.15	9/29/20 20:10	9/29/20 20:15	0.000	0.000
9/29/20 20:15	9/29/20 20:20	236.49	9/29/20 20:15	9/29/20 20:20	43.27	9/29/20 20:15	9/29/20 20:20	59.79	9/29/20 20:15	9/29/20 20:20	0.000	0.000
9/29/20 20:20	9/29/20 20:25	233.91	9/29/20 20:20	9/29/20 20:25	52.46	9/29/20 20:20	9/29/20 20:25	59.95	9/29/20 20:20	9/29/20 20:25	0.000	0.000
9/29/20 20:25	9/29/20 20:30	234.44	9/29/20 20:25	9/29/20 20:30	59.82	9/29/20 20:25	9/29/20 20:30	60.35	9/29/20 20:25	9/29/20 20:30	0.000	0.000
9/29/20 20:30	9/29/20 20:35	236.26	9/29/20 20:30	9/29/20 20:35	58.43	9/29/20 20:30	9/29/20 20:35	60.09	9/29/20 20:30	9/29/20 20:35	0.000	0.000
9/29/20 20:35	9/29/20 20:40	236.28	9/29/20 20:35	9/29/20 20:40	56.29	9/29/20 20:35	9/29/20 20:40	59.73	9/29/20 20:35	9/29/20 20:40	0.000	0.000
9/29/20 20:40	9/29/20 20:45	236.48	9/29/20 20:40	9/29/20 20:45	54.11	9/29/20 20:40	9/29/20 20:45	59.77	9/29/20 20:40	9/29/20 20:45	0.000	0.000
9/29/20 20:45	9/29/20 20:50	236.36	9/29/20 20:45	9/29/20 20:50	52.03	9/29/20 20:45	9/29/20 20:50	60.30	9/29/20 20:45	9/29/20 20:50	0.000	0.000
9/29/20 20:50	9/29/20 20:55	236.34	9/29/20 20:50	9/29/20 20:55	50.12	9/29/20 20:50	9/29/20 20:55	60.20	9/29/20 20:50	9/29/20 20:55	0.000	0.000
9/29/20 20:55	9/29/20 21:00	236.39	9/29/20 20:55	9/29/20 21:00	48.19	9/29/20 20:55	9/29/20 21:00	59.82	9/29/20 20:55	9/29/20 21:00	0.000	0.000
9/29/20 21:00	9/29/20 21:05	236.40	9/29/20 21:00	9/29/20 21:05	46.32	9/29/20 21:00	9/29/20 21:05	59.89	9/29/20 21:00	9/29/20 21:05	0.000	0.000
9/29/20 21:05	9/29/20 21:10	236.44	9/29/20 21:05	9/29/20 21:10	44.64	9/29/20 21:05	9/29/20 21:10	60.33	9/29/20 21:05	9/29/20 21:10	0.000	0.000
9/29/20 21:10	9/29/20 21:15	236.47	9/29/20 21:10	9/29/20 21:15	43.13	9/29/20 21:10	9/29/20 21:15	60.12	9/29/20 21:10	9/29/20 21:15	0.000	0.000
9/29/20 21:15	9/29/20 21:20	236.42	9/29/20 21:15	9/29/20 21:20	41.72	9/29/20 21:15	9/29/20 21:20	59.76	9/29/20 21:15	9/29/20 21:20	0.000	0.000
9/29/20 21:20	9/29/20 21:25	233.87	9/29/20 21:20	9/29/20 21:25	52.66	9/29/20 21:20	9/29/20 21:25	59.77	9/29/20 21:20	9/29/20 21:25	0.000	0.000
9/29/20 21:25	9/29/20 21:30	233.50	9/29/20 21:25	9/29/20 21:30	59.73	9/29/20 21:25	9/29/20 21:30	60.32	9/29/20 21:25	9/29/20 21:30	0.000	0.000
9/29/20 21:30	9/29/20 21:35	236.06	9/29/20 21:30	9/29/20 21:35	59.43	9/29/20 21:30	9/29/20 21:35	60.30	9/29/20 21:30	9/29/20 21:35	0.000	0.000
9/29/20 21:35	9/29/20 21:40	236.17	9/29/20 21:35	9/29/20 21:40	57.31	9/29/20 21:35	9/29/20 21:40	59.88	9/29/20 21:35	9/29/20 21:40	0.000	0.000
9/29/20 21:40	9/29/20 21:45	236.31	9/29/20 21:40	9/29/20 21:45	54.94	9/29/20 21:40	9/29/20 21:45	59.76	9/29/20 21:40	9/29/20 21:45	0.000	0.000
9/29/20 21:45	9/29/20 21:50	236.38	9/29/20 21:45	9/29/20 21:50	52.65	9/29/20 21:45	9/29/20 21:50	60.27	9/29/20 21:45	9/29/20 21:50	0.000	0.000
9/29/20 21:50	9/29/20 21:55	236.30	9/29/20 21:50	9/29/20 21:55	50.55	9/29/20 21:50	9/29/20 21:55	60.21	9/29/20 21:50	9/29/20 21:55	0.000	0.000
9/29/20 21:55	9/29/20 22:00	236.32	9/29/20 21:55	9/29/20 22:00	48.59	9/29/20 21:55	9/29/20 22:00	59.86	9/29/20 21:55	9/29/20 22:00	0.000	0.000
9/29/20 22:00	9/29/20 22:05	236.37	9/29/20 22:00	9/29/20 22:05	46.78	9/29/20 22:00	9/29/20 22:05	59.95	9/29/20 22:00	9/29/20 22:05	0.000	0.000
9/29/20 22:05	9/29/20 22:10	236.36	9/29/20 22:05	9/29/20 22:10	45.10	9/29/20 22:05	9/29/20 22:10	60.39	9/29/20 22:05	9/29/20 22:10	0.000	0.000
9/29/20 22:10	9/29/20 22:15	236.33	9/29/20 22:10	9/29/20 22:15	43.56	9/29/20 22:10	9/29/20 22:15	60.11	9/29/20 22:10	9/29/20 22:15	0.000	0.000
9/29/20 22:15	9/29/20 22:20	236.36	9/29/20 22:15	9/29/20 22:20	42.01	9/29/20 22:15	9/29/20 22:20	59.47	9/29/20 22:15	9/29/20 22:20	0.000	0.000
9/29/20 22:20	9/29/20 22:25	236.39	9/29/20 22:20	9/29/20 22:25	40.48	9/29/20 22:20	9/29/20 22:25	59.82	9/29/20 22:20	9/29/20 22:25	0.000	0.000
9/29/20 22:25	9/29/20 22:30	236.27	9/29/20 22:25	9/29/20 22:30	39.13	9/29/20 22:25	9/29/20 22:30	60.17	9/29/20 22:25	9/29/20 22:30	0.000	0.000
9/29/20 22:30	9/29/20 22:35	236.16	9/29/20 22:30	9/29/20 22:35	37.94	9/29/20 22:30	9/29/20 22:35	60.08	9/29/20 22:30	9/29/20 22:35	0.000	0.000
9/29/20 22:35	9/29/20 22:40	236.35	9/29/20 22:35	9/29/20 22:40	36.87	9/29/20 22:35	9/29/20 22:40	59.75	9/29/20 22:35	9/29/20 22:40	0.000	0.000
9/29/20 22:40	9/29/20 22:45	236.29	9/29/20 22:40	9/29/20 22:45	35.93	9/29/20 22:40	9/29/20 22:45	60.14	9/29/20 22:40	9/29/20 22:45	0.000	0.000
9/29/20 22:45	9/29/20 22:50	236.12	9/29/20 22:45	9/29/20 22:50	35.06	9/29/20 22:45	9/29/20 22:50	60.33	9/29/20 22:45	9/29/20 22:50	0.000	0.000
9/29/20 22:50	9/29/20 22:55	236.21	9/29/20 22:50	9/29/20 22:55	34.24	9/29/20 22:50	9/29/20 22:55	60.06	9/29/20 22:50	9/29/20 22:55	0.000	0.000
9/29/20 22:55	9/29/20 23:00	236.29	9/29/20 22:55	9/29/20 23:00	33.48	9/29/20 22:55	9/29/20 23:00	59.86	9/29/20 22:55	9/29/20 23:00	0.000	0.000
9/29/20 23:00	9/29/20 23:05	237.25	9/29/20 23:00	9/29/20 23:05	32.64	9/29/20 23:00	9/29/20 23:05	59.81	9/29/20 23:00	9/29/20 23:05	0.000	0.000

FIT-3693C 5 min averages

	Scrubber Flow	GPM
9/29/20 23:05	9/29/20 23:10	243.01
9/29/20 23:10	9/29/20 23:15	240.66
9/29/20 23:15	9/29/20 23:20	244.38
9/29/20 23:20	9/29/20 23:25	244.04
9/29/20 23:25	9/29/20 23:30	241.68
9/29/20 23:30	9/29/20 23:35	241.73
9/29/20 23:35	9/29/20 23:40	241.77
9/29/20 23:40	9/29/20 23:45	242.14
9/29/20 23:45	9/29/20 23:50	242.18
9/29/20 23:50	9/29/20 23:55	242.40
9/29/20 23:55	9/30/20 0:00	242.24
9/30/20 0:00	9/30/20 0:05	241.77
9/30/20 0:05	9/30/20 0:10	241.67
9/30/20 0:10	9/30/20 0:15	241.49
9/30/20 0:15	9/30/20 0:20	241.21
9/30/20 0:20	9/30/20 0:25	241.01
9/30/20 0:25	9/30/20 0:30	240.61
9/30/20 0:30	9/30/20 0:35	240.56
9/30/20 0:35	9/30/20 0:40	240.22
9/30/20 0:40	9/30/20 0:45	240.01
9/30/20 0:45	9/30/20 0:50	239.63
9/30/20 0:50	9/30/20 0:55	239.58
9/30/20 0:55	9/30/20 1:00	239.36
9/30/20 1:00	9/30/20 1:05	239.14
9/30/20 1:05	9/30/20 1:10	238.93
9/30/20 1:10	9/30/20 1:15	238.67
9/30/20 1:15	9/30/20 1:20	238.35
9/30/20 1:20	9/30/20 1:25	238.23
9/30/20 1:25	9/30/20 1:30	237.71
9/30/20 1:30	9/30/20 1:35	237.72
9/30/20 1:35	9/30/20 1:40	237.26
9/30/20 1:40	9/30/20 1:45	237.15
9/30/20 1:45	9/30/20 1:50	236.88
9/30/20 1:50	9/30/20 1:55	236.55
9/30/20 1:55	9/30/20 2:00	236.45
9/30/20 2:00	9/30/20 2:05	236.25
9/30/20 2:05	9/30/20 2:10	236.04
9/30/20 2:10	9/30/20 2:15	235.95
9/30/20 2:15	9/30/20 2:20	235.95
9/30/20 2:20	9/30/20 2:25	235.66
9/30/20 2:25	9/30/20 2:30	235.78
9/30/20 2:30	9/30/20 2:35	235.38
9/30/20 2:35	9/30/20 2:40	235.31
9/30/20 2:40	9/30/20 2:45	235.33
9/30/20 2:45	9/30/20 2:50	235.62
9/30/20 2:50	9/30/20 2:55	235.39
9/30/20 2:55	9/30/20 3:00	235.44

TIT-3693E 5 min averages

	Outlet Water Blowdown Temp	°C
9/29/20 23:05	9/29/20 23:10	31.86
9/29/20 23:10	9/29/20 23:15	31.12
9/29/20 23:15	9/29/20 23:20	30.46
9/29/20 23:20	9/29/20 23:25	30.75
9/29/20 23:25	9/29/20 23:30	50.08
9/29/20 23:30	9/29/20 23:35	51.39
9/29/20 23:35	9/29/20 23:40	49.66
9/29/20 23:40	9/29/20 23:45	47.95
9/29/20 23:45	9/29/20 23:50	46.41
9/29/20 23:50	9/29/20 23:55	45.01
9/29/20 23:55	9/30/20 0:00	43.62
9/30/20 0:00	9/30/20 0:05	42.27
9/30/20 0:05	9/30/20 0:10	40.98
9/30/20 0:10	9/30/20 0:15	39.81
9/30/20 0:15	9/30/20 0:20	38.70
9/30/20 0:20	9/30/20 0:25	37.61
9/30/20 0:25	9/30/20 0:30	36.62
9/30/20 0:30	9/30/20 0:35	35.62
9/30/20 0:35	9/30/20 0:40	34.70
9/30/20 0:40	9/30/20 0:45	33.78
9/30/20 0:45	9/30/20 0:50	32.96
9/30/20 0:50	9/30/20 0:55	32.24
9/30/20 0:55	9/30/20 1:00	31.57
9/30/20 1:00	9/30/20 1:05	31.05
9/30/20 1:05	9/30/20 1:10	30.43
9/30/20 1:10	9/30/20 1:15	29.84
9/30/20 1:15	9/30/20 1:20	29.28
9/30/20 1:20	9/30/20 1:25	28.78
9/30/20 1:25	9/30/20 1:30	28.26
9/30/20 1:30	9/30/20 1:35	27.78
9/30/20 1:35	9/30/20 1:40	27.38
9/30/20 1:40	9/30/20 1:45	26.98
9/30/20 1:45	9/30/20 1:50	26.60
9/30/20 1:50	9/30/20 1:55	26.28
9/30/20 1:55	9/30/20 2:00	25.93
9/30/20 2:00	9/30/20 2:05	25.64
9/30/20 2:05	9/30/20 2:10	25.36
9/30/20 2:10	9/30/20 2:15	25.09
9/30/20 2:15	9/30/20 2:20	24.87
9/30/20 2:20	9/30/20 2:25	24.65
9/30/20 2:25	9/30/20 2:30	24.43
9/30/20 2:30	9/30/20 2:35	24.24
9/30/20 2:35	9/30/20 2:40	24.06
9/30/20 2:40	9/30/20 2:45	23.91
9/30/20 2:45	9/30/20 2:50	23.77
9/30/20 2:50	9/30/20 2:55	23.65
9/30/20 2:55	9/30/20 3:00	23.51

TIT-3693F 5 min averages

	Scrubber Exhaust Temperature	°C
9/29/20 23:05	9/29/20 23:10	59.93
9/29/20 23:10	9/29/20 23:15	59.38
9/29/20 23:15	9/29/20 23:20	57.59
9/29/20 23:20	9/29/20 23:25	55.98
9/29/20 23:25	9/29/20 23:30	54.72
9/29/20 23:30	9/29/20 23:35	53.75
9/29/20 23:35	9/29/20 23:40	54.48
9/29/20 23:40	9/29/20 23:45	54.74
9/29/20 23:45	9/29/20 23:50	54.41
9/29/20 23:50	9/29/20 23:55	53.81
9/29/20 23:55	9/30/20 0:00	53.05
9/30/20 0:00	9/30/20 0:05	52.22
9/30/20 0:05	9/30/20 0:10	51.33
9/30/20 0:10	9/30/20 0:15	50.37
9/30/20 0:15	9/30/20 0:20	49.43
9/30/20 0:20	9/30/20 0:25	48.47
9/30/20 0:25	9/30/20 0:30	47.45
9/30/20 0:30	9/30/20 0:35	46.48
9/30/20 0:35	9/30/20 0:40	45.49
9/30/20 0:40	9/30/20 0:45	44.34
9/30/20 0:45	9/30/20 0:50	43.18
9/30/20 0:50	9/30/20 0:55	42.12
9/30/20 0:55	9/30/20 1:00	41.25
9/30/20 1:00	9/30/20 1:05	40.52
9/30/20 1:05	9/30/20 1:10	39.79
9/30/20 1:10	9/30/20 1:15	39.04
9/30/20 1:15	9/30/20 1:20	38.26
9/30/20 1:20	9/30/20 1:25	37.52
9/30/20 1:25	9/30/20 1:30	36.77
9/30/20 1:30	9/30/20 1:35	36.07
9/30/20 1:35	9/30/20 1:40	35.40
9/30/20 1:40	9/30/20 1:45	34.72
9/30/20 1:45	9/30/20 1:50	34.08
9/30/20 1:50	9/30/20 1:55	33.42
9/30/20 1:55	9/30/20 2:00	32.79
9/30/20 2:00	9/30/20 2:05	32.16
9/30/20 2:05	9/30/20 2:10	31.56
9/30/20 2:10	9/30/20 2:15	30.99
9/30/20 2:15	9/30/20 2:20	30.40
9/30/20 2:20	9/30/20 2:25	29.85
9/30/20 2:25	9/30/20 2:30	29.33
9/30/20 2:30	9/30/20 2:35	28.82
9/30/20 2:35	9/30/20 2:40	28.33
9/30/20 2:40	9/30/20 2:45	27.84
9/30/20 2:45	9/30/20 2:50	27.38
9/30/20 2:50	9/30/20 2:55	26.95
9/30/20 2:55	9/30/20 3:00	26.53

FIT-3693B 5 min averages

	Caustic additive Flow to Scrubber	GPM	GPD
9/29/20 23:05	9/29/20 23:10	0.000	0.000
9/29/20 23:10	9/29/20 23:15	0.000	0.000
9/29/20 23:15	9/29/20 23:20	0.000	0.000
9/29/20 23:20	9/29/20 23:25	0.000	0.000
9/29/20 23:25	9/29/20 23:30	0.000	0.000
9/29/20 23:30	9/29/20 23:35	0.000	0.000
9/29/20 23:35	9/29/20 23:40	0.000	0.000
9/29/20 23:40	9/29/20 23:45	0.000	0.000
9/29/20 23:45	9/29/20 23:50	0.000	0.000
9/29/20 23:50	9/29/20 23:55	0.000	0.000
9/29/20 23:55	9/30/20 0:00	0.000	0.000
9/30/20 0:00	9/30/20 0:05	0.000	0.000
9/30/20 0:05	9/30/20 0:10	0.000	0.000
9/30/20 0:10	9/30/20 0:15	0.000	0.000
9/30/20 0:15	9/30/20 0:20	0.000	0.000
9/30/20 0:20	9/30/20 0:25	0.000	0.000
9/30/20 0:25	9/30/20 0:30	0.000	0.000
9/30/20 0:30	9/30/20 0:35	0.000	0.000
9/30/20 0:35	9/30/20 0:40	0.000	0.000
9/30/20 0:40	9/30/20 0:45	0.000	0.000
9/30/20 0:45	9/30/20 0:50	0.000	0.000
9/30/20 0:50	9/30/20 0:55	0.000	0.000
9/30/20 0:55	9/30/20 1:00	0.000	0.000
9/30/20 1:00	9/30/20 1:05	0.000	0.000
9/30/20 1:05	9/30/20 1:10	0.000	0.000
9/30/20 1:10	9/30/20 1:15	0.000	0.000
9/30/20 1:15	9/30/20 1:20	0.000	0.000
9/30/20 1:20	9/30/20 1:25	0.000	0.000
9/30/20 1:25	9/30/20 1:30	0.000	0.000
9/30/20 1:30	9/30/20 1:35	0.000	0.000
9/30/20 1:35	9/30/20 1:40	0.000	0.000
9/30/20 1:40	9/30/20 1:45	0.000	0.000
9/30/20 1:45	9/30/20 1:50	0.000	0.000
9/30/20 1:50	9/30/20 1:55	0.000	0.000
9/30/20 1:55	9/30/20 2:00	0.000	0.000
9/30/20 2:00	9/30/20 2:05	0.000	0.000
9/30/20 2:05	9/30/20 2:10	0.000	0.000
9/30/20 2:10	9/30/20 2:15	0.000	0.000
9/30/20 2:15	9/30/20 2:20	0.000	0.000
9/30/20 2:20	9/30/20 2:25	0.000	0.000
9/30/20 2:25	9/30/20 2:30	0.000	0.000
9/30/20 2:30	9/30/20 2:35	0.000	0.000
9/30/20 2:35	9/30/20 2:40	0.000	0.000
9/30/20 2:40	9/30/20 2:45	0.000	0.000
9/30/20 2:45	9/30/20 2:50	0.000	0.000
9/30/20 2:50	9/30/20 2:55	0.000	0.000
9/30/20 2:55	9/30/20 3:00	0.000	0.000

FIT-3693C		5 min averages	TIT-3693E		5 min averages	TIT-3693F		5 min averages	FIT-3693B		5 min averages	
	Scrubber Flow	GPM		Outlet Water Blowdown Temp	°C		Scrubber Exhaust Temperature	°C		Caustic additive Flow to Scrubber	GPM	GPD
9/30/20 3:00	9/30/20 3:05	235.24	9/30/20 3:00	9/30/20 3:05	23.36	9/30/20 3:00	9/30/20 3:05	26.11	9/30/20 3:00	9/30/20 3:05	0.000	0.000
9/30/20 3:05	9/30/20 3:10	235.26	9/30/20 3:05	9/30/20 3:10	23.21	9/30/20 3:05	9/30/20 3:10	25.71	9/30/20 3:05	9/30/20 3:10	0.000	0.000
9/30/20 3:10	9/30/20 3:15	235.32	9/30/20 3:10	9/30/20 3:15	23.12	9/30/20 3:10	9/30/20 3:15	25.30	9/30/20 3:10	9/30/20 3:15	0.000	0.000
9/30/20 3:15	9/30/20 3:20	235.37	9/30/20 3:15	9/30/20 3:20	23.01	9/30/20 3:15	9/30/20 3:20	24.91	9/30/20 3:15	9/30/20 3:20	0.000	0.000
9/30/20 3:20	9/30/20 3:25	234.92	9/30/20 3:20	9/30/20 3:25	22.94	9/30/20 3:20	9/30/20 3:25	24.53	9/30/20 3:20	9/30/20 3:25	0.000	0.000
9/30/20 3:25	9/30/20 3:30	235.27	9/30/20 3:25	9/30/20 3:30	22.86	9/30/20 3:25	9/30/20 3:30	24.17	9/30/20 3:25	9/30/20 3:30	0.000	0.000
9/30/20 3:30	9/30/20 3:35	235.13	9/30/20 3:30	9/30/20 3:35	22.76	9/30/20 3:30	9/30/20 3:35	23.82	9/30/20 3:30	9/30/20 3:35	0.000	0.000
9/30/20 3:35	9/30/20 3:40	235.31	9/30/20 3:35	9/30/20 3:40	22.70	9/30/20 3:35	9/30/20 3:40	23.48	9/30/20 3:35	9/30/20 3:40	0.000	0.000
9/30/20 3:40	9/30/20 3:45	235.68	9/30/20 3:40	9/30/20 3:45	22.60	9/30/20 3:40	9/30/20 3:45	23.15	9/30/20 3:40	9/30/20 3:45	0.000	0.000
9/30/20 3:45	9/30/20 3:50	235.33	9/30/20 3:45	9/30/20 3:50	22.54	9/30/20 3:45	9/30/20 3:50	22.88	9/30/20 3:45	9/30/20 3:50	0.000	0.000
9/30/20 3:50	9/30/20 3:55	235.61	9/30/20 3:50	9/30/20 3:55	22.49	9/30/20 3:50	9/30/20 3:55	22.59	9/30/20 3:50	9/30/20 3:55	0.000	0.000
9/30/20 3:55	9/30/20 4:00	235.43	9/30/20 3:55	9/30/20 4:00	22.40	9/30/20 3:55	9/30/20 4:00	22.30	9/30/20 3:55	9/30/20 4:00	0.000	0.000
9/30/20 4:00	9/30/20 4:05	235.77	9/30/20 4:00	9/30/20 4:05	22.35	9/30/20 4:00	9/30/20 4:05	22.00	9/30/20 4:00	9/30/20 4:05	0.000	0.000
9/30/20 4:05	9/30/20 4:10	235.86	9/30/20 4:05	9/30/20 4:10	22.31	9/30/20 4:05	9/30/20 4:10	21.70	9/30/20 4:05	9/30/20 4:10	0.001	1.759
9/30/20 4:10	9/30/20 4:15	235.71	9/30/20 4:10	9/30/20 4:15	22.30	9/30/20 4:10	9/30/20 4:15	21.53	9/30/20 4:10	9/30/20 4:15	0.017	24.427
9/30/20 4:15	9/30/20 4:20	237.86	9/30/20 4:15	9/30/20 4:20	22.34	9/30/20 4:15	9/30/20 4:20	22.06	9/30/20 4:15	9/30/20 4:20	0.096	137.564
9/30/20 4:20	9/30/20 4:25	240.05	9/30/20 4:20	9/30/20 4:25	25.50	9/30/20 4:20	9/30/20 4:25	31.92	9/30/20 4:20	9/30/20 4:25	0.000	0.000
9/30/20 4:25	9/30/20 4:30	242.37	9/30/20 4:25	9/30/20 4:30	37.75	9/30/20 4:25	9/30/20 4:30	45.79	9/30/20 4:25	9/30/20 4:30	0.069	100.049
9/30/20 4:30	9/30/20 4:35	242.90	9/30/20 4:30	9/30/20 4:35	47.82	9/30/20 4:30	9/30/20 4:35	52.40	9/30/20 4:30	9/30/20 4:35	0.000	0.000
9/30/20 4:35	9/30/20 4:40	243.01	9/30/20 4:35	9/30/20 4:40	52.82	9/30/20 4:35	9/30/20 4:40	55.22	9/30/20 4:35	9/30/20 4:40	0.044	63.976
9/30/20 4:40	9/30/20 4:45	241.38	9/30/20 4:40	9/30/20 4:45	55.47	9/30/20 4:40	9/30/20 4:45	57.05	9/30/20 4:40	9/30/20 4:45	0.000	0.000
9/30/20 4:45	9/30/20 4:50	237.90	9/30/20 4:45	9/30/20 4:50	57.20	9/30/20 4:45	9/30/20 4:50	57.69	9/30/20 4:45	9/30/20 4:50	0.074	106.596
9/30/20 4:50	9/30/20 4:55	239.12	9/30/20 4:50	9/30/20 4:55	57.65	9/30/20 4:50	9/30/20 4:55	57.96	9/30/20 4:50	9/30/20 4:55	0.000	0.000
9/30/20 4:55	9/30/20 5:00	243.94	9/30/20 4:55	9/30/20 5:00	56.72	9/30/20 4:55	9/30/20 5:00	58.28	9/30/20 4:55	9/30/20 5:00	0.029	42.426
9/30/20 5:00	9/30/20 5:05	245.81	9/30/20 5:00	9/30/20 5:05	54.55	9/30/20 5:00	9/30/20 5:05	58.36	9/30/20 5:00	9/30/20 5:05	0.031	44.924
9/30/20 5:05	9/30/20 5:10	246.06	9/30/20 5:05	9/30/20 5:10	52.31	9/30/20 5:05	9/30/20 5:10	58.55	9/30/20 5:05	9/30/20 5:10	0.000	0.000
9/30/20 5:10	9/30/20 5:15	245.90	9/30/20 5:10	9/30/20 5:15	50.12	9/30/20 5:10	9/30/20 5:15	58.63	9/30/20 5:10	9/30/20 5:15	0.065	93.075
9/30/20 5:15	9/30/20 5:20	246.11	9/30/20 5:15	9/30/20 5:20	48.02	9/30/20 5:15	9/30/20 5:20	58.52	9/30/20 5:15	9/30/20 5:20	0.000	0.000
9/30/20 5:20	9/30/20 5:25	246.39	9/30/20 5:20	9/30/20 5:25	45.90	9/30/20 5:20	9/30/20 5:25	58.58	9/30/20 5:20	9/30/20 5:25	0.020	29.219
9/30/20 5:25	9/30/20 5:30	246.24	9/30/20 5:25	9/30/20 5:30	43.72	9/30/20 5:25	9/30/20 5:30	58.66	9/30/20 5:25	9/30/20 5:30	0.014	19.667
9/30/20 5:30	9/30/20 5:35	246.17	9/30/20 5:30	9/30/20 5:35	41.65	9/30/20 5:30	9/30/20 5:35	58.84	9/30/20 5:30	9/30/20 5:35	0.008	10.905
9/30/20 5:35	9/30/20 5:40	245.66	9/30/20 5:35	9/30/20 5:40	40.57	9/30/20 5:35	9/30/20 5:40	57.62	9/30/20 5:35	9/30/20 5:40	0.000	0.000
9/30/20 5:40	9/30/20 5:45	245.64	9/30/20 5:40	9/30/20 5:45	52.68	9/30/20 5:40	9/30/20 5:45	55.78	9/30/20 5:40	9/30/20 5:45	0.000	0.000
9/30/20 5:45	9/30/20 5:50	245.27	9/30/20 5:45	9/30/20 5:50	56.16	9/30/20 5:45	9/30/20 5:50	55.68	9/30/20 5:45	9/30/20 5:50	0.000	0.000
9/30/20 5:50	9/30/20 5:55	245.56	9/30/20 5:50	9/30/20 5:55	56.17	9/30/20 5:50	9/30/20 5:55	58.15	9/30/20 5:50	9/30/20 5:55	0.000	0.000
9/30/20 5:55	9/30/20 6:00	245.23	9/30/20 5:55	9/30/20 6:00	55.82	9/30/20 5:55	9/30/20 6:00	58.64	9/30/20 5:55	9/30/20 6:00	0.000	0.000
9/30/20 6:00	9/30/20 6:05	245.10	9/30/20 6:00	9/30/20 6:05	55.26	9/30/20 6:00	9/30/20 6:05	56.83	9/30/20 6:00	9/30/20 6:05	0.000	0.000
9/30/20 6:05	9/30/20 6:10	245.11	9/30/20 6:05	9/30/20 6:10	53.11	9/30/20 6:05	9/30/20 6:10	52.40	9/30/20 6:05	9/30/20 6:10	0.000	0.000
9/30/20 6:10	9/30/20 6:15	244.91	9/30/20 6:10	9/30/20 6:15	50.57	9/30/20 6:10	9/30/20 6:15	50.31	9/30/20 6:10	9/30/20 6:15	0.000	0.000
9/30/20 6:15	9/30/20 6:20	244.95	9/30/20 6:15	9/30/20 6:20	48.68	9/30/20 6:15	9/30/20 6:20	48.59	9/30/20 6:15	9/30/20 6:20	0.000	0.000
9/30/20 6:20	9/30/20 6:25	244.79	9/30/20 6:20	9/30/20 6:25	47.40	9/30/20 6:20	9/30/20 6:25	47.26	9/30/20 6:20	9/30/20 6:25	0.000	0.000
9/30/20 6:25	9/30/20 6:30	244.73	9/30/20 6:25	9/30/20 6:30	46.52	9/30/20 6:25	9/30/20 6:30	46.54	9/30/20 6:25	9/30/20 6:30	0.000	0.000
9/30/20 6:30	9/30/20 6:35	245.11	9/30/20 6:30	9/30/20 6:35	46.07	9/30/20 6:30	9/30/20 6:35	45.90	9/30/20 6:30	9/30/20 6:35	0.000	0.000
9/30/20 6:35	9/30/20 6:40	245.14	9/30/20 6:35	9/30/20 6:40	45.76	9/30/20 6:35	9/30/20 6:40	43.91	9/30/20 6:35	9/30/20 6:40	0.000	0.000
9/30/20 6:40	9/30/20 6:45	245.21	9/30/20 6:40	9/30/20 6:45	45.53	9/30/20 6:40	9/30/20 6:45	43.57	9/30/20 6:40	9/30/20 6:45	0.000	0.000
9/30/20 6:45	9/30/20 6:50	245.14	9/30/20 6:45	9/30/20 6:50	44.87	9/30/20 6:45	9/30/20 6:50	44.31	9/30/20 6:45	9/30/20 6:50	0.000	0.000
9/30/20 6:50	9/30/20 6:55	245.09	9/30/20 6:50	9/30/20 6:55	43.69	9/30/20 6:50	9/30/20 6:55	43.22	9/30/20 6:50	9/30/20 6:55	0.000	0.000

	FIT-3693C	5 min averages		TIT-3693E	5 min averages		TIT-3693F	5 min averages		FIT-3693B	5 min averages	
	Scrubber Flow	GPM		Outlet Water Blowdown Temp	°C		Scrubber Exhaust Temperature	°C		Caustic additive Flow to Scrubber	GPM	GPD
9/30/20 6:55	9/30/20 7:00	244.94	9/30/20 6:55	9/30/20 7:00	42.89	9/30/20 6:55	9/30/20 7:00	44.32	9/30/20 6:55	9/30/20 7:00	0.000	0.000
9/30/20 7:00	9/30/20 7:05	245.03	9/30/20 7:00	9/30/20 7:05	44.73	9/30/20 7:00	9/30/20 7:05	48.93	9/30/20 7:00	9/30/20 7:05	0.000	0.000
9/30/20 7:05	9/30/20 7:10	245.18	9/30/20 7:05	9/30/20 7:10	48.78	9/30/20 7:05	9/30/20 7:10	53.38	9/30/20 7:05	9/30/20 7:10	0.000	0.000
9/30/20 7:10	9/30/20 7:15	244.99	9/30/20 7:10	9/30/20 7:15	52.01	9/30/20 7:10	9/30/20 7:15	55.59	9/30/20 7:10	9/30/20 7:15	0.000	0.000
9/30/20 7:15	9/30/20 7:20	243.23	9/30/20 7:15	9/30/20 7:20	53.65	9/30/20 7:15	9/30/20 7:20	56.86	9/30/20 7:15	9/30/20 7:20	0.000	0.000
9/30/20 7:20	9/30/20 7:25	240.01	9/30/20 7:20	9/30/20 7:25	54.92	9/30/20 7:20	9/30/20 7:25	57.48	9/30/20 7:20	9/30/20 7:25	0.000	0.000
9/30/20 7:25	9/30/20 7:30	239.90	9/30/20 7:25	9/30/20 7:30	55.75	9/30/20 7:25	9/30/20 7:30	57.91	9/30/20 7:25	9/30/20 7:30	0.000	0.000
9/30/20 7:30	9/30/20 7:35	239.54	9/30/20 7:30	9/30/20 7:35	56.14	9/30/20 7:30	9/30/20 7:35	58.27	9/30/20 7:30	9/30/20 7:35	0.000	0.000
9/30/20 7:35	9/30/20 7:40	239.78	9/30/20 7:35	9/30/20 7:40	56.39	9/30/20 7:35	9/30/20 7:40	58.49	9/30/20 7:35	9/30/20 7:40	0.000	0.000
9/30/20 7:40	9/30/20 7:45	240.01	9/30/20 7:40	9/30/20 7:45	56.67	9/30/20 7:40	9/30/20 7:45	58.70	9/30/20 7:40	9/30/20 7:45	0.000	0.000
9/30/20 7:45	9/30/20 7:50	239.56	9/30/20 7:45	9/30/20 7:50	56.82	9/30/20 7:45	9/30/20 7:50	58.95	9/30/20 7:45	9/30/20 7:50	0.000	0.000
9/30/20 7:50	9/30/20 7:55	238.79	9/30/20 7:50	9/30/20 7:55	57.01	9/30/20 7:50	9/30/20 7:55	59.10	9/30/20 7:50	9/30/20 7:55	0.000	0.000
9/30/20 7:55	9/30/20 8:00	238.31	9/30/20 7:55	9/30/20 8:00	57.02	9/30/20 7:55	9/30/20 8:00	59.15	9/30/20 7:55	9/30/20 8:00	0.000	0.000
9/30/20 8:00	9/30/20 8:05	238.35	9/30/20 8:00	9/30/20 8:05	57.02	9/30/20 8:00	9/30/20 8:05	59.25	9/30/20 8:00	9/30/20 8:05	0.000	0.000
9/30/20 8:05	9/30/20 8:10	238.07	9/30/20 8:05	9/30/20 8:10	56.98	9/30/20 8:05	9/30/20 8:10	59.31	9/30/20 8:05	9/30/20 8:10	0.000	0.000
9/30/20 8:10	9/30/20 8:15	238.22	9/30/20 8:10	9/30/20 8:15	57.12	9/30/20 8:10	9/30/20 8:15	59.32	9/30/20 8:10	9/30/20 8:15	0.000	0.000
9/30/20 8:15	9/30/20 8:20	238.03	9/30/20 8:15	9/30/20 8:20	57.13	9/30/20 8:15	9/30/20 8:20	59.35	9/30/20 8:15	9/30/20 8:20	0.000	0.000
9/30/20 8:20	9/30/20 8:25	238.16	9/30/20 8:20	9/30/20 8:25	57.05	9/30/20 8:20	9/30/20 8:25	59.40	9/30/20 8:20	9/30/20 8:25	0.000	0.000
9/30/20 8:25	9/30/20 8:30	238.30	9/30/20 8:25	9/30/20 8:30	57.02	9/30/20 8:25	9/30/20 8:30	59.47	9/30/20 8:25	9/30/20 8:30	0.000	0.000
9/30/20 8:30	9/30/20 8:35	238.19	9/30/20 8:30	9/30/20 8:35	57.13	9/30/20 8:30	9/30/20 8:35	59.50	9/30/20 8:30	9/30/20 8:35	0.000	0.000
9/30/20 8:35	9/30/20 8:40	238.26	9/30/20 8:35	9/30/20 8:40	57.18	9/30/20 8:35	9/30/20 8:40	59.53	9/30/20 8:35	9/30/20 8:40	0.000	0.000
9/30/20 8:40	9/30/20 8:45	238.17	9/30/20 8:40	9/30/20 8:45	57.29	9/30/20 8:40	9/30/20 8:45	59.53	9/30/20 8:40	9/30/20 8:45	0.000	0.000
9/30/20 8:45	9/30/20 8:50	237.85	9/30/20 8:45	9/30/20 8:50	57.43	9/30/20 8:45	9/30/20 8:50	59.57	9/30/20 8:45	9/30/20 8:50	0.000	0.000
9/30/20 8:50	9/30/20 8:55	237.56	9/30/20 8:50	9/30/20 8:55	57.49	9/30/20 8:50	9/30/20 8:55	59.61	9/30/20 8:50	9/30/20 8:55	0.000	0.000
9/30/20 8:55	9/30/20 9:00	237.27	9/30/20 8:55	9/30/20 9:00	57.66	9/30/20 8:55	9/30/20 9:00	59.67	9/30/20 8:55	9/30/20 9:00	0.000	0.000
9/30/20 9:00	9/30/20 9:05	237.43	9/30/20 9:00	9/30/20 9:05	57.75	9/30/20 9:00	9/30/20 9:05	59.71	9/30/20 9:00	9/30/20 9:05	0.000	0.000
9/30/20 9:05	9/30/20 9:10	237.19	9/30/20 9:05	9/30/20 9:10	57.84	9/30/20 9:05	9/30/20 9:10	59.72	9/30/20 9:05	9/30/20 9:10	0.000	0.000
9/30/20 9:10	9/30/20 9:15	237.41	9/30/20 9:10	9/30/20 9:15	57.86	9/30/20 9:10	9/30/20 9:15	59.78	9/30/20 9:10	9/30/20 9:15	0.000	0.000
9/30/20 9:15	9/30/20 9:20	237.19	9/30/20 9:15	9/30/20 9:20	57.98	9/30/20 9:15	9/30/20 9:20	59.80	9/30/20 9:15	9/30/20 9:20	0.000	0.000
9/30/20 9:20	9/30/20 9:25	237.19	9/30/20 9:20	9/30/20 9:25	57.90	9/30/20 9:20	9/30/20 9:25	59.86	9/30/20 9:20	9/30/20 9:25	0.000	0.000
9/30/20 9:25	9/30/20 9:30	237.20	9/30/20 9:25	9/30/20 9:30	57.96	9/30/20 9:25	9/30/20 9:30	59.92	9/30/20 9:25	9/30/20 9:30	0.000	0.000
9/30/20 9:30	9/30/20 9:35	237.53	9/30/20 9:30	9/30/20 9:35	57.91	9/30/20 9:30	9/30/20 9:35	59.94	9/30/20 9:30	9/30/20 9:35	0.000	0.000
9/30/20 9:35	9/30/20 9:40	238.59	9/30/20 9:35	9/30/20 9:40	57.93	9/30/20 9:35	9/30/20 9:40	59.99	9/30/20 9:35	9/30/20 9:40	0.000	0.000
9/30/20 9:40	9/30/20 9:45	239.05	9/30/20 9:40	9/30/20 9:45	57.73	9/30/20 9:40	9/30/20 9:45	60.02	9/30/20 9:40	9/30/20 9:45	0.000	0.000
9/30/20 9:45	9/30/20 9:50	237.31	9/30/20 9:45	9/30/20 9:50	57.78	9/30/20 9:45	9/30/20 9:50	59.99	9/30/20 9:45	9/30/20 9:50	0.000	0.000
9/30/20 9:50	9/30/20 9:55	236.76	9/30/20 9:50	9/30/20 9:55	57.71	9/30/20 9:50	9/30/20 9:55	59.95	9/30/20 9:50	9/30/20 9:55	0.000	0.000
9/30/20 9:55	9/30/20 10:00	236.62	9/30/20 9:55	9/30/20 10:00	58.06	9/30/20 9:55	9/30/20 10:00	60.18	9/30/20 9:55	9/30/20 10:00	0.000	0.000
9/30/20 10:00	9/30/20 10:05	237.34	9/30/20 10:00	9/30/20 10:05	58.18	9/30/20 10:00	9/30/20 10:05	60.52	9/30/20 10:00	9/30/20 10:05	0.000	0.000
9/30/20 10:05	9/30/20 10:10	239.10	9/30/20 10:05	9/30/20 10:10	58.51	9/30/20 10:05	9/30/20 10:10	60.58	9/30/20 10:05	9/30/20 10:10	0.000	0.000
9/30/20 10:10	9/30/20 10:15	240.63	9/30/20 10:10	9/30/20 10:15	58.66	9/30/20 10:10	9/30/20 10:15	60.67	9/30/20 10:10	9/30/20 10:15	0.000	0.000
9/30/20 10:15	9/30/20 10:20	238.42	9/30/20 10:15	9/30/20 10:20	58.80	9/30/20 10:15	9/30/20 10:20	60.73	9/30/20 10:15	9/30/20 10:20	0.000	0.000
9/30/20 10:20	9/30/20 10:25	237.84	9/30/20 10:20	9/30/20 10:25	58.84	9/30/20 10:20	9/30/20 10:25	60.61	9/30/20 10:20	9/30/20 10:25	0.000	0.000
9/30/20 10:25	9/30/20 10:30	237.79	9/30/20 10:25	9/30/20 10:30	58.81	9/30/20 10:25	9/30/20 10:30	60.42	9/30/20 10:25	9/30/20 10:30	0.000	0.000
9/30/20 10:30	9/30/20 10:35	237.71	9/30/20 10:30	9/30/20 10:35	57.66	9/30/20 10:30	9/30/20 10:35	60.33	9/30/20 10:30	9/30/20 10:35	0.000	0.000
9/30/20 10:35	9/30/20 10:40	237.68	9/30/20 10:35	9/30/20 10:40	55.61	9/30/20 10:35	9/30/20 10:40	60.30	9/30/20 10:35	9/30/20 10:40	0.000	0.000
9/30/20 10:40	9/30/20 10:45	237.46	9/30/20 10:40	9/30/20 10:45	53.58	9/30/20 10:40	9/30/20 10:45	60.60	9/30/20 10:40	9/30/20 10:45	0.000	0.000
9/30/20 10:45	9/30/20 10:50	237.03	9/30/20 10:45	9/30/20 10:50	52.07	9/30/20 10:45	9/30/20 10:50	60.82	9/30/20 10:45	9/30/20 10:50	0.000	0.000

FIT-3693C		5 min averages
	Scrubber Flow	GPM
9/30/20 10:50	9/30/20 10:55	237.20
9/30/20 10:55	9/30/20 11:00	241.34
9/30/20 11:00	9/30/20 11:05	242.37
9/30/20 11:05	9/30/20 11:10	236.92
9/30/20 11:10	9/30/20 11:15	236.98
9/30/20 11:15	9/30/20 11:20	237.07
9/30/20 11:20	9/30/20 11:25	239.17
9/30/20 11:25	9/30/20 11:30	237.77
9/30/20 11:30	9/30/20 11:35	237.07
9/30/20 11:35	9/30/20 11:40	237.28
9/30/20 11:40	9/30/20 11:45	235.42
9/30/20 11:45	9/30/20 11:50	236.19
9/30/20 11:50	9/30/20 11:55	244.33
9/30/20 11:55	9/30/20 12:00	245.29
9/30/20 12:00	9/30/20 12:05	245.34
9/30/20 12:05	9/30/20 12:10	245.32
9/30/20 12:10	9/30/20 12:15	245.28
9/30/20 12:15	9/30/20 12:20	243.54
9/30/20 12:20	9/30/20 12:25	242.53
9/30/20 12:25	9/30/20 12:30	242.71
9/30/20 12:30	9/30/20 12:35	242.63
9/30/20 12:35	9/30/20 12:40	242.40
9/30/20 12:40	9/30/20 12:45	242.49
9/30/20 12:45	9/30/20 12:50	242.77
9/30/20 12:50	9/30/20 12:55	242.93
9/30/20 12:55	9/30/20 13:00	243.32
9/30/20 13:00	9/30/20 13:05	243.70
9/30/20 13:05	9/30/20 13:10	244.24
9/30/20 13:10	9/30/20 13:15	245.44
9/30/20 13:15	9/30/20 13:20	243.61
9/30/20 13:20	9/30/20 13:25	244.69
9/30/20 13:25	9/30/20 13:30	244.18
9/30/20 13:30	9/30/20 13:35	242.69
9/30/20 13:35	9/30/20 13:40	243.90
9/30/20 13:40	9/30/20 13:45	245.18
9/30/20 13:45	9/30/20 13:50	247.60
9/30/20 13:50	9/30/20 13:55	245.70
9/30/20 13:55	9/30/20 14:00	244.93
9/30/20 14:00	9/30/20 14:05	244.67
9/30/20 14:05	9/30/20 14:10	244.54
9/30/20 14:10	9/30/20 14:15	244.53
9/30/20 14:15	9/30/20 14:20	244.76
9/30/20 14:20	9/30/20 14:25	245.00
9/30/20 14:25	9/30/20 14:30	244.74
9/30/20 14:30	9/30/20 14:35	244.83
9/30/20 14:35	9/30/20 14:40	245.03
9/30/20 14:40	9/30/20 14:45	244.93

	TIT-3693E	5 min averages
	Outlet Water Blowdown Temp	°C
9/30/20 10:50	9/30/20 10:55	50.84
9/30/20 10:55	9/30/20 11:00	49.02
9/30/20 11:00	9/30/20 11:05	47.02
9/30/20 11:05	9/30/20 11:10	44.95
9/30/20 11:10	9/30/20 11:15	42.93
9/30/20 11:15	9/30/20 11:20	41.16
9/30/20 11:20	9/30/20 11:25	39.67
9/30/20 11:25	9/30/20 11:30	38.34
9/30/20 11:30	9/30/20 11:35	39.56
9/30/20 11:35	9/30/20 11:40	42.95
9/30/20 11:40	9/30/20 11:45	53.38
9/30/20 11:45	9/30/20 11:50	59.37
9/30/20 11:50	9/30/20 11:55	59.86
9/30/20 11:55	9/30/20 12:00	58.15
9/30/20 12:00	9/30/20 12:05	55.07
9/30/20 12:05	9/30/20 12:10	51.89
9/30/20 12:10	9/30/20 12:15	49.16
9/30/20 12:15	9/30/20 12:20	52.63
9/30/20 12:20	9/30/20 12:25	59.07
9/30/20 12:25	9/30/20 12:30	59.31
9/30/20 12:30	9/30/20 12:35	59.45
9/30/20 12:35	9/30/20 12:40	59.06
9/30/20 12:40	9/30/20 12:45	59.02
9/30/20 12:45	9/30/20 12:50	59.38
9/30/20 12:50	9/30/20 12:55	59.47
9/30/20 12:55	9/30/20 13:00	59.47
9/30/20 13:00	9/30/20 13:05	59.46
9/30/20 13:05	9/30/20 13:10	59.96
9/30/20 13:10	9/30/20 13:15	60.29
9/30/20 13:15	9/30/20 13:20	60.33
9/30/20 13:20	9/30/20 13:25	59.77
9/30/20 13:25	9/30/20 13:30	59.14
9/30/20 13:30	9/30/20 13:35	57.44
9/30/20 13:35	9/30/20 13:40	54.88
9/30/20 13:40	9/30/20 13:45	52.81
9/30/20 13:45	9/30/20 13:50	51.14
9/30/20 13:50	9/30/20 13:55	50.11
9/30/20 13:55	9/30/20 14:00	49.62
9/30/20 14:00	9/30/20 14:05	49.46
9/30/20 14:05	9/30/20 14:10	49.61
9/30/20 14:10	9/30/20 14:15	49.57
9/30/20 14:15	9/30/20 14:20	49.34
9/30/20 14:20	9/30/20 14:25	49.18
9/30/20 14:25	9/30/20 14:30	49.24
9/30/20 14:30	9/30/20 14:35	49.12
9/30/20 14:35	9/30/20 14:40	48.91
9/30/20 14:40	9/30/20 14:45	48.78

	TIT-3693F	5 min averages
	Scrubber Exhaust Temperature	°C
9/30/20 10:50	9/30/20 10:55	59.28
9/30/20 10:55	9/30/20 11:00	58.96
9/30/20 11:00	9/30/20 11:05	58.69
9/30/20 11:05	9/30/20 11:10	57.52
9/30/20 11:10	9/30/20 11:15	57.30
9/30/20 11:15	9/30/20 11:20	56.97
9/30/20 11:20	9/30/20 11:25	58.40
9/30/20 11:25	9/30/20 11:30	59.28
9/30/20 11:30	9/30/20 11:35	58.91
9/30/20 11:35	9/30/20 11:40	58.84
9/30/20 11:40	9/30/20 11:45	59.13
9/30/20 11:45	9/30/20 11:50	59.88
9/30/20 11:50	9/30/20 11:55	60.06
9/30/20 11:55	9/30/20 12:00	59.74
9/30/20 12:00	9/30/20 12:05	59.41
9/30/20 12:05	9/30/20 12:10	59.87
9/30/20 12:10	9/30/20 12:15	59.83
9/30/20 12:15	9/30/20 12:20	59.39
9/30/20 12:20	9/30/20 12:25	59.26
9/30/20 12:25	9/30/20 12:30	59.36
9/30/20 12:30	9/30/20 12:35	59.17
9/30/20 12:35	9/30/20 12:40	58.73
9/30/20 12:40	9/30/20 12:45	59.19
9/30/20 12:45	9/30/20 12:50	59.30
9/30/20 12:50	9/30/20 12:55	59.30
9/30/20 12:55	9/30/20 13:00	59.28
9/30/20 13:00	9/30/20 13:05	59.62
9/30/20 13:05	9/30/20 13:10	60.07
9/30/20 13:10	9/30/20 13:15	60.17
9/30/20 13:15	9/30/20 13:20	60.27
9/30/20 13:20	9/30/20 13:25	60.17
9/30/20 13:25	9/30/20 13:30	60.19
9/30/20 13:30	9/30/20 13:35	59.93
9/30/20 13:35	9/30/20 13:40	59.44
9/30/20 13:40	9/30/20 13:45	59.19
9/30/20 13:45	9/30/20 13:50	59.08
9/30/20 13:50	9/30/20 13:55	59.08
9/30/20 13:55	9/30/20 14:00	59.65
9/30/20 14:00	9/30/20 14:05	60.04
9/30/20 14:05	9/30/20 14:10	59.93
9/30/20 14:10	9/30/20 14:15	59.50
9/30/20 14:15	9/30/20 14:20	59.44
9/30/20 14:20	9/30/20 14:25	60.01
9/30/20 14:25	9/30/20 14:30	59.99
9/30/20 14:30	9/30/20 14:35	59.64
9/30/20 14:35	9/30/20 14:40	59.40
9/30/20 14:40	9/30/20 14:45	59.95

	FIT-3693B	5 min averages	
	Caustic additive Flow to Scrubber	GPM	GPD
9/30/20 10:50	9/30/20 10:55	0.000	0.000
9/30/20 10:55	9/30/20 11:00	0.000	0.000
9/30/20 11:00	9/30/20 11:05	0.000	0.000
9/30/20 11:05	9/30/20 11:10	0.022	32.268
9/30/20 11:10	9/30/20 11:15	0.079	113.993
9/30/20 11:15	9/30/20 11:20	0.000	0.000
9/30/20 11:20	9/30/20 11:25	0.000	0.000
9/30/20 11:25	9/30/20 11:30	0.000	0.000
9/30/20 11:30	9/30/20 11:35	0.000	0.000
9/30/20 11:35	9/30/20 11:40	0.000	0.000
9/30/20 11:40	9/30/20 11:45	0.000	0.000
9/30/20 11:45	9/30/20 11:50	0.000	0.000
9/30/20 11:50	9/30/20 11:55	0.000	0.000
9/30/20 11:55	9/30/20 12:00	0.000	0.000
9/30/20 12:00	9/30/20 12:05	0.000	0.000
9/30/20 12:05	9/30/20 12:10	0.000	0.000
9/30/20 12:10	9/30/20 12:15	0.000	0.000
9/30/20 12:15	9/30/20 12:20	0.000	0.000
9/30/20 12:20	9/30/20 12:25	0.000	0.000
9/30/20 12:25	9/30/20 12:30	0.000	0.000
9/30/20 12:30	9/30/20 12:35	0.000	0.000
9/30/20 12:35	9/30/20 12:40	0.000	0.000
9/30/20 12:40	9/30/20 12:45	0.000	0.000
9/30/20 12:45	9/30/20 12:50	0.000	0.000
9/30/20 12:50	9/30/20 12:55	0.000	0.000
9/30/20 12:55	9/30/20 13:00	0.000	0.000
9/30/20 13:00	9/30/20 13:05	0.000	0.000
9/30/20 13:05	9/30/20 13:10	0.000	0.000
9/30/20 13:10	9/30/20 13:15	0.000	0.000
9/30/20 13:15	9/30/20 13:20	0.000	0.000
9/30/20 13:20	9/30/20 13:25	0.000	0.000
9/30/20 13:25	9/30/20 13:30	0.000	0.000
9/30/20 13:30	9/30/20 13:35	0.000	0.000
9/30/20 13:35	9/30/20 13:40	0.000	0.000
9/30/20 13:40	9/30/20 13:45	0.000	0.000
9/30/20 13:45	9/30/20 13:50	0.000	0.000
9/30/20 13:50	9/30/20 13:55	0.000	0.000
9/30/20 13:55	9/30/20 14:00	0.000	0.000
9/30/20 14:00	9/30/20 14:05	0.000	0.000
9/30/20 14:05	9/30/20 14:10	0.000	0.000
9/30/20 14:10	9/30/20 14:15	0.000	0.000
9/30/20 14:15	9/30/20 14:20	0.000	0.000
9/30/20 14:20	9/30/20 14:25	0.000	0.000
9/30/20 14:25	9/30/20 14:30	0.000	0.000
9/30/20 14:30	9/30/20 14:35	0.000	0.000
9/30/20 14:35	9/30/20 14:40	0.000	0.000
9/30/20 14:40	9/30/20 14:45	0.000	0.000

FIT-3693C		5 min averages
	Scrubber Flow	GPM
9/30/20 14:45	9/30/20 14:50	244.88
9/30/20 14:50	9/30/20 14:55	245.03
9/30/20 14:55	9/30/20 15:00	245.13
9/30/20 15:00	9/30/20 15:05	245.12
9/30/20 15:05	9/30/20 15:10	245.04
9/30/20 15:10	9/30/20 15:15	245.12
9/30/20 15:15	9/30/20 15:20	245.26
9/30/20 15:20	9/30/20 15:25	245.36
9/30/20 15:25	9/30/20 15:30	245.14
9/30/20 15:30	9/30/20 15:35	245.14
9/30/20 15:35	9/30/20 15:40	245.16
9/30/20 15:40	9/30/20 15:45	242.87
9/30/20 15:45	9/30/20 15:50	242.39
9/30/20 15:50	9/30/20 15:55	243.97
9/30/20 15:55	9/30/20 16:00	245.39
9/30/20 16:00	9/30/20 16:05	245.59
9/30/20 16:05	9/30/20 16:10	245.39
9/30/20 16:10	9/30/20 16:15	245.34
9/30/20 16:15	9/30/20 16:20	245.07
9/30/20 16:20	9/30/20 16:25	244.88
9/30/20 16:25	9/30/20 16:30	242.77
9/30/20 16:30	9/30/20 16:35	243.72
9/30/20 16:35	9/30/20 16:40	245.26
9/30/20 16:40	9/30/20 16:45	245.39
9/30/20 16:45	9/30/20 16:50	243.71
9/30/20 16:50	9/30/20 16:55	242.54
9/30/20 16:55	9/30/20 17:00	242.54
9/30/20 17:00	9/30/20 17:05	242.31
9/30/20 17:05	9/30/20 17:10	242.56
9/30/20 17:10	9/30/20 17:15	242.52
9/30/20 17:15	9/30/20 17:20	242.72
9/30/20 17:20	9/30/20 17:25	244.76
9/30/20 17:25	9/30/20 17:30	245.00
9/30/20 17:30	9/30/20 17:35	245.29
9/30/20 17:35	9/30/20 17:40	244.12
9/30/20 17:40	9/30/20 17:45	242.62
9/30/20 17:45	9/30/20 17:50	242.52
9/30/20 17:50	9/30/20 17:55	242.46
9/30/20 17:55	9/30/20 18:00	242.91
9/30/20 18:00	9/30/20 18:05	242.77
9/30/20 18:05	9/30/20 18:10	242.76
9/30/20 18:10	9/30/20 18:15	242.82
9/30/20 18:15	9/30/20 18:20	242.84
9/30/20 18:20	9/30/20 18:25	242.98
9/30/20 18:25	9/30/20 18:30	242.92
9/30/20 18:30	9/30/20 18:35	242.83
9/30/20 18:35	9/30/20 18:40	242.89

TIT-3693E		5 min averages
	Outlet Water Blowdown Temp	°C
9/30/20 14:45	9/30/20 14:50	48.80
9/30/20 14:50	9/30/20 14:55	48.87
9/30/20 14:55	9/30/20 15:00	48.71
9/30/20 15:00	9/30/20 15:05	48.60
9/30/20 15:05	9/30/20 15:10	48.66
9/30/20 15:10	9/30/20 15:15	48.74
9/30/20 15:15	9/30/20 15:20	48.64
9/30/20 15:20	9/30/20 15:25	48.64
9/30/20 15:25	9/30/20 15:30	48.52
9/30/20 15:30	9/30/20 15:35	48.40
9/30/20 15:35	9/30/20 15:40	48.70
9/30/20 15:40	9/30/20 15:45	58.09
9/30/20 15:45	9/30/20 15:50	59.85
9/30/20 15:50	9/30/20 15:55	59.89
9/30/20 15:55	9/30/20 16:00	58.29
9/30/20 16:00	9/30/20 16:05	55.82
9/30/20 16:05	9/30/20 16:10	53.32
9/30/20 16:10	9/30/20 16:15	51.03
9/30/20 16:15	9/30/20 16:20	48.87
9/30/20 16:20	9/30/20 16:25	47.52
9/30/20 16:25	9/30/20 16:30	58.74
9/30/20 16:30	9/30/20 16:35	60.84
9/30/20 16:35	9/30/20 16:40	59.62
9/30/20 16:40	9/30/20 16:45	57.10
9/30/20 16:45	9/30/20 16:50	57.20
9/30/20 16:50	9/30/20 16:55	60.16
9/30/20 16:55	9/30/20 17:00	60.97
9/30/20 17:00	9/30/20 17:05	61.10
9/30/20 17:05	9/30/20 17:10	60.86
9/30/20 17:10	9/30/20 17:15	60.62
9/30/20 17:15	9/30/20 17:20	60.63
9/30/20 17:20	9/30/20 17:25	60.19
9/30/20 17:25	9/30/20 17:30	58.14
9/30/20 17:30	9/30/20 17:35	55.81
9/30/20 17:35	9/30/20 17:40	55.26
9/30/20 17:40	9/30/20 17:45	60.00
9/30/20 17:45	9/30/20 17:50	60.33
9/30/20 17:50	9/30/20 17:55	60.43
9/30/20 17:55	9/30/20 18:00	60.42
9/30/20 18:00	9/30/20 18:05	60.39
9/30/20 18:05	9/30/20 18:10	60.37
9/30/20 18:10	9/30/20 18:15	60.37
9/30/20 18:15	9/30/20 18:20	60.37
9/30/20 18:20	9/30/20 18:25	60.60
9/30/20 18:25	9/30/20 18:30	61.25
9/30/20 18:30	9/30/20 18:35	61.34
9/30/20 18:35	9/30/20 18:40	61.09

TIT-3693F		5 min averages
	Scrubber Exhaust Temperature	°C
9/30/20 14:45	9/30/20 14:50	60.08
9/30/20 14:50	9/30/20 14:55	59.71
9/30/20 14:55	9/30/20 15:00	59.48
9/30/20 15:00	9/30/20 15:05	60.03
9/30/20 15:05	9/30/20 15:10	60.05
9/30/20 15:10	9/30/20 15:15	59.62
9/30/20 15:15	9/30/20 15:20	59.30
9/30/20 15:20	9/30/20 15:25	59.56
9/30/20 15:25	9/30/20 15:30	59.78
9/30/20 15:30	9/30/20 15:35	59.44
9/30/20 15:35	9/30/20 15:40	59.16
9/30/20 15:40	9/30/20 15:45	59.20
9/30/20 15:45	9/30/20 15:50	59.66
9/30/20 15:50	9/30/20 15:55	59.57
9/30/20 15:55	9/30/20 16:00	59.25
9/30/20 16:00	9/30/20 16:05	59.31
9/30/20 16:05	9/30/20 16:10	59.79
9/30/20 16:10	9/30/20 16:15	59.62
9/30/20 16:15	9/30/20 16:20	59.54
9/30/20 16:20	9/30/20 16:25	59.89
9/30/20 16:25	9/30/20 16:30	60.74
9/30/20 16:30	9/30/20 16:35	61.02
9/30/20 16:35	9/30/20 16:40	60.62
9/30/20 16:40	9/30/20 16:45	60.32
9/30/20 16:45	9/30/20 16:50	60.24
9/30/20 16:50	9/30/20 16:55	60.67
9/30/20 16:55	9/30/20 17:00	61.06
9/30/20 17:00	9/30/20 17:05	60.76
9/30/20 17:05	9/30/20 17:10	60.50
9/30/20 17:10	9/30/20 17:15	60.40
9/30/20 17:15	9/30/20 17:20	60.96
9/30/20 17:20	9/30/20 17:25	61.27
9/30/20 17:25	9/30/20 17:30	60.90
9/30/20 17:30	9/30/20 17:35	60.60
9/30/20 17:35	9/30/20 17:40	60.47
9/30/20 17:40	9/30/20 17:45	60.42
9/30/20 17:45	9/30/20 17:50	60.36
9/30/20 17:50	9/30/20 17:55	60.33
9/30/20 17:55	9/30/20 18:00	60.33
9/30/20 18:00	9/30/20 18:05	60.33
9/30/20 18:05	9/30/20 18:10	60.33
9/30/20 18:10	9/30/20 18:15	60.33
9/30/20 18:15	9/30/20 18:20	60.37
9/30/20 18:20	9/30/20 18:25	61.09
9/30/20 18:25	9/30/20 18:30	61.26
9/30/20 18:30	9/30/20 18:35	61.04
9/30/20 18:35	9/30/20 18:40	60.75

FIT-3693B		5 min averages	
	Caustic additive Flow to Scrubber	GPM	GPD
9/30/20 14:45	9/30/20 14:50	0.000	0.000
9/30/20 14:50	9/30/20 14:55	0.000	0.000
9/30/20 14:55	9/30/20 15:00	0.000	0.000
9/30/20 15:00	9/30/20 15:05	0.000	0.000
9/30/20 15:05	9/30/20 15:10	0.000	0.000
9/30/20 15:10	9/30/20 15:15	0.000	0.000
9/30/20 15:15	9/30/20 15:20	0.000	0.000
9/30/20 15:20	9/30/20 15:25	0.000	0.000
9/30/20 15:25	9/30/20 15:30	0.000	0.000
9/30/20 15:30	9/30/20 15:35	0.000	0.000
9/30/20 15:35	9/30/20 15:40	0.000	0.000
9/30/20 15:40	9/30/20 15:45	0.000	0.000
9/30/20 15:45	9/30/20 15:50	0.000	0.000
9/30/20 15:50	9/30/20 15:55	0.000	0.000
9/30/20 15:55	9/30/20 16:00	0.000	0.000
9/30/20 16:00	9/30/20 16:05	0.000	0.000
9/30/20 16:05	9/30/20 16:10	0.000	0.000
9/30/20 16:10	9/30/20 16:15	0.000	0.000
9/30/20 16:15	9/30/20 16:20	0.000	0.000
9/30/20 16:20	9/30/20 16:25	0.000	0.000
9/30/20 16:25	9/30/20 16:30	0.000	0.000
9/30/20 16:30	9/30/20 16:35	0.000	0.000
9/30/20 16:35	9/30/20 16:40	0.000	0.000
9/30/20 16:40	9/30/20 16:45	0.000	0.000
9/30/20 16:45	9/30/20 16:50	0.000	0.000
9/30/20 16:50	9/30/20 16:55	0.000	0.000
9/30/20 16:55	9/30/20 17:00	0.000	0.000
9/30/20 17:00	9/30/20 17:05	0.000	0.000
9/30/20 17:05	9/30/20 17:10	0.000	0.000
9/30/20 17:10	9/30/20 17:15	0.000	0.000
9/30/20 17:15	9/30/20 17:20	0.000	0.000
9/30/20 17:20	9/30/20 17:25	0.000	0.000
9/30/20 17:25	9/30/20 17:30	0.000	0.000
9/30/20 17:30	9/30/20 17:35	0.000	0.000
9/30/20 17:35	9/30/20 17:40	0.000	0.000
9/30/20 17:40	9/30/20 17:45	0.000	0.000
9/30/20 17:45	9/30/20 17:50	0.000	0.000
9/30/20 17:50	9/30/20 17:55	0.000	0.000
9/30/20 17:55	9/30/20 18:00	0.000	0.000
9/30/20 18:00	9/30/20 18:05	0.000	0.000
9/30/20 18:05	9/30/20 18:10	0.000	0.000
9/30/20 18:10	9/30/20 18:15	0.000	0.000
9/30/20 18:15	9/30/20 18:20	0.000	0.000
9/30/20 18:20	9/30/20 18:25	0.000	0.000
9/30/20 18:25	9/30/20 18:30	0.000	0.000
9/30/20 18:30	9/30/20 18:35	0.000	0.000
9/30/20 18:35	9/30/20 18:40	0.000	0.000

FIT-3693C		5 min averages
	Scrubber Flow	GPM
9/30/20 18:40	9/30/20 18:45	242.73
9/30/20 18:45	9/30/20 18:50	242.74
9/30/20 18:50	9/30/20 18:55	242.89
9/30/20 18:55	9/30/20 19:00	242.81
9/30/20 19:00	9/30/20 19:05	242.72
9/30/20 19:05	9/30/20 19:10	242.79
9/30/20 19:10	9/30/20 19:15	242.97
9/30/20 19:15	9/30/20 19:20	242.81
9/30/20 19:20	9/30/20 19:25	242.75
9/30/20 19:25	9/30/20 19:30	242.96
9/30/20 19:30	9/30/20 19:35	242.93
9/30/20 19:35	9/30/20 19:40	242.66
9/30/20 19:40	9/30/20 19:45	244.69
9/30/20 19:45	9/30/20 19:50	244.95
9/30/20 19:50	9/30/20 19:55	245.24
9/30/20 19:55	9/30/20 20:00	245.20
9/30/20 20:00	9/30/20 20:05	245.05
9/30/20 20:05	9/30/20 20:10	242.33
9/30/20 20:10	9/30/20 20:15	237.67
9/30/20 20:15	9/30/20 20:20	240.81
9/30/20 20:20	9/30/20 20:25	244.43
9/30/20 20:25	9/30/20 20:30	245.06
9/30/20 20:30	9/30/20 20:35	245.21
9/30/20 20:35	9/30/20 20:40	245.36
9/30/20 20:40	9/30/20 20:45	245.44
9/30/20 20:45	9/30/20 20:50	245.58
9/30/20 20:50	9/30/20 20:55	243.36
9/30/20 20:55	9/30/20 21:00	242.70
9/30/20 21:00	9/30/20 21:05	242.62
9/30/20 21:05	9/30/20 21:10	242.82
9/30/20 21:10	9/30/20 21:15	242.82
9/30/20 21:15	9/30/20 21:20	242.80
9/30/20 21:20	9/30/20 21:25	243.00
9/30/20 21:25	9/30/20 21:30	242.76
9/30/20 21:30	9/30/20 21:35	243.27
9/30/20 21:35	9/30/20 21:40	243.07
9/30/20 21:40	9/30/20 21:45	243.10
9/30/20 21:45	9/30/20 21:50	243.27
9/30/20 21:50	9/30/20 21:55	243.07
9/30/20 21:55	9/30/20 22:00	243.33
9/30/20 22:00	9/30/20 22:05	243.12
9/30/20 22:05	9/30/20 22:10	243.33
9/30/20 22:10	9/30/20 22:15	243.19
9/30/20 22:15	9/30/20 22:20	243.56
9/30/20 22:20	9/30/20 22:25	243.54
9/30/20 22:25	9/30/20 22:30	243.72
9/30/20 22:30	9/30/20 22:35	243.69

TIT-3693E		5 min averages
	Outlet Water Blowdown Temp	°C
9/30/20 18:40	9/30/20 18:45	60.86
9/30/20 18:45	9/30/20 18:50	60.76
9/30/20 18:50	9/30/20 18:55	60.67
9/30/20 18:55	9/30/20 19:00	60.63
9/30/20 19:00	9/30/20 19:05	60.60
9/30/20 19:05	9/30/20 19:10	60.59
9/30/20 19:10	9/30/20 19:15	61.20
9/30/20 19:15	9/30/20 19:20	61.55
9/30/20 19:20	9/30/20 19:25	61.40
9/30/20 19:25	9/30/20 19:30	61.55
9/30/20 19:30	9/30/20 19:35	61.90
9/30/20 19:35	9/30/20 19:40	62.07
9/30/20 19:40	9/30/20 19:45	61.72
9/30/20 19:45	9/30/20 19:50	60.37
9/30/20 19:50	9/30/20 19:55	58.56
9/30/20 19:55	9/30/20 20:00	56.65
9/30/20 20:00	9/30/20 20:05	54.73
9/30/20 20:05	9/30/20 20:10	52.92
9/30/20 20:10	9/30/20 20:15	51.18
9/30/20 20:15	9/30/20 20:20	49.52
9/30/20 20:20	9/30/20 20:25	47.94
9/30/20 20:25	9/30/20 20:30	46.37
9/30/20 20:30	9/30/20 20:35	44.80
9/30/20 20:35	9/30/20 20:40	43.28
9/30/20 20:40	9/30/20 20:45	41.94
9/30/20 20:45	9/30/20 20:50	40.77
9/30/20 20:50	9/30/20 20:55	52.75
9/30/20 20:55	9/30/20 21:00	60.51
9/30/20 21:00	9/30/20 21:05	60.71
9/30/20 21:05	9/30/20 21:10	60.73
9/30/20 21:10	9/30/20 21:15	60.74
9/30/20 21:15	9/30/20 21:20	60.72
9/30/20 21:20	9/30/20 21:25	60.72
9/30/20 21:25	9/30/20 21:30	60.72
9/30/20 21:30	9/30/20 21:35	60.74
9/30/20 21:35	9/30/20 21:40	60.75
9/30/20 21:40	9/30/20 21:45	60.76
9/30/20 21:45	9/30/20 21:50	60.75
9/30/20 21:50	9/30/20 21:55	60.75
9/30/20 21:55	9/30/20 22:00	60.80
9/30/20 22:00	9/30/20 22:05	60.75
9/30/20 22:05	9/30/20 22:10	60.73
9/30/20 22:10	9/30/20 22:15	60.75
9/30/20 22:15	9/30/20 22:20	60.80
9/30/20 22:20	9/30/20 22:25	60.82
9/30/20 22:25	9/30/20 22:30	60.83
9/30/20 22:30	9/30/20 22:35	60.85

TIT-3693F		5 min averages
	Scrubber Exhaust Temperature	°C
9/30/20 18:40	9/30/20 18:45	60.59
9/30/20 18:45	9/30/20 18:50	60.51
9/30/20 18:50	9/30/20 18:55	60.43
9/30/20 18:55	9/30/20 19:00	60.40
9/30/20 19:00	9/30/20 19:05	60.36
9/30/20 19:05	9/30/20 19:10	60.79
9/30/20 19:10	9/30/20 19:15	61.29
9/30/20 19:15	9/30/20 19:20	61.24
9/30/20 19:20	9/30/20 19:25	61.18
9/30/20 19:25	9/30/20 19:30	61.53
9/30/20 19:30	9/30/20 19:35	61.74
9/30/20 19:35	9/30/20 19:40	61.80
9/30/20 19:40	9/30/20 19:45	61.79
9/30/20 19:45	9/30/20 19:50	61.58
9/30/20 19:50	9/30/20 19:55	61.22
9/30/20 19:55	9/30/20 20:00	61.17
9/30/20 20:00	9/30/20 20:05	61.66
9/30/20 20:05	9/30/20 20:10	61.81
9/30/20 20:10	9/30/20 20:15	61.69
9/30/20 20:15	9/30/20 20:20	61.14
9/30/20 20:20	9/30/20 20:25	60.77
9/30/20 20:25	9/30/20 20:30	60.63
9/30/20 20:30	9/30/20 20:35	60.49
9/30/20 20:35	9/30/20 20:40	60.54
9/30/20 20:40	9/30/20 20:45	60.89
9/30/20 20:45	9/30/20 20:50	60.85
9/30/20 20:50	9/30/20 20:55	60.71
9/30/20 20:55	9/30/20 21:00	60.60
9/30/20 21:00	9/30/20 21:05	60.55
9/30/20 21:05	9/30/20 21:10	60.55
9/30/20 21:10	9/30/20 21:15	60.55
9/30/20 21:15	9/30/20 21:20	60.50
9/30/20 21:20	9/30/20 21:25	60.49
9/30/20 21:25	9/30/20 21:30	60.50
9/30/20 21:30	9/30/20 21:35	60.55
9/30/20 21:35	9/30/20 21:40	60.55
9/30/20 21:40	9/30/20 21:45	60.55
9/30/20 21:45	9/30/20 21:50	60.55
9/30/20 21:50	9/30/20 21:55	60.58
9/30/20 21:55	9/30/20 22:00	60.57
9/30/20 22:00	9/30/20 22:05	60.53
9/30/20 22:05	9/30/20 22:10	60.55
9/30/20 22:10	9/30/20 22:15	60.58
9/30/20 22:15	9/30/20 22:20	60.60
9/30/20 22:20	9/30/20 22:25	60.61
9/30/20 22:25	9/30/20 22:30	60.60
9/30/20 22:30	9/30/20 22:35	61.01

FIT-3693B		5 min averages	
	Caustic additive Flow to Scrubber	GPM	GPD
9/30/20 18:40	9/30/20 18:45	0.000	0.000
9/30/20 18:45	9/30/20 18:50	0.000	0.000
9/30/20 18:50	9/30/20 18:55	0.000	0.000
9/30/20 18:55	9/30/20 19:00	0.000	0.000
9/30/20 19:00	9/30/20 19:05	0.000	0.000
9/30/20 19:05	9/30/20 19:10	0.000	0.000
9/30/20 19:10	9/30/20 19:15	0.000	0.000
9/30/20 19:15	9/30/20 19:20	0.000	0.000
9/30/20 19:20	9/30/20 19:25	0.064	91.485
9/30/20 19:25	9/30/20 19:30	0.009	12.949
9/30/20 19:30	9/30/20 19:35	0.000	0.000
9/30/20 19:35	9/30/20 19:40	0.000	0.000
9/30/20 19:40	9/30/20 19:45	0.000	0.000
9/30/20 19:45	9/30/20 19:50	0.000	0.000
9/30/20 19:50	9/30/20 19:55	0.000	0.000
9/30/20 19:55	9/30/20 20:00	0.000	0.000
9/30/20 20:00	9/30/20 20:05	0.000	0.000
9/30/20 20:05	9/30/20 20:10	0.000	0.000
9/30/20 20:10	9/30/20 20:15	0.000	0.000
9/30/20 20:15	9/30/20 20:20	0.000	0.000
9/30/20 20:20	9/30/20 20:25	0.000	0.000
9/30/20 20:25	9/30/20 20:30	0.000	0.000
9/30/20 20:30	9/30/20 20:35	0.000	0.000
9/30/20 20:35	9/30/20 20:40	0.000	0.000
9/30/20 20:40	9/30/20 20:45	0.000	0.000
9/30/20 20:45	9/30/20 20:50	0.000	0.000
9/30/20 20:50	9/30/20 20:55	0.000	0.000
9/30/20 20:55	9/30/20 21:00	0.000	0.000
9/30/20 21:00	9/30/20 21:05	0.000	0.000
9/30/20 21:05	9/30/20 21:10	0.000	0.000
9/30/20 21:10	9/30/20 21:15	0.000	0.000
9/30/20 21:15	9/30/20 21:20	0.000	0.000
9/30/20 21:20	9/30/20 21:25	0.000	0.000
9/30/20 21:25	9/30/20 21:30	0.000	0.000
9/30/20 21:30	9/30/20 21:35	0.000	0.000
9/30/20 21:35	9/30/20 21:40	0.000	0.000
9/30/20 21:40	9/30/20 21:45	0.060	86.592
9/30/20 21:45	9/30/20 21:50	0.002	2.810
9/30/20 21:50	9/30/20 21:55	0.000	0.000
9/30/20 21:55	9/30/20 22:00	0.000	0.000
9/30/20 22:00	9/30/20 22:05	0.000	0.000
9/30/20 22:05	9/30/20 22:10	0.000	0.000
9/30/20 22:10	9/30/20 22:15	0.000	0.000
9/30/20 22:15	9/30/20 22:20	0.072	103.572
9/30/20 22:20	9/30/20 22:25	0.000	0.000
9/30/20 22:25	9/30/20 22:30	0.000	0.000
9/30/20 22:30	9/30/20 22:35	0.000	0.000

	FIT-3693C	5 min averages
	Scrubber Flow	GPM
9/30/20 22:35	9/30/20 22:40	243.71
9/30/20 22:40	9/30/20 22:45	243.90
9/30/20 22:45	9/30/20 22:50	243.72
9/30/20 22:50	9/30/20 22:55	243.68
9/30/20 22:55	9/30/20 23:00	243.34
9/30/20 23:00	9/30/20 23:05	243.30
9/30/20 23:05	9/30/20 23:10	243.22
9/30/20 23:10	9/30/20 23:15	243.24
9/30/20 23:15	9/30/20 23:20	242.97
9/30/20 23:20	9/30/20 23:25	242.79
9/30/20 23:25	9/30/20 23:30	242.65
9/30/20 23:30	9/30/20 23:35	242.83
9/30/20 23:35	9/30/20 23:40	242.69
9/30/20 23:40	9/30/20 23:45	245.31
9/30/20 23:45	9/30/20 23:50	245.29
9/30/20 23:50	9/30/20 23:55	245.44
9/30/20 23:55	10/1/20 0:00	245.42

	TIT-3693E	5 min averages
	Outlet Water Blowdown Temp	°C
9/30/20 22:35	9/30/20 22:40	61.36
9/30/20 22:40	9/30/20 22:45	61.69
9/30/20 22:45	9/30/20 22:50	61.60
9/30/20 22:50	9/30/20 22:55	61.49
9/30/20 22:55	9/30/20 23:00	61.89
9/30/20 23:00	9/30/20 23:05	62.17
9/30/20 23:05	9/30/20 23:10	62.31
9/30/20 23:10	9/30/20 23:15	62.25
9/30/20 23:15	9/30/20 23:20	61.99
9/30/20 23:20	9/30/20 23:25	61.64
9/30/20 23:25	9/30/20 23:30	61.41
9/30/20 23:30	9/30/20 23:35	61.28
9/30/20 23:35	9/30/20 23:40	61.46
9/30/20 23:40	9/30/20 23:45	61.36
9/30/20 23:45	9/30/20 23:50	59.84
9/30/20 23:50	9/30/20 23:55	57.95
9/30/20 23:55	10/1/20 0:00	55.98

	TIT-3693F	5 min averages
	Scrubber Exhaust Temperature	°C
9/30/20 22:35	9/30/20 22:40	61.44
9/30/20 22:40	9/30/20 22:45	61.37
9/30/20 22:45	9/30/20 22:50	61.15
9/30/20 22:50	9/30/20 22:55	61.53
9/30/20 22:55	9/30/20 23:00	61.81
9/30/20 23:00	9/30/20 23:05	61.95
9/30/20 23:05	9/30/20 23:10	61.99
9/30/20 23:10	9/30/20 23:15	61.80
9/30/20 23:15	9/30/20 23:20	61.45
9/30/20 23:20	9/30/20 23:25	61.16
9/30/20 23:25	9/30/20 23:30	61.01
9/30/20 23:30	9/30/20 23:35	60.96
9/30/20 23:35	9/30/20 23:40	61.55
9/30/20 23:40	9/30/20 23:45	61.75
9/30/20 23:45	9/30/20 23:50	61.53
9/30/20 23:50	9/30/20 23:55	61.23
9/30/20 23:55	10/1/20 0:00	61.02

	FIT-3693B	5 min averages	
	Caustic additive Flow to Scrubber	GPM	GPD
9/30/20 22:35	9/30/20 22:40	0.000	0.000
9/30/20 22:40	9/30/20 22:45	0.000	0.000
9/30/20 22:45	9/30/20 22:50	0.000	0.000
9/30/20 22:50	9/30/20 22:55	0.000	0.000
9/30/20 22:55	9/30/20 23:00	0.000	0.000
9/30/20 23:00	9/30/20 23:05	0.000	0.000
9/30/20 23:05	9/30/20 23:10	0.000	0.000
9/30/20 23:10	9/30/20 23:15	0.000	0.000
9/30/20 23:15	9/30/20 23:20	0.000	0.000
9/30/20 23:20	9/30/20 23:25	0.000	0.000
9/30/20 23:25	9/30/20 23:30	0.000	0.000
9/30/20 23:30	9/30/20 23:35	0.000	0.000
9/30/20 23:35	9/30/20 23:40	0.000	0.000
9/30/20 23:40	9/30/20 23:45	0.000	0.000
9/30/20 23:45	9/30/20 23:50	0.000	0.000
9/30/20 23:50	9/30/20 23:55	0.000	0.000
9/30/20 23:55	10/1/20 0:00	0.000	0.000

	PIT-3693E Scrubber Top Pressure (for pressure drop calc)	5 min averages "WC		PIT-3693F Scrubber Bottom Pressure (for pressure drop calc)	5 min averages "WC		Scrubber Pressure Drop (calculated)	"WC
9/29/20 11:20	9/29/20 11:25	-11.2	9/29/20 11:20	9/29/20 11:25	-7.70	9/29/20 11:20	9/29/20 11:25	3.49
9/29/20 11:25	9/29/20 11:30	-11.2	9/29/20 11:25	9/29/20 11:30	-7.72	9/29/20 11:25	9/29/20 11:30	3.51
9/29/20 11:30	9/29/20 11:35	-11.2	9/29/20 11:30	9/29/20 11:35	-7.71	9/29/20 11:30	9/29/20 11:35	3.48
9/29/20 11:35	9/29/20 11:40	-11.1	9/29/20 11:35	9/29/20 11:40	-7.73	9/29/20 11:35	9/29/20 11:40	3.34
9/29/20 11:40	9/29/20 11:45	-10.8	9/29/20 11:40	9/29/20 11:45	-7.63	9/29/20 11:40	9/29/20 11:45	3.20
9/29/20 11:45	9/29/20 11:50	-10.7	9/29/20 11:45	9/29/20 11:50	-7.63	9/29/20 11:45	9/29/20 11:50	3.09
9/29/20 11:50	9/29/20 11:55	-10.5	9/29/20 11:50	9/29/20 11:55	-7.50	9/29/20 11:50	9/29/20 11:55	3.02
9/29/20 11:55	9/29/20 12:00	-10.6	9/29/20 11:55	9/29/20 12:00	-7.55	9/29/20 11:55	9/29/20 12:00	3.07
9/29/20 12:00	9/29/20 12:05	-10.7	9/29/20 12:00	9/29/20 12:05	-7.59	9/29/20 12:00	9/29/20 12:05	3.12
9/29/20 12:05	9/29/20 12:10	-10.8	9/29/20 12:05	9/29/20 12:10	-7.55	9/29/20 12:05	9/29/20 12:10	3.23
9/29/20 12:10	9/29/20 12:15	-10.8	9/29/20 12:10	9/29/20 12:15	-7.58	9/29/20 12:10	9/29/20 12:15	3.19
9/29/20 12:15	9/29/20 12:20	-10.8	9/29/20 12:15	9/29/20 12:20	-7.60	9/29/20 12:15	9/29/20 12:20	3.19
9/29/20 12:20	9/29/20 12:25	-10.8	9/29/20 12:20	9/29/20 12:25	-7.56	9/29/20 12:20	9/29/20 12:25	3.22
9/29/20 12:25	9/29/20 12:30	-10.7	9/29/20 12:25	9/29/20 12:30	-7.54	9/29/20 12:25	9/29/20 12:30	3.18
9/29/20 12:30	9/29/20 12:35	-10.7	9/29/20 12:30	9/29/20 12:35	-7.56	9/29/20 12:30	9/29/20 12:35	3.18
9/29/20 12:35	9/29/20 12:40	-10.8	9/29/20 12:35	9/29/20 12:40	-7.55	9/29/20 12:35	9/29/20 12:40	3.24
9/29/20 12:40	9/29/20 12:45	-10.8	9/29/20 12:40	9/29/20 12:45	-7.60	9/29/20 12:40	9/29/20 12:45	3.24
9/29/20 12:45	9/29/20 12:50	-10.8	9/29/20 12:45	9/29/20 12:50	-7.57	9/29/20 12:45	9/29/20 12:50	3.20
9/29/20 12:50	9/29/20 12:55	-10.9	9/29/20 12:50	9/29/20 12:55	-7.63	9/29/20 12:50	9/29/20 12:55	3.27
9/29/20 12:55	9/29/20 13:00	-10.9	9/29/20 12:55	9/29/20 13:00	-7.64	9/29/20 12:55	9/29/20 13:00	3.21
9/29/20 13:00	9/29/20 13:05	-10.9	9/29/20 13:00	9/29/20 13:05	-7.62	9/29/20 13:00	9/29/20 13:05	3.28
9/29/20 13:05	9/29/20 13:10	-11.0	9/29/20 13:05	9/29/20 13:10	-7.63	9/29/20 13:05	9/29/20 13:10	3.33
9/29/20 13:10	9/29/20 13:15	-10.9	9/29/20 13:10	9/29/20 13:15	-7.73	9/29/20 13:10	9/29/20 13:15	3.20
9/29/20 13:15	9/29/20 13:20	-10.9	9/29/20 13:15	9/29/20 13:20	-7.74	9/29/20 13:15	9/29/20 13:20	3.18
9/29/20 13:20	9/29/20 13:25	-10.9	9/29/20 13:20	9/29/20 13:25	-7.70	9/29/20 13:20	9/29/20 13:25	3.22
9/29/20 13:25	9/29/20 13:30	-10.9	9/29/20 13:25	9/29/20 13:30	-7.70	9/29/20 13:25	9/29/20 13:30	3.20
9/29/20 13:30	9/29/20 13:35	-10.9	9/29/20 13:30	9/29/20 13:35	-7.72	9/29/20 13:30	9/29/20 13:35	3.21
9/29/20 13:35	9/29/20 13:40	-10.9	9/29/20 13:35	9/29/20 13:40	-7.69	9/29/20 13:35	9/29/20 13:40	3.19
9/29/20 13:40	9/29/20 13:45	-10.9	9/29/20 13:40	9/29/20 13:45	-7.68	9/29/20 13:40	9/29/20 13:45	3.22
9/29/20 13:45	9/29/20 13:50	-10.8	9/29/20 13:45	9/29/20 13:50	-7.66	9/29/20 13:45	9/29/20 13:50	3.18
9/29/20 13:50	9/29/20 13:55	-10.9	9/29/20 13:50	9/29/20 13:55	-7.60	9/29/20 13:50	9/29/20 13:55	3.28
9/29/20 13:55	9/29/20 14:00	-11.0	9/29/20 13:55	9/29/20 14:00	-7.62	9/29/20 13:55	9/29/20 14:00	3.33
9/29/20 14:00	9/29/20 14:05	-11.0	9/29/20 14:00	9/29/20 14:05	-7.63	9/29/20 14:00	9/29/20 14:05	3.38
9/29/20 14:05	9/29/20 14:10	-10.9	9/29/20 14:05	9/29/20 14:10	-7.65	9/29/20 14:05	9/29/20 14:10	3.28
9/29/20 14:10	9/29/20 14:15	-11.0	9/29/20 14:10	9/29/20 14:15	-7.64	9/29/20 14:10	9/29/20 14:15	3.35
9/29/20 14:15	9/29/20 14:20	-11.0	9/29/20 14:15	9/29/20 14:20	-7.66	9/29/20 14:15	9/29/20 14:20	3.33
9/29/20 14:20	9/29/20 14:25	-11.0	9/29/20 14:20	9/29/20 14:25	-7.71	9/29/20 14:20	9/29/20 14:25	3.33
9/29/20 14:25	9/29/20 14:30	-11.0	9/29/20 14:25	9/29/20 14:30	-7.69	9/29/20 14:25	9/29/20 14:30	3.33
9/29/20 14:30	9/29/20 14:35	-11.0	9/29/20 14:30	9/29/20 14:35	-7.66	9/29/20 14:30	9/29/20 14:35	3.36
9/29/20 14:35	9/29/20 14:40	-11.0	9/29/20 14:35	9/29/20 14:40	-7.69	9/29/20 14:35	9/29/20 14:40	3.32
9/29/20 14:40	9/29/20 14:45	-11.0	9/29/20 14:40	9/29/20 14:45	-7.72	9/29/20 14:40	9/29/20 14:45	3.26
9/29/20 14:45	9/29/20 14:50	-11.0	9/29/20 14:45	9/29/20 14:50	-7.64	9/29/20 14:45	9/29/20 14:50	3.36
9/29/20 14:50	9/29/20 14:55	-11.0	9/29/20 14:50	9/29/20 14:55	-7.68	9/29/20 14:50	9/29/20 14:55	3.33
9/29/20 14:55	9/29/20 15:00	-11.0	9/29/20 14:55	9/29/20 15:00	-7.69	9/29/20 14:55	9/29/20 15:00	3.32
9/29/20 15:00	9/29/20 15:05	-11.2	9/29/20 15:00	9/29/20 15:05	-7.65	9/29/20 15:00	9/29/20 15:05	3.53
9/29/20 15:05	9/29/20 15:10	-11.5	9/29/20 15:05	9/29/20 15:10	-7.82	9/29/20 15:05	9/29/20 15:10	3.69
9/29/20 15:10	9/29/20 15:15	-11.5	9/29/20 15:10	9/29/20 15:15	-7.86	9/29/20 15:10	9/29/20 15:15	3.68

	PIT-3693E Scrubber Top Pressure (for pressure drop calc)	5 min averages "WC
9/29/20 15:15	9/29/20 15:20	-11.4
9/29/20 15:20	9/29/20 15:25	-11.3
9/29/20 15:25	9/29/20 15:30	-11.3
9/29/20 15:30	9/29/20 15:35	-11.2
9/29/20 15:35	9/29/20 15:40	-11.1
9/29/20 15:40	9/29/20 15:45	-11.1
9/29/20 15:45	9/29/20 15:50	-11.1
9/29/20 15:50	9/29/20 15:55	-11.1
9/29/20 15:55	9/29/20 16:00	-11.1
9/29/20 16:00	9/29/20 16:05	-11.1
9/29/20 16:05	9/29/20 16:10	-11.1
9/29/20 16:10	9/29/20 16:15	-11.1
9/29/20 16:15	9/29/20 16:20	-11.1
9/29/20 16:20	9/29/20 16:25	-10.9
9/29/20 16:25	9/29/20 16:30	-10.9
9/29/20 16:30	9/29/20 16:35	-10.8
9/29/20 16:35	9/29/20 16:40	-10.9
9/29/20 16:40	9/29/20 16:45	-10.8
9/29/20 16:45	9/29/20 16:50	-10.9
9/29/20 16:50	9/29/20 16:55	-10.9
9/29/20 16:55	9/29/20 17:00	-10.8
9/29/20 17:00	9/29/20 17:05	-10.8
9/29/20 17:05	9/29/20 17:10	-10.8
9/29/20 17:10	9/29/20 17:15	-10.8
9/29/20 17:15	9/29/20 17:20	-10.8
9/29/20 17:20	9/29/20 17:25	-10.9
9/29/20 17:25	9/29/20 17:30	-10.8
9/29/20 17:30	9/29/20 17:35	-10.8
9/29/20 17:35	9/29/20 17:40	-10.8
9/29/20 17:40	9/29/20 17:45	-10.8
9/29/20 17:45	9/29/20 17:50	-10.7
9/29/20 17:50	9/29/20 17:55	-10.7
9/29/20 17:55	9/29/20 18:00	-10.7
9/29/20 18:00	9/29/20 18:05	-10.9
9/29/20 18:05	9/29/20 18:10	-11.1
9/29/20 18:10	9/29/20 18:15	-10.8
9/29/20 18:15	9/29/20 18:20	-10.8
9/29/20 18:20	9/29/20 18:25	-10.8
9/29/20 18:25	9/29/20 18:30	-10.8
9/29/20 18:30	9/29/20 18:35	-10.8
9/29/20 18:35	9/29/20 18:40	-10.7
9/29/20 18:40	9/29/20 18:45	-10.8
9/29/20 18:45	9/29/20 18:50	-10.7
9/29/20 18:50	9/29/20 18:55	-10.8
9/29/20 18:55	9/29/20 19:00	-10.7
9/29/20 19:00	9/29/20 19:05	-10.7
9/29/20 19:05	9/29/20 19:10	-10.7

	PIT-3693F Scrubber Bottom Pressure (for pressure drop calc)	5 min averages "WC
9/29/20 15:15	9/29/20 15:20	-7.81
9/29/20 15:20	9/29/20 15:25	-7.80
9/29/20 15:25	9/29/20 15:30	-7.75
9/29/20 15:30	9/29/20 15:35	-7.77
9/29/20 15:35	9/29/20 15:40	-7.73
9/29/20 15:40	9/29/20 15:45	-7.80
9/29/20 15:45	9/29/20 15:50	-7.80
9/29/20 15:50	9/29/20 15:55	-7.86
9/29/20 15:55	9/29/20 16:00	-7.80
9/29/20 16:00	9/29/20 16:05	-7.77
9/29/20 16:05	9/29/20 16:10	-7.79
9/29/20 16:10	9/29/20 16:15	-7.80
9/29/20 16:15	9/29/20 16:20	-7.82
9/29/20 16:20	9/29/20 16:25	-7.73
9/29/20 16:25	9/29/20 16:30	-7.68
9/29/20 16:30	9/29/20 16:35	-7.69
9/29/20 16:35	9/29/20 16:40	-7.69
9/29/20 16:40	9/29/20 16:45	-7.67
9/29/20 16:45	9/29/20 16:50	-7.64
9/29/20 16:50	9/29/20 16:55	-7.70
9/29/20 16:55	9/29/20 17:00	-7.72
9/29/20 17:00	9/29/20 17:05	-7.70
9/29/20 17:05	9/29/20 17:10	-7.66
9/29/20 17:10	9/29/20 17:15	-7.70
9/29/20 17:15	9/29/20 17:20	-7.70
9/29/20 17:20	9/29/20 17:25	-7.67
9/29/20 17:25	9/29/20 17:30	-7.69
9/29/20 17:30	9/29/20 17:35	-7.72
9/29/20 17:35	9/29/20 17:40	-7.69
9/29/20 17:40	9/29/20 17:45	-7.68
9/29/20 17:45	9/29/20 17:50	-7.65
9/29/20 17:50	9/29/20 17:55	-7.69
9/29/20 17:55	9/29/20 18:00	-7.67
9/29/20 18:00	9/29/20 18:05	-7.61
9/29/20 18:05	9/29/20 18:10	-7.76
9/29/20 18:10	9/29/20 18:15	-7.70
9/29/20 18:15	9/29/20 18:20	-7.69
9/29/20 18:20	9/29/20 18:25	-7.70
9/29/20 18:25	9/29/20 18:30	-7.69
9/29/20 18:30	9/29/20 18:35	-7.68
9/29/20 18:35	9/29/20 18:40	-7.70
9/29/20 18:40	9/29/20 18:45	-7.68
9/29/20 18:45	9/29/20 18:50	-7.67
9/29/20 18:50	9/29/20 18:55	-7.72
9/29/20 18:55	9/29/20 19:00	-7.73
9/29/20 19:00	9/29/20 19:05	-7.68
9/29/20 19:05	9/29/20 19:10	-7.67

	Scrubber Pressure Drop (calculated)	"WC
9/29/20 15:15	9/29/20 15:20	3.57
9/29/20 15:20	9/29/20 15:25	3.54
9/29/20 15:25	9/29/20 15:30	3.51
9/29/20 15:30	9/29/20 15:35	3.39
9/29/20 15:35	9/29/20 15:40	3.33
9/29/20 15:40	9/29/20 15:45	3.25
9/29/20 15:45	9/29/20 15:50	3.35
9/29/20 15:50	9/29/20 15:55	3.27
9/29/20 15:55	9/29/20 16:00	3.29
9/29/20 16:00	9/29/20 16:05	3.30
9/29/20 16:05	9/29/20 16:10	3.28
9/29/20 16:10	9/29/20 16:15	3.28
9/29/20 16:15	9/29/20 16:20	3.24
9/29/20 16:20	9/29/20 16:25	3.22
9/29/20 16:25	9/29/20 16:30	3.23
9/29/20 16:30	9/29/20 16:35	3.14
9/29/20 16:35	9/29/20 16:40	3.17
9/29/20 16:40	9/29/20 16:45	3.15
9/29/20 16:45	9/29/20 16:50	3.23
9/29/20 16:50	9/29/20 16:55	3.21
9/29/20 16:55	9/29/20 17:00	3.11
9/29/20 17:00	9/29/20 17:05	3.15
9/29/20 17:05	9/29/20 17:10	3.17
9/29/20 17:10	9/29/20 17:15	3.14
9/29/20 17:15	9/29/20 17:20	3.11
9/29/20 17:20	9/29/20 17:25	3.18
9/29/20 17:25	9/29/20 17:30	3.15
9/29/20 17:30	9/29/20 17:35	3.07
9/29/20 17:35	9/29/20 17:40	3.08
9/29/20 17:40	9/29/20 17:45	3.11
9/29/20 17:45	9/29/20 17:50	3.10
9/29/20 17:50	9/29/20 17:55	3.03
9/29/20 17:55	9/29/20 18:00	3.07
9/29/20 18:00	9/29/20 18:05	3.30
9/29/20 18:05	9/29/20 18:10	3.35
9/29/20 18:10	9/29/20 18:15	3.08
9/29/20 18:15	9/29/20 18:20	3.10
9/29/20 18:20	9/29/20 18:25	3.12
9/29/20 18:25	9/29/20 18:30	3.07
9/29/20 18:30	9/29/20 18:35	3.11
9/29/20 18:35	9/29/20 18:40	3.01
9/29/20 18:40	9/29/20 18:45	3.08
9/29/20 18:45	9/29/20 18:50	3.07
9/29/20 18:50	9/29/20 18:55	3.07
9/29/20 18:55	9/29/20 19:00	3.00
9/29/20 19:00	9/29/20 19:05	3.01
9/29/20 19:05	9/29/20 19:10	3.00

	PIT-3693E Scrubber Top Pressure (for pressure drop calc)	5 min averages "WC		PIT-3693F Scrubber Bottom Pressure (for pressure drop calc)	5 min averages "WC		Scrubber Pressure Drop (calculated)	"WC
9/29/20 19:10	9/29/20 19:15	-10.8	9/29/20 19:10	9/29/20 19:15	-7.67	9/29/20 19:10	9/29/20 19:15	3.08
9/29/20 19:15	9/29/20 19:20	-10.7	9/29/20 19:15	9/29/20 19:20	-7.67	9/29/20 19:15	9/29/20 19:20	3.07
9/29/20 19:20	9/29/20 19:25	-10.7	9/29/20 19:20	9/29/20 19:25	-7.69	9/29/20 19:20	9/29/20 19:25	3.04
9/29/20 19:25	9/29/20 19:30	-10.7	9/29/20 19:25	9/29/20 19:30	-7.62	9/29/20 19:25	9/29/20 19:30	3.07
9/29/20 19:30	9/29/20 19:35	-11.0	9/29/20 19:30	9/29/20 19:35	-7.69	9/29/20 19:30	9/29/20 19:35	3.30
9/29/20 19:35	9/29/20 19:40	-11.1	9/29/20 19:35	9/29/20 19:40	-7.76	9/29/20 19:35	9/29/20 19:40	3.32
9/29/20 19:40	9/29/20 19:45	-11.0	9/29/20 19:40	9/29/20 19:45	-7.73	9/29/20 19:40	9/29/20 19:45	3.32
9/29/20 19:45	9/29/20 19:50	-11.0	9/29/20 19:45	9/29/20 19:50	-7.73	9/29/20 19:45	9/29/20 19:50	3.29
9/29/20 19:50	9/29/20 19:55	-11.0	9/29/20 19:50	9/29/20 19:55	-7.76	9/29/20 19:50	9/29/20 19:55	3.27
9/29/20 19:55	9/29/20 20:00	-11.1	9/29/20 19:55	9/29/20 20:00	-7.76	9/29/20 19:55	9/29/20 20:00	3.30
9/29/20 20:00	9/29/20 20:05	-11.1	9/29/20 20:00	9/29/20 20:05	-7.79	9/29/20 20:00	9/29/20 20:05	3.27
9/29/20 20:05	9/29/20 20:10	-11.0	9/29/20 20:05	9/29/20 20:10	-7.69	9/29/20 20:05	9/29/20 20:10	3.36
9/29/20 20:10	9/29/20 20:15	-11.0	9/29/20 20:10	9/29/20 20:15	-7.78	9/29/20 20:10	9/29/20 20:15	3.26
9/29/20 20:15	9/29/20 20:20	-11.0	9/29/20 20:15	9/29/20 20:20	-7.77	9/29/20 20:15	9/29/20 20:20	3.27
9/29/20 20:20	9/29/20 20:25	-11.0	9/29/20 20:20	9/29/20 20:25	-7.74	9/29/20 20:20	9/29/20 20:25	3.27
9/29/20 20:25	9/29/20 20:30	-11.0	9/29/20 20:25	9/29/20 20:30	-7.72	9/29/20 20:25	9/29/20 20:30	3.24
9/29/20 20:30	9/29/20 20:35	-11.0	9/29/20 20:30	9/29/20 20:35	-7.75	9/29/20 20:30	9/29/20 20:35	3.27
9/29/20 20:35	9/29/20 20:40	-11.0	9/29/20 20:35	9/29/20 20:40	-7.76	9/29/20 20:35	9/29/20 20:40	3.23
9/29/20 20:40	9/29/20 20:45	-11.1	9/29/20 20:40	9/29/20 20:45	-7.77	9/29/20 20:40	9/29/20 20:45	3.31
9/29/20 20:45	9/29/20 20:50	-11.0	9/29/20 20:45	9/29/20 20:50	-7.75	9/29/20 20:45	9/29/20 20:50	3.27
9/29/20 20:50	9/29/20 20:55	-11.0	9/29/20 20:50	9/29/20 20:55	-7.77	9/29/20 20:50	9/29/20 20:55	3.23
9/29/20 20:55	9/29/20 21:00	-11.0	9/29/20 20:55	9/29/20 21:00	-7.73	9/29/20 20:55	9/29/20 21:00	3.28
9/29/20 21:00	9/29/20 21:05	-11.0	9/29/20 21:00	9/29/20 21:05	-7.75	9/29/20 21:00	9/29/20 21:05	3.30
9/29/20 21:05	9/29/20 21:10	-11.0	9/29/20 21:05	9/29/20 21:10	-7.73	9/29/20 21:05	9/29/20 21:10	3.29
9/29/20 21:10	9/29/20 21:15	-11.0	9/29/20 21:10	9/29/20 21:15	-7.76	9/29/20 21:10	9/29/20 21:15	3.27
9/29/20 21:15	9/29/20 21:20	-11.0	9/29/20 21:15	9/29/20 21:20	-7.77	9/29/20 21:15	9/29/20 21:20	3.27
9/29/20 21:20	9/29/20 21:25	-11.0	9/29/20 21:20	9/29/20 21:25	-7.77	9/29/20 21:20	9/29/20 21:25	3.26
9/29/20 21:25	9/29/20 21:30	-11.0	9/29/20 21:25	9/29/20 21:30	-7.75	9/29/20 21:25	9/29/20 21:30	3.25
9/29/20 21:30	9/29/20 21:35	-11.0	9/29/20 21:30	9/29/20 21:35	-7.75	9/29/20 21:30	9/29/20 21:35	3.25
9/29/20 21:35	9/29/20 21:40	-11.0	9/29/20 21:35	9/29/20 21:40	-7.78	9/29/20 21:35	9/29/20 21:40	3.23
9/29/20 21:40	9/29/20 21:45	-11.0	9/29/20 21:40	9/29/20 21:45	-7.79	9/29/20 21:40	9/29/20 21:45	3.26
9/29/20 21:45	9/29/20 21:50	-11.0	9/29/20 21:45	9/29/20 21:50	-7.75	9/29/20 21:45	9/29/20 21:50	3.28
9/29/20 21:50	9/29/20 21:55	-11.0	9/29/20 21:50	9/29/20 21:55	-7.75	9/29/20 21:50	9/29/20 21:55	3.29
9/29/20 21:55	9/29/20 22:00	-11.0	9/29/20 21:55	9/29/20 22:00	-7.75	9/29/20 21:55	9/29/20 22:00	3.23
9/29/20 22:00	9/29/20 22:05	-11.1	9/29/20 22:00	9/29/20 22:05	-7.79	9/29/20 22:00	9/29/20 22:05	3.29
9/29/20 22:05	9/29/20 22:10	-11.0	9/29/20 22:05	9/29/20 22:10	-7.71	9/29/20 22:05	9/29/20 22:10	3.31
9/29/20 22:10	9/29/20 22:15	-11.0	9/29/20 22:10	9/29/20 22:15	-7.79	9/29/20 22:10	9/29/20 22:15	3.18
9/29/20 22:15	9/29/20 22:20	-10.9	9/29/20 22:15	9/29/20 22:20	-7.78	9/29/20 22:15	9/29/20 22:20	3.12
9/29/20 22:20	9/29/20 22:25	-10.9	9/29/20 22:20	9/29/20 22:25	-7.74	9/29/20 22:20	9/29/20 22:25	3.18
9/29/20 22:25	9/29/20 22:30	-11.0	9/29/20 22:25	9/29/20 22:30	-7.76	9/29/20 22:25	9/29/20 22:30	3.29
9/29/20 22:30	9/29/20 22:35	-11.1	9/29/20 22:30	9/29/20 22:35	-7.79	9/29/20 22:30	9/29/20 22:35	3.33
9/29/20 22:35	9/29/20 22:40	-11.1	9/29/20 22:35	9/29/20 22:40	-7.83	9/29/20 22:35	9/29/20 22:40	3.28
9/29/20 22:40	9/29/20 22:45	-11.2	9/29/20 22:40	9/29/20 22:45	-7.82	9/29/20 22:40	9/29/20 22:45	3.37
9/29/20 22:45	9/29/20 22:50	-11.2	9/29/20 22:45	9/29/20 22:50	-7.81	9/29/20 22:45	9/29/20 22:50	3.34
9/29/20 22:50	9/29/20 22:55	-11.2	9/29/20 22:50	9/29/20 22:55	-7.86	9/29/20 22:50	9/29/20 22:55	3.33
9/29/20 22:55	9/29/20 23:00	-11.3	9/29/20 22:55	9/29/20 23:00	-7.93	9/29/20 22:55	9/29/20 23:00	3.40
9/29/20 23:00	9/29/20 23:05	-11.4	9/29/20 23:00	9/29/20 23:05	-7.99	9/29/20 23:00	9/29/20 23:05	3.40

	PIT-3693E Scrubber Top Pressure (for pressure drop calc)	5 min averages "WC		PIT-3693F Scrubber Bottom Pressure (for pressure drop calc)	5 min averages "WC		**Scrubber Pressure Drop (calculated)**	"WC
9/29/20 23:05	9/29/20 23:10	-11.0	9/29/20 23:05	9/29/20 23:10	-7.73	9/29/20 23:05	9/29/20 23:10	3.31
9/29/20 23:10	9/29/20 23:15	-0.5	9/29/20 23:10	9/29/20 23:15	-0.39	9/29/20 23:10	9/29/20 23:15	0.15
9/29/20 23:15	9/29/20 23:20	-0.1	9/29/20 23:15	9/29/20 23:20	0.06	9/29/20 23:15	9/29/20 23:20	0.18
9/29/20 23:20	9/29/20 23:25	-0.1	9/29/20 23:20	9/29/20 23:25	0.26	9/29/20 23:20	9/29/20 23:25	0.40
9/29/20 23:25	9/29/20 23:30	-0.2	9/29/20 23:25	9/29/20 23:30	0.26	9/29/20 23:25	9/29/20 23:30	0.41
9/29/20 23:30	9/29/20 23:35	-0.2	9/29/20 23:30	9/29/20 23:35	0.26	9/29/20 23:30	9/29/20 23:35	0.43
9/29/20 23:35	9/29/20 23:40	-0.2	9/29/20 23:35	9/29/20 23:40	0.26	9/29/20 23:35	9/29/20 23:40	0.45
9/29/20 23:40	9/29/20 23:45	-0.2	9/29/20 23:40	9/29/20 23:45	0.26	9/29/20 23:40	9/29/20 23:45	0.46
9/29/20 23:45	9/29/20 23:50	-0.2	9/29/20 23:45	9/29/20 23:50	0.26	9/29/20 23:45	9/29/20 23:50	0.49
9/29/20 23:50	9/29/20 23:55	-0.2	9/29/20 23:50	9/29/20 23:55	0.26	9/29/20 23:50	9/29/20 23:55	0.50
9/29/20 23:55	9/30/20 0:00	-0.3	9/29/20 23:55	9/30/20 0:00	0.26	9/29/20 23:55	9/30/20 0:00	0.51
9/30/20 0:00	9/30/20 0:05	-0.3	9/30/20 0:00	9/30/20 0:05	0.26	9/30/20 0:00	9/30/20 0:05	0.53
9/30/20 0:05	9/30/20 0:10	-0.3	9/30/20 0:05	9/30/20 0:10	0.26	9/30/20 0:05	9/30/20 0:10	0.54
9/30/20 0:10	9/30/20 0:15	-0.3	9/30/20 0:10	9/30/20 0:15	0.26	9/30/20 0:10	9/30/20 0:15	0.56
9/30/20 0:15	9/30/20 0:20	-0.3	9/30/20 0:15	9/30/20 0:20	0.26	9/30/20 0:15	9/30/20 0:20	0.57
9/30/20 0:20	9/30/20 0:25	-0.3	9/30/20 0:20	9/30/20 0:25	0.26	9/30/20 0:20	9/30/20 0:25	0.57
9/30/20 0:25	9/30/20 0:30	-0.3	9/30/20 0:25	9/30/20 0:30	0.26	9/30/20 0:25	9/30/20 0:30	0.58
9/30/20 0:30	9/30/20 0:35	-0.3	9/30/20 0:30	9/30/20 0:35	0.26	9/30/20 0:30	9/30/20 0:35	0.59
9/30/20 0:35	9/30/20 0:40	-0.3	9/30/20 0:35	9/30/20 0:40	0.08	9/30/20 0:35	9/30/20 0:40	0.41
9/30/20 0:40	9/30/20 0:45	-0.4	9/30/20 0:40	9/30/20 0:45	-0.08	9/30/20 0:40	9/30/20 0:45	0.28
9/30/20 0:45	9/30/20 0:50	-0.4	9/30/20 0:45	9/30/20 0:50	-0.09	9/30/20 0:45	9/30/20 0:50	0.27
9/30/20 0:50	9/30/20 0:55	-0.4	9/30/20 0:50	9/30/20 0:55	-0.10	9/30/20 0:50	9/30/20 0:55	0.27
9/30/20 0:55	9/30/20 1:00	-0.4	9/30/20 0:55	9/30/20 1:00	-0.10	9/30/20 0:55	9/30/20 1:00	0.26
9/30/20 1:00	9/30/20 1:05	-0.4	9/30/20 1:00	9/30/20 1:05	-0.11	9/30/20 1:00	9/30/20 1:05	0.27
9/30/20 1:05	9/30/20 1:10	-0.4	9/30/20 1:05	9/30/20 1:10	-0.12	9/30/20 1:05	9/30/20 1:10	0.27
9/30/20 1:10	9/30/20 1:15	-0.4	9/30/20 1:10	9/30/20 1:15	-0.13	9/30/20 1:10	9/30/20 1:15	0.27
9/30/20 1:15	9/30/20 1:20	-0.4	9/30/20 1:15	9/30/20 1:20	-0.12	9/30/20 1:15	9/30/20 1:20	0.27
9/30/20 1:20	9/30/20 1:25	-0.4	9/30/20 1:20	9/30/20 1:25	-0.13	9/30/20 1:20	9/30/20 1:25	0.27
9/30/20 1:25	9/30/20 1:30	-0.4	9/30/20 1:25	9/30/20 1:30	-0.14	9/30/20 1:25	9/30/20 1:30	0.28
9/30/20 1:30	9/30/20 1:35	-0.4	9/30/20 1:30	9/30/20 1:35	-0.15	9/30/20 1:30	9/30/20 1:35	0.27
9/30/20 1:35	9/30/20 1:40	-0.4	9/30/20 1:35	9/30/20 1:40	-0.15	9/30/20 1:35	9/30/20 1:40	0.27
9/30/20 1:40	9/30/20 1:45	-0.4	9/30/20 1:40	9/30/20 1:45	-0.16	9/30/20 1:40	9/30/20 1:45	0.26
9/30/20 1:45	9/30/20 1:50	-0.4	9/30/20 1:45	9/30/20 1:50	-0.16	9/30/20 1:45	9/30/20 1:50	0.27
9/30/20 1:50	9/30/20 1:55	-0.4	9/30/20 1:50	9/30/20 1:55	-0.17	9/30/20 1:50	9/30/20 1:55	0.27
9/30/20 1:55	9/30/20 2:00	-0.4	9/30/20 1:55	9/30/20 2:00	-0.16	9/30/20 1:55	9/30/20 2:00	0.27
9/30/20 2:00	9/30/20 2:05	-0.4	9/30/20 2:00	9/30/20 2:05	-0.18	9/30/20 2:00	9/30/20 2:05	0.26
9/30/20 2:05	9/30/20 2:10	-0.4	9/30/20 2:05	9/30/20 2:10	-0.18	9/30/20 2:05	9/30/20 2:10	0.27
9/30/20 2:10	9/30/20 2:15	-0.5	9/30/20 2:10	9/30/20 2:15	-0.19	9/30/20 2:10	9/30/20 2:15	0.27
9/30/20 2:15	9/30/20 2:20	-0.4	9/30/20 2:15	9/30/20 2:20	-0.19	9/30/20 2:15	9/30/20 2:20	0.26
9/30/20 2:20	9/30/20 2:25	-0.5	9/30/20 2:20	9/30/20 2:25	-0.19	9/30/20 2:20	9/30/20 2:25	0.27
9/30/20 2:25	9/30/20 2:30	-0.5	9/30/20 2:25	9/30/20 2:30	-0.20	9/30/20 2:25	9/30/20 2:30	0.26
9/30/20 2:30	9/30/20 2:35	-0.5	9/30/20 2:30	9/30/20 2:35	-0.21	9/30/20 2:30	9/30/20 2:35	0.26
9/30/20 2:35	9/30/20 2:40	-0.5	9/30/20 2:35	9/30/20 2:40	-0.21	9/30/20 2:35	9/30/20 2:40	0.26
9/30/20 2:40	9/30/20 2:45	-0.5	9/30/20 2:40	9/30/20 2:45	-0.21	9/30/20 2:40	9/30/20 2:45	0.26
9/30/20 2:45	9/30/20 2:50	-0.5	9/30/20 2:45	9/30/20 2:50	-0.22	9/30/20 2:45	9/30/20 2:50	0.25
9/30/20 2:50	9/30/20 2:55	-0.5	9/30/20 2:50	9/30/20 2:55	-0.22	9/30/20 2:50	9/30/20 2:55	0.25
9/30/20 2:55	9/30/20 3:00	-0.5	9/30/20 2:55	9/30/20 3:00	-0.22	9/30/20 2:55	9/30/20 3:00	0.25

	PIT-3693E Scrubber Top Pressure (for pressure drop calc)	5 min averages "WC		PIT-3693F Scrubber Bottom Pressure (for pressure drop calc)	5 min averages "WC		Scrubber Pressure Drop (calculated)	"WC
9/30/20 3:00	9/30/20 3:05	-0.5	9/30/20 3:00	9/30/20 3:05	-0.22	9/30/20 3:00	9/30/20 3:05	0.26
9/30/20 3:05	9/30/20 3:10	-0.5	9/30/20 3:05	9/30/20 3:10	-0.23	9/30/20 3:05	9/30/20 3:10	0.25
9/30/20 3:10	9/30/20 3:15	-0.5	9/30/20 3:10	9/30/20 3:15	-0.24	9/30/20 3:10	9/30/20 3:15	0.24
9/30/20 3:15	9/30/20 3:20	-0.5	9/30/20 3:15	9/30/20 3:20	-0.23	9/30/20 3:15	9/30/20 3:20	0.26
9/30/20 3:20	9/30/20 3:25	-0.5	9/30/20 3:20	9/30/20 3:25	-0.25	9/30/20 3:20	9/30/20 3:25	0.25
9/30/20 3:25	9/30/20 3:30	-0.5	9/30/20 3:25	9/30/20 3:30	-0.24	9/30/20 3:25	9/30/20 3:30	0.25
9/30/20 3:30	9/30/20 3:35	-0.5	9/30/20 3:30	9/30/20 3:35	-0.25	9/30/20 3:30	9/30/20 3:35	0.24
9/30/20 3:35	9/30/20 3:40	-0.5	9/30/20 3:35	9/30/20 3:40	-0.26	9/30/20 3:35	9/30/20 3:40	0.24
9/30/20 3:40	9/30/20 3:45	-0.5	9/30/20 3:40	9/30/20 3:45	-0.25	9/30/20 3:40	9/30/20 3:45	0.24
9/30/20 3:45	9/30/20 3:50	-0.5	9/30/20 3:45	9/30/20 3:50	-0.26	9/30/20 3:45	9/30/20 3:50	0.24
9/30/20 3:50	9/30/20 3:55	-0.5	9/30/20 3:50	9/30/20 3:55	-0.26	9/30/20 3:50	9/30/20 3:55	0.24
9/30/20 3:55	9/30/20 4:00	-0.5	9/30/20 3:55	9/30/20 4:00	-0.27	9/30/20 3:55	9/30/20 4:00	0.23
9/30/20 4:00	9/30/20 4:05	-0.5	9/30/20 4:00	9/30/20 4:05	-0.27	9/30/20 4:00	9/30/20 4:05	0.23
9/30/20 4:05	9/30/20 4:10	-0.5	9/30/20 4:05	9/30/20 4:10	-0.28	9/30/20 4:05	9/30/20 4:10	0.23
9/30/20 4:10	9/30/20 4:15	-0.5	9/30/20 4:10	9/30/20 4:15	-0.27	9/30/20 4:10	9/30/20 4:15	0.23
9/30/20 4:15	9/30/20 4:20	-1.3	9/30/20 4:15	9/30/20 4:20	-0.92	9/30/20 4:15	9/30/20 4:20	0.41
9/30/20 4:20	9/30/20 4:25	-9.4	9/30/20 4:20	9/30/20 4:25	-6.86	9/30/20 4:20	9/30/20 4:25	2.52
9/30/20 4:25	9/30/20 4:30	-10.4	9/30/20 4:25	9/30/20 4:30	-7.85	9/30/20 4:25	9/30/20 4:30	2.51
9/30/20 4:30	9/30/20 4:35	-10.2	9/30/20 4:30	9/30/20 4:35	-7.69	9/30/20 4:30	9/30/20 4:35	2.46
9/30/20 4:35	9/30/20 4:40	-10.2	9/30/20 4:35	9/30/20 4:40	-7.66	9/30/20 4:35	9/30/20 4:40	2.57
9/30/20 4:40	9/30/20 4:45	-10.3	9/30/20 4:40	9/30/20 4:45	-7.62	9/30/20 4:40	9/30/20 4:45	2.66
9/30/20 4:45	9/30/20 4:50	-10.3	9/30/20 4:45	9/30/20 4:50	-7.65	9/30/20 4:45	9/30/20 4:50	2.67
9/30/20 4:50	9/30/20 4:55	-10.4	9/30/20 4:50	9/30/20 4:55	-7.67	9/30/20 4:50	9/30/20 4:55	2.71
9/30/20 4:55	9/30/20 5:00	-10.5	9/30/20 4:55	9/30/20 5:00	-7.68	9/30/20 4:55	9/30/20 5:00	2.80
9/30/20 5:00	9/30/20 5:05	-10.6	9/30/20 5:00	9/30/20 5:05	-7.76	9/30/20 5:00	9/30/20 5:05	2.82
9/30/20 5:05	9/30/20 5:10	-10.7	9/30/20 5:05	9/30/20 5:10	-7.71	9/30/20 5:05	9/30/20 5:10	2.95
9/30/20 5:10	9/30/20 5:15	-10.7	9/30/20 5:10	9/30/20 5:15	-7.71	9/30/20 5:10	9/30/20 5:15	2.96
9/30/20 5:15	9/30/20 5:20	-10.7	9/30/20 5:15	9/30/20 5:20	-7.71	9/30/20 5:15	9/30/20 5:20	2.96
9/30/20 5:20	9/30/20 5:25	-10.7	9/30/20 5:20	9/30/20 5:25	-7.69	9/30/20 5:20	9/30/20 5:25	2.98
9/30/20 5:25	9/30/20 5:30	-10.8	9/30/20 5:25	9/30/20 5:30	-7.69	9/30/20 5:25	9/30/20 5:30	3.12
9/30/20 5:30	9/30/20 5:35	-9.4	9/30/20 5:30	9/30/20 5:35	-6.90	9/30/20 5:30	9/30/20 5:35	2.55
9/30/20 5:35	9/30/20 5:40	-0.3	9/30/20 5:35	9/30/20 5:40	-0.25	9/30/20 5:35	9/30/20 5:40	0.06
9/30/20 5:40	9/30/20 5:45	-0.2	9/30/20 5:40	9/30/20 5:45	-0.11	9/30/20 5:40	9/30/20 5:45	0.05
9/30/20 5:45	9/30/20 5:50	-0.1	9/30/20 5:45	9/30/20 5:50	-0.09	9/30/20 5:45	9/30/20 5:50	0.05
9/30/20 5:50	9/30/20 5:55	-0.2	9/30/20 5:50	9/30/20 5:55	-0.11	9/30/20 5:50	9/30/20 5:55	0.05
9/30/20 5:55	9/30/20 6:00	-0.2	9/30/20 5:55	9/30/20 6:00	-0.12	9/30/20 5:55	9/30/20 6:00	0.05
9/30/20 6:00	9/30/20 6:05	-4.6	9/30/20 6:00	9/30/20 6:05	-4.47	9/30/20 6:00	9/30/20 6:05	0.15
9/30/20 6:05	9/30/20 6:10	-7.3	9/30/20 6:05	9/30/20 6:10	-7.15	9/30/20 6:05	9/30/20 6:10	0.18
9/30/20 6:10	9/30/20 6:15	-7.3	9/30/20 6:10	9/30/20 6:15	-7.17	9/30/20 6:10	9/30/20 6:15	0.15
9/30/20 6:15	9/30/20 6:20	-7.3	9/30/20 6:15	9/30/20 6:20	-7.18	9/30/20 6:15	9/30/20 6:20	0.17
9/30/20 6:20	9/30/20 6:25	-7.4	9/30/20 6:20	9/30/20 6:25	-7.18	9/30/20 6:20	9/30/20 6:25	0.18
9/30/20 6:25	9/30/20 6:30	-9.8	9/30/20 6:25	9/30/20 6:30	-6.56	9/30/20 6:25	9/30/20 6:30	3.21
9/30/20 6:30	9/30/20 6:35	-0.7	9/30/20 6:30	9/30/20 6:35	-0.62	9/30/20 6:30	9/30/20 6:35	0.13
9/30/20 6:35	9/30/20 6:40	-0.2	9/30/20 6:35	9/30/20 6:40	-0.11	9/30/20 6:35	9/30/20 6:40	0.12
9/30/20 6:40	9/30/20 6:45	-1.1	9/30/20 6:40	9/30/20 6:45	-0.73	9/30/20 6:40	9/30/20 6:45	0.38
9/30/20 6:45	9/30/20 6:50	-7.7	9/30/20 6:45	9/30/20 6:50	-4.72	9/30/20 6:45	9/30/20 6:50	3.03
9/30/20 6:50	9/30/20 6:55	-8.4	9/30/20 6:50	9/30/20 6:55	-5.74	9/30/20 6:50	9/30/20 6:55	2.68

	PIT-3693E Scrubber Top Pressure (for pressure drop calc)	5 min averages "WC		PIT-3693F Scrubber Bottom Pressure (for pressure drop calc)	5 min averages "WC		Scrubber Pressure Drop (calculated)	"WC
9/30/20 6:55	9/30/20 7:00	-7.8	9/30/20 6:55	9/30/20 7:00	-5.50	9/30/20 6:55	9/30/20 7:00	2.26
9/30/20 7:00	9/30/20 7:05	-7.6	9/30/20 7:00	9/30/20 7:05	-5.35	9/30/20 7:00	9/30/20 7:05	2.21
9/30/20 7:05	9/30/20 7:10	-7.7	9/30/20 7:05	9/30/20 7:10	-5.33	9/30/20 7:05	9/30/20 7:10	2.35
9/30/20 7:10	9/30/20 7:15	-7.8	9/30/20 7:10	9/30/20 7:15	-5.33	9/30/20 7:10	9/30/20 7:15	2.49
9/30/20 7:15	9/30/20 7:20	-7.8	9/30/20 7:15	9/30/20 7:20	-5.36	9/30/20 7:15	9/30/20 7:20	2.43
9/30/20 7:20	9/30/20 7:25	-7.7	9/30/20 7:20	9/30/20 7:25	-5.39	9/30/20 7:20	9/30/20 7:25	2.36
9/30/20 7:25	9/30/20 7:30	-7.7	9/30/20 7:25	9/30/20 7:30	-5.38	9/30/20 7:25	9/30/20 7:30	2.33
9/30/20 7:30	9/30/20 7:35	-7.7	9/30/20 7:30	9/30/20 7:35	-5.37	9/30/20 7:30	9/30/20 7:35	2.31
9/30/20 7:35	9/30/20 7:40	-7.7	9/30/20 7:35	9/30/20 7:40	-5.38	9/30/20 7:35	9/30/20 7:40	2.27
9/30/20 7:40	9/30/20 7:45	-7.6	9/30/20 7:40	9/30/20 7:45	-5.35	9/30/20 7:40	9/30/20 7:45	2.29
9/30/20 7:45	9/30/20 7:50	-7.6	9/30/20 7:45	9/30/20 7:50	-5.31	9/30/20 7:45	9/30/20 7:50	2.25
9/30/20 7:50	9/30/20 7:55	-7.5	9/30/20 7:50	9/30/20 7:55	-5.30	9/30/20 7:50	9/30/20 7:55	2.23
9/30/20 7:55	9/30/20 8:00	-7.5	9/30/20 7:55	9/30/20 8:00	-5.33	9/30/20 7:55	9/30/20 8:00	2.19
9/30/20 8:00	9/30/20 8:05	-7.5	9/30/20 8:00	9/30/20 8:05	-5.31	9/30/20 8:00	9/30/20 8:05	2.21
9/30/20 8:05	9/30/20 8:10	-7.5	9/30/20 8:05	9/30/20 8:10	-5.29	9/30/20 8:05	9/30/20 8:10	2.21
9/30/20 8:10	9/30/20 8:15	-7.5	9/30/20 8:10	9/30/20 8:15	-5.29	9/30/20 8:10	9/30/20 8:15	2.24
9/30/20 8:15	9/30/20 8:20	-7.5	9/30/20 8:15	9/30/20 8:20	-5.29	9/30/20 8:15	9/30/20 8:20	2.25
9/30/20 8:20	9/30/20 8:25	-7.5	9/30/20 8:20	9/30/20 8:25	-5.32	9/30/20 8:20	9/30/20 8:25	2.23
9/30/20 8:25	9/30/20 8:30	-7.5	9/30/20 8:25	9/30/20 8:30	-5.29	9/30/20 8:25	9/30/20 8:30	2.25
9/30/20 8:30	9/30/20 8:35	-7.5	9/30/20 8:30	9/30/20 8:35	-5.28	9/30/20 8:30	9/30/20 8:35	2.26
9/30/20 8:35	9/30/20 8:40	-7.5	9/30/20 8:35	9/30/20 8:40	-5.30	9/30/20 8:35	9/30/20 8:40	2.24
9/30/20 8:40	9/30/20 8:45	-7.6	9/30/20 8:40	9/30/20 8:45	-5.29	9/30/20 8:40	9/30/20 8:45	2.28
9/30/20 8:45	9/30/20 8:50	-7.6	9/30/20 8:45	9/30/20 8:50	-5.28	9/30/20 8:45	9/30/20 8:50	2.28
9/30/20 8:50	9/30/20 8:55	-7.6	9/30/20 8:50	9/30/20 8:55	-5.31	9/30/20 8:50	9/30/20 8:55	2.27
9/30/20 8:55	9/30/20 9:00	-7.6	9/30/20 8:55	9/30/20 9:00	-5.30	9/30/20 8:55	9/30/20 9:00	2.29
9/30/20 9:00	9/30/20 9:05	-7.6	9/30/20 9:00	9/30/20 9:05	-5.28	9/30/20 9:00	9/30/20 9:05	2.29
9/30/20 9:05	9/30/20 9:10	-7.6	9/30/20 9:05	9/30/20 9:10	-5.32	9/30/20 9:05	9/30/20 9:10	2.32
9/30/20 9:10	9/30/20 9:15	-7.6	9/30/20 9:10	9/30/20 9:15	-5.31	9/30/20 9:10	9/30/20 9:15	2.32
9/30/20 9:15	9/30/20 9:20	-7.7	9/30/20 9:15	9/30/20 9:20	-5.28	9/30/20 9:15	9/30/20 9:20	2.38
9/30/20 9:20	9/30/20 9:25	-7.7	9/30/20 9:20	9/30/20 9:25	-5.34	9/30/20 9:20	9/30/20 9:25	2.33
9/30/20 9:25	9/30/20 9:30	-7.7	9/30/20 9:25	9/30/20 9:30	-5.34	9/30/20 9:25	9/30/20 9:30	2.37
9/30/20 9:30	9/30/20 9:35	-7.8	9/30/20 9:30	9/30/20 9:35	-5.36	9/30/20 9:30	9/30/20 9:35	2.42
9/30/20 9:35	9/30/20 9:40	-7.8	9/30/20 9:35	9/30/20 9:40	-5.35	9/30/20 9:35	9/30/20 9:40	2.47
9/30/20 9:40	9/30/20 9:45	-7.9	9/30/20 9:40	9/30/20 9:45	-5.35	9/30/20 9:40	9/30/20 9:45	2.50
9/30/20 9:45	9/30/20 9:50	-7.8	9/30/20 9:45	9/30/20 9:50	-5.35	9/30/20 9:45	9/30/20 9:50	2.47
9/30/20 9:50	9/30/20 9:55	-7.8	9/30/20 9:50	9/30/20 9:55	-5.33	9/30/20 9:50	9/30/20 9:55	2.50
9/30/20 9:55	9/30/20 10:00	-7.7	9/30/20 9:55	9/30/20 10:00	-5.41	9/30/20 9:55	9/30/20 10:00	2.32
9/30/20 10:00	9/30/20 10:05	-7.6	9/30/20 10:00	9/30/20 10:05	-5.30	9/30/20 10:00	9/30/20 10:05	2.32
9/30/20 10:05	9/30/20 10:10	-7.6	9/30/20 10:05	9/30/20 10:10	-5.29	9/30/20 10:05	9/30/20 10:10	2.33
9/30/20 10:10	9/30/20 10:15	-7.6	9/30/20 10:10	9/30/20 10:15	-5.26	9/30/20 10:10	9/30/20 10:15	2.37
9/30/20 10:15	9/30/20 10:20	-7.6	9/30/20 10:15	9/30/20 10:20	-5.25	9/30/20 10:15	9/30/20 10:20	2.37
9/30/20 10:20	9/30/20 10:25	-7.5	9/30/20 10:20	9/30/20 10:25	-5.24	9/30/20 10:20	9/30/20 10:25	2.30
9/30/20 10:25	9/30/20 10:30	-7.5	9/30/20 10:25	9/30/20 10:30	-5.22	9/30/20 10:25	9/30/20 10:30	2.28
9/30/20 10:30	9/30/20 10:35	-7.5	9/30/20 10:30	9/30/20 10:35	-5.23	9/30/20 10:30	9/30/20 10:35	2.27
9/30/20 10:35	9/30/20 10:40	-7.5	9/30/20 10:35	9/30/20 10:40	-5.24	9/30/20 10:35	9/30/20 10:40	2.24
9/30/20 10:40	9/30/20 10:45	-7.5	9/30/20 10:40	9/30/20 10:45	-5.21	9/30/20 10:40	9/30/20 10:45	2.30
9/30/20 10:45	9/30/20 10:50	-4.1	9/30/20 10:45	9/30/20 10:50	-2.95	9/30/20 10:45	9/30/20 10:50	1.16

	PIT-3693E Scrubber Top Pressure (for pressure drop calc)	5 min averages "WC		PIT-3693F Scrubber Bottom Pressure (for pressure drop calc)	5 min averages "WC		Scrubber Pressure Drop (calculated)	"WC
9/30/20 10:50	9/30/20 10:55	-0.1	9/30/20 10:50	9/30/20 10:55	-0.04	9/30/20 10:50	9/30/20 10:55	0.10
9/30/20 10:55	9/30/20 11:00	-1.5	9/30/20 10:55	9/30/20 11:00	-1.06	9/30/20 10:55	9/30/20 11:00	0.46
9/30/20 11:00	9/30/20 11:05	-4.7	9/30/20 11:00	9/30/20 11:05	-3.38	9/30/20 11:00	9/30/20 11:05	1.35
9/30/20 11:05	9/30/20 11:10	-0.2	9/30/20 11:05	9/30/20 11:10	-0.08	9/30/20 11:05	9/30/20 11:10	0.13
9/30/20 11:10	9/30/20 11:15	-0.5	9/30/20 11:10	9/30/20 11:15	-0.28	9/30/20 11:10	9/30/20 11:15	0.20
9/30/20 11:15	9/30/20 11:20	-6.3	9/30/20 11:15	9/30/20 11:20	-4.35	9/30/20 11:15	9/30/20 11:20	1.93
9/30/20 11:20	9/30/20 11:25	-7.8	9/30/20 11:20	9/30/20 11:25	-5.24	9/30/20 11:20	9/30/20 11:25	2.61
9/30/20 11:25	9/30/20 11:30	-7.9	9/30/20 11:25	9/30/20 11:30	-5.31	9/30/20 11:25	9/30/20 11:30	2.61
9/30/20 11:30	9/30/20 11:35	-8.4	9/30/20 11:30	9/30/20 11:35	-5.68	9/30/20 11:30	9/30/20 11:35	2.74
9/30/20 11:35	9/30/20 11:40	-8.9	9/30/20 11:35	9/30/20 11:40	-6.13	9/30/20 11:35	9/30/20 11:40	2.81
9/30/20 11:40	9/30/20 11:45	-8.9	9/30/20 11:40	9/30/20 11:45	-6.14	9/30/20 11:40	9/30/20 11:45	2.79
9/30/20 11:45	9/30/20 11:50	-8.9	9/30/20 11:45	9/30/20 11:50	-6.08	9/30/20 11:45	9/30/20 11:50	2.81
9/30/20 11:50	9/30/20 11:55	-8.9	9/30/20 11:50	9/30/20 11:55	-6.04	9/30/20 11:50	9/30/20 11:55	2.87
9/30/20 11:55	9/30/20 12:00	-8.9	9/30/20 11:55	9/30/20 12:00	-6.10	9/30/20 11:55	9/30/20 12:00	2.85
9/30/20 12:00	9/30/20 12:05	-8.9	9/30/20 12:00	9/30/20 12:05	-6.10	9/30/20 12:00	9/30/20 12:05	2.83
9/30/20 12:05	9/30/20 12:10	-8.9	9/30/20 12:05	9/30/20 12:10	-6.07	9/30/20 12:05	9/30/20 12:10	2.86
9/30/20 12:10	9/30/20 12:15	-9.0	9/30/20 12:10	9/30/20 12:15	-6.06	9/30/20 12:10	9/30/20 12:15	2.89
9/30/20 12:15	9/30/20 12:20	-8.9	9/30/20 12:15	9/30/20 12:20	-6.11	9/30/20 12:15	9/30/20 12:20	2.80
9/30/20 12:20	9/30/20 12:25	-8.9	9/30/20 12:20	9/30/20 12:25	-6.13	9/30/20 12:20	9/30/20 12:25	2.78
9/30/20 12:25	9/30/20 12:30	-8.9	9/30/20 12:25	9/30/20 12:30	-6.14	9/30/20 12:25	9/30/20 12:30	2.78
9/30/20 12:30	9/30/20 12:35	-9.2	9/30/20 12:30	9/30/20 12:35	-6.27	9/30/20 12:30	9/30/20 12:35	2.94
9/30/20 12:35	9/30/20 12:40	-9.7	9/30/20 12:35	9/30/20 12:40	-6.64	9/30/20 12:35	9/30/20 12:40	3.01
9/30/20 12:40	9/30/20 12:45	-9.5	9/30/20 12:40	9/30/20 12:45	-6.62	9/30/20 12:40	9/30/20 12:45	2.91
9/30/20 12:45	9/30/20 12:50	-9.9	9/30/20 12:45	9/30/20 12:50	-6.90	9/30/20 12:45	9/30/20 12:50	3.02
9/30/20 12:50	9/30/20 12:55	-10.1	9/30/20 12:50	9/30/20 12:55	-7.15	9/30/20 12:50	9/30/20 12:55	2.97
9/30/20 12:55	9/30/20 13:00	-10.1	9/30/20 12:55	9/30/20 13:00	-7.13	9/30/20 12:55	9/30/20 13:00	2.98
9/30/20 13:00	9/30/20 13:05	-10.2	9/30/20 13:00	9/30/20 13:05	-7.19	9/30/20 13:00	9/30/20 13:05	2.98
9/30/20 13:05	9/30/20 13:10	-10.5	9/30/20 13:05	9/30/20 13:10	-7.43	9/30/20 13:05	9/30/20 13:10	3.10
9/30/20 13:10	9/30/20 13:15	-10.6	9/30/20 13:10	9/30/20 13:15	-7.46	9/30/20 13:10	9/30/20 13:15	3.19
9/30/20 13:15	9/30/20 13:20	-10.7	9/30/20 13:15	9/30/20 13:20	-7.45	9/30/20 13:15	9/30/20 13:20	3.23
9/30/20 13:20	9/30/20 13:25	-10.8	9/30/20 13:20	9/30/20 13:25	-7.45	9/30/20 13:20	9/30/20 13:25	3.30
9/30/20 13:25	9/30/20 13:30	-10.8	9/30/20 13:25	9/30/20 13:30	-7.42	9/30/20 13:25	9/30/20 13:30	3.42
9/30/20 13:30	9/30/20 13:35	-10.9	9/30/20 13:30	9/30/20 13:35	-7.51	9/30/20 13:30	9/30/20 13:35	3.38
9/30/20 13:35	9/30/20 13:40	-10.8	9/30/20 13:35	9/30/20 13:40	-7.48	9/30/20 13:35	9/30/20 13:40	3.31
9/30/20 13:40	9/30/20 13:45	-10.7	9/30/20 13:40	9/30/20 13:45	-7.44	9/30/20 13:40	9/30/20 13:45	3.27
9/30/20 13:45	9/30/20 13:50	-10.8	9/30/20 13:45	9/30/20 13:50	-7.49	9/30/20 13:45	9/30/20 13:50	3.29
9/30/20 13:50	9/30/20 13:55	-10.8	9/30/20 13:50	9/30/20 13:55	-7.56	9/30/20 13:50	9/30/20 13:55	3.23
9/30/20 13:55	9/30/20 14:00	-10.8	9/30/20 13:55	9/30/20 14:00	-7.51	9/30/20 13:55	9/30/20 14:00	3.25
9/30/20 14:00	9/30/20 14:05	-10.7	9/30/20 14:00	9/30/20 14:05	-7.41	9/30/20 14:00	9/30/20 14:05	3.24
9/30/20 14:05	9/30/20 14:10	-10.7	9/30/20 14:05	9/30/20 14:10	-7.41	9/30/20 14:05	9/30/20 14:10	3.27
9/30/20 14:10	9/30/20 14:15	-10.7	9/30/20 14:10	9/30/20 14:15	-7.46	9/30/20 14:10	9/30/20 14:15	3.27
9/30/20 14:15	9/30/20 14:20	-10.7	9/30/20 14:15	9/30/20 14:20	-7.51	9/30/20 14:15	9/30/20 14:20	3.22
9/30/20 14:20	9/30/20 14:25	-10.7	9/30/20 14:20	9/30/20 14:25	-7.45	9/30/20 14:20	9/30/20 14:25	3.30
9/30/20 14:25	9/30/20 14:30	-10.8	9/30/20 14:25	9/30/20 14:30	-7.46	9/30/20 14:25	9/30/20 14:30	3.35
9/30/20 14:30	9/30/20 14:35	-10.8	9/30/20 14:30	9/30/20 14:35	-7.52	9/30/20 14:30	9/30/20 14:35	3.26
9/30/20 14:35	9/30/20 14:40	-10.8	9/30/20 14:35	9/30/20 14:40	-7.58	9/30/20 14:35	9/30/20 14:40	3.20
9/30/20 14:40	9/30/20 14:45	-10.8	9/30/20 14:40	9/30/20 14:45	-7.53	9/30/20 14:40	9/30/20 14:45	3.28

	PIT-3693E Scrubber Top Pressure (for pressure drop calc)	5 min averages "WC		PIT-3693F Scrubber Bottom Pressure (for pressure drop calc)	5 min averages "WC		Scrubber Pressure Drop (calculated)	"WC
9/30/20 14:45	9/30/20 14:50	-10.8	9/30/20 14:45	9/30/20 14:50	-7.50	9/30/20 14:45	9/30/20 14:50	3.29
9/30/20 14:50	9/30/20 14:55	-10.8	9/30/20 14:50	9/30/20 14:55	-7.53	9/30/20 14:50	9/30/20 14:55	3.29
9/30/20 14:55	9/30/20 15:00	-10.7	9/30/20 14:55	9/30/20 15:00	-7.52	9/30/20 14:55	9/30/20 15:00	3.22
9/30/20 15:00	9/30/20 15:05	-10.7	9/30/20 15:00	9/30/20 15:05	-7.46	9/30/20 15:00	9/30/20 15:05	3.26
9/30/20 15:05	9/30/20 15:10	-10.8	9/30/20 15:05	9/30/20 15:10	-7.50	9/30/20 15:05	9/30/20 15:10	3.30
9/30/20 15:10	9/30/20 15:15	-10.8	9/30/20 15:10	9/30/20 15:15	-7.51	9/30/20 15:10	9/30/20 15:15	3.30
9/30/20 15:15	9/30/20 15:20	-10.8	9/30/20 15:15	9/30/20 15:20	-7.53	9/30/20 15:15	9/30/20 15:20	3.24
9/30/20 15:20	9/30/20 15:25	-10.8	9/30/20 15:20	9/30/20 15:25	-7.51	9/30/20 15:20	9/30/20 15:25	3.25
9/30/20 15:25	9/30/20 15:30	-10.8	9/30/20 15:25	9/30/20 15:30	-7.50	9/30/20 15:25	9/30/20 15:30	3.33
9/30/20 15:30	9/30/20 15:35	-10.9	9/30/20 15:30	9/30/20 15:35	-7.57	9/30/20 15:30	9/30/20 15:35	3.34
9/30/20 15:35	9/30/20 15:40	-10.8	9/30/20 15:35	9/30/20 15:40	-7.58	9/30/20 15:35	9/30/20 15:40	3.24
9/30/20 15:40	9/30/20 15:45	-10.9	9/30/20 15:40	9/30/20 15:45	-7.54	9/30/20 15:40	9/30/20 15:45	3.33
9/30/20 15:45	9/30/20 15:50	-10.9	9/30/20 15:45	9/30/20 15:50	-7.57	9/30/20 15:45	9/30/20 15:50	3.38
9/30/20 15:50	9/30/20 15:55	-11.0	9/30/20 15:50	9/30/20 15:55	-7.54	9/30/20 15:50	9/30/20 15:55	3.45
9/30/20 15:55	9/30/20 16:00	-11.0	9/30/20 15:55	9/30/20 16:00	-7.63	9/30/20 15:55	9/30/20 16:00	3.40
9/30/20 16:00	9/30/20 16:05	-11.0	9/30/20 16:00	9/30/20 16:05	-7.55	9/30/20 16:00	9/30/20 16:05	3.41
9/30/20 16:05	9/30/20 16:10	-11.0	9/30/20 16:05	9/30/20 16:10	-7.55	9/30/20 16:05	9/30/20 16:10	3.44
9/30/20 16:10	9/30/20 16:15	-11.1	9/30/20 16:10	9/30/20 16:15	-7.62	9/30/20 16:10	9/30/20 16:15	3.49
9/30/20 16:15	9/30/20 16:20	-11.0	9/30/20 16:15	9/30/20 16:20	-7.67	9/30/20 16:15	9/30/20 16:20	3.33
9/30/20 16:20	9/30/20 16:25	-10.6	9/30/20 16:20	9/30/20 16:25	-7.58	9/30/20 16:20	9/30/20 16:25	3.04
9/30/20 16:25	9/30/20 16:30	-10.5	9/30/20 16:25	9/30/20 16:30	-7.52	9/30/20 16:25	9/30/20 16:30	3.02
9/30/20 16:30	9/30/20 16:35	-10.6	9/30/20 16:30	9/30/20 16:35	-7.44	9/30/20 16:30	9/30/20 16:35	3.12
9/30/20 16:35	9/30/20 16:40	-10.6	9/30/20 16:35	9/30/20 16:40	-7.50	9/30/20 16:35	9/30/20 16:40	3.10
9/30/20 16:40	9/30/20 16:45	-10.6	9/30/20 16:40	9/30/20 16:45	-7.54	9/30/20 16:40	9/30/20 16:45	3.02
9/30/20 16:45	9/30/20 16:50	-10.5	9/30/20 16:45	9/30/20 16:50	-7.52	9/30/20 16:45	9/30/20 16:50	2.98
9/30/20 16:50	9/30/20 16:55	-10.5	9/30/20 16:50	9/30/20 16:55	-7.46	9/30/20 16:50	9/30/20 16:55	2.99
9/30/20 16:55	9/30/20 17:00	-10.5	9/30/20 16:55	9/30/20 17:00	-7.41	9/30/20 16:55	9/30/20 17:00	3.05
9/30/20 17:00	9/30/20 17:05	-10.6	9/30/20 17:00	9/30/20 17:05	-7.56	9/30/20 17:00	9/30/20 17:05	3.01
9/30/20 17:05	9/30/20 17:10	-10.6	9/30/20 17:05	9/30/20 17:10	-7.58	9/30/20 17:05	9/30/20 17:10	3.01
9/30/20 17:10	9/30/20 17:15	-10.6	9/30/20 17:10	9/30/20 17:15	-7.56	9/30/20 17:10	9/30/20 17:15	3.01
9/30/20 17:15	9/30/20 17:20	-10.5	9/30/20 17:15	9/30/20 17:20	-7.50	9/30/20 17:15	9/30/20 17:20	2.99
9/30/20 17:20	9/30/20 17:25	-10.6	9/30/20 17:20	9/30/20 17:25	-7.50	9/30/20 17:20	9/30/20 17:25	3.08
9/30/20 17:25	9/30/20 17:30	-10.6	9/30/20 17:25	9/30/20 17:30	-7.53	9/30/20 17:25	9/30/20 17:30	3.09
9/30/20 17:30	9/30/20 17:35	-10.5	9/30/20 17:30	9/30/20 17:35	-7.53	9/30/20 17:30	9/30/20 17:35	3.01
9/30/20 17:35	9/30/20 17:40	-10.5	9/30/20 17:35	9/30/20 17:40	-7.51	9/30/20 17:35	9/30/20 17:40	2.99
9/30/20 17:40	9/30/20 17:45	-10.4	9/30/20 17:40	9/30/20 17:45	-7.49	9/30/20 17:40	9/30/20 17:45	2.93
9/30/20 17:45	9/30/20 17:50	-10.4	9/30/20 17:45	9/30/20 17:50	-7.48	9/30/20 17:45	9/30/20 17:50	2.89
9/30/20 17:50	9/30/20 17:55	-10.4	9/30/20 17:50	9/30/20 17:55	-7.52	9/30/20 17:50	9/30/20 17:55	2.91
9/30/20 17:55	9/30/20 18:00	-10.4	9/30/20 17:55	9/30/20 18:00	-7.47	9/30/20 17:55	9/30/20 18:00	2.89
9/30/20 18:00	9/30/20 18:05	-10.3	9/30/20 18:00	9/30/20 18:05	-7.43	9/30/20 18:00	9/30/20 18:05	2.92
9/30/20 18:05	9/30/20 18:10	-10.3	9/30/20 18:05	9/30/20 18:10	-7.46	9/30/20 18:05	9/30/20 18:10	2.85
9/30/20 18:10	9/30/20 18:15	-10.3	9/30/20 18:10	9/30/20 18:15	-7.44	9/30/20 18:10	9/30/20 18:15	2.83
9/30/20 18:15	9/30/20 18:20	-10.2	9/30/20 18:15	9/30/20 18:20	-7.45	9/30/20 18:15	9/30/20 18:20	2.80
9/30/20 18:20	9/30/20 18:25	-10.3	9/30/20 18:20	9/30/20 18:25	-7.39	9/30/20 18:20	9/30/20 18:25	2.88
9/30/20 18:25	9/30/20 18:30	-10.2	9/30/20 18:25	9/30/20 18:30	-7.36	9/30/20 18:25	9/30/20 18:30	2.87
9/30/20 18:30	9/30/20 18:35	-10.2	9/30/20 18:30	9/30/20 18:35	-7.34	9/30/20 18:30	9/30/20 18:35	2.85
9/30/20 18:35	9/30/20 18:40	-10.2	9/30/20 18:35	9/30/20 18:40	-7.34	9/30/20 18:35	9/30/20 18:40	2.85

	PIT-3693E Scrubber Top Pressure (for pressure drop calc)	5 min averages "WC		PIT-3693F Scrubber Bottom Pressure (for pressure drop calc)	5 min averages "WC		**Scrubber Pressure Drop (calculated)**	"WC
9/30/20 18:40	9/30/20 18:45	-10.2	9/30/20 18:40	9/30/20 18:45	-7.34	9/30/20 18:40	9/30/20 18:45	2.82
9/30/20 18:45	9/30/20 18:50	-10.1	9/30/20 18:45	9/30/20 18:50	-7.33	9/30/20 18:45	9/30/20 18:50	2.82
9/30/20 18:50	9/30/20 18:55	-10.1	9/30/20 18:50	9/30/20 18:55	-7.39	9/30/20 18:50	9/30/20 18:55	2.76
9/30/20 18:55	9/30/20 19:00	-10.1	9/30/20 18:55	9/30/20 19:00	-7.36	9/30/20 18:55	9/30/20 19:00	2.76
9/30/20 19:00	9/30/20 19:05	-10.1	9/30/20 19:00	9/30/20 19:05	-7.41	9/30/20 19:00	9/30/20 19:05	2.71
9/30/20 19:05	9/30/20 19:10	-10.1	9/30/20 19:05	9/30/20 19:10	-7.36	9/30/20 19:05	9/30/20 19:10	2.77
9/30/20 19:10	9/30/20 19:15	-10.2	9/30/20 19:10	9/30/20 19:15	-7.37	9/30/20 19:10	9/30/20 19:15	2.80
9/30/20 19:15	9/30/20 19:20	-10.2	9/30/20 19:15	9/30/20 19:20	-7.35	9/30/20 19:15	9/30/20 19:20	2.83
9/30/20 19:20	9/30/20 19:25	-10.1	9/30/20 19:20	9/30/20 19:25	-7.37	9/30/20 19:20	9/30/20 19:25	2.77
9/30/20 19:25	9/30/20 19:30	-10.2	9/30/20 19:25	9/30/20 19:30	-7.36	9/30/20 19:25	9/30/20 19:30	2.85
9/30/20 19:30	9/30/20 19:35	-10.2	9/30/20 19:30	9/30/20 19:35	-7.34	9/30/20 19:30	9/30/20 19:35	2.91
9/30/20 19:35	9/30/20 19:40	-10.3	9/30/20 19:35	9/30/20 19:40	-7.38	9/30/20 19:35	9/30/20 19:40	2.93
9/30/20 19:40	9/30/20 19:45	-10.4	9/30/20 19:40	9/30/20 19:45	-7.32	9/30/20 19:40	9/30/20 19:45	3.07
9/30/20 19:45	9/30/20 19:50	-10.4	9/30/20 19:45	9/30/20 19:50	-7.38	9/30/20 19:45	9/30/20 19:50	3.03
9/30/20 19:50	9/30/20 19:55	-10.4	9/30/20 19:50	9/30/20 19:55	-7.34	9/30/20 19:50	9/30/20 19:55	3.02
9/30/20 19:55	9/30/20 20:00	-10.3	9/30/20 19:55	9/30/20 20:00	-7.33	9/30/20 19:55	9/30/20 20:00	2.98
9/30/20 20:00	9/30/20 20:05	-10.4	9/30/20 20:00	9/30/20 20:05	-7.31	9/30/20 20:00	9/30/20 20:05	3.09
9/30/20 20:05	9/30/20 20:10	-10.4	9/30/20 20:05	9/30/20 20:10	-7.35	9/30/20 20:05	9/30/20 20:10	3.07
9/30/20 20:10	9/30/20 20:15	-10.4	9/30/20 20:10	9/30/20 20:15	-7.35	9/30/20 20:10	9/30/20 20:15	3.10
9/30/20 20:15	9/30/20 20:20	-10.5	9/30/20 20:15	9/30/20 20:20	-7.33	9/30/20 20:15	9/30/20 20:20	3.12
9/30/20 20:20	9/30/20 20:25	-10.4	9/30/20 20:20	9/30/20 20:25	-7.30	9/30/20 20:20	9/30/20 20:25	3.11
9/30/20 20:25	9/30/20 20:30	-10.5	9/30/20 20:25	9/30/20 20:30	-7.38	9/30/20 20:25	9/30/20 20:30	3.08
9/30/20 20:30	9/30/20 20:35	-10.4	9/30/20 20:30	9/30/20 20:35	-7.45	9/30/20 20:30	9/30/20 20:35	2.94
9/30/20 20:35	9/30/20 20:40	-10.3	9/30/20 20:35	9/30/20 20:40	-7.43	9/30/20 20:35	9/30/20 20:40	2.91
9/30/20 20:40	9/30/20 20:45	-10.4	9/30/20 20:40	9/30/20 20:45	-7.44	9/30/20 20:40	9/30/20 20:45	2.96
9/30/20 20:45	9/30/20 20:50	-10.4	9/30/20 20:45	9/30/20 20:50	-7.44	9/30/20 20:45	9/30/20 20:50	2.94
9/30/20 20:50	9/30/20 20:55	-10.4	9/30/20 20:50	9/30/20 20:55	-7.43	9/30/20 20:50	9/30/20 20:55	2.92
9/30/20 20:55	9/30/20 21:00	-10.3	9/30/20 20:55	9/30/20 21:00	-7.44	9/30/20 20:55	9/30/20 21:00	2.86
9/30/20 21:00	9/30/20 21:05	-10.3	9/30/20 21:00	9/30/20 21:05	-7.40	9/30/20 21:00	9/30/20 21:05	2.86
9/30/20 21:05	9/30/20 21:10	-10.3	9/30/20 21:05	9/30/20 21:10	-7.43	9/30/20 21:05	9/30/20 21:10	2.83
9/30/20 21:10	9/30/20 21:15	-10.3	9/30/20 21:10	9/30/20 21:15	-7.42	9/30/20 21:10	9/30/20 21:15	2.89
9/30/20 21:15	9/30/20 21:20	-10.2	9/30/20 21:15	9/30/20 21:20	-7.46	9/30/20 21:15	9/30/20 21:20	2.78
9/30/20 21:20	9/30/20 21:25	-10.2	9/30/20 21:20	9/30/20 21:25	-7.45	9/30/20 21:20	9/30/20 21:25	2.79
9/30/20 21:25	9/30/20 21:30	-10.2	9/30/20 21:25	9/30/20 21:30	-7.37	9/30/20 21:25	9/30/20 21:30	2.80
9/30/20 21:30	9/30/20 21:35	-10.2	9/30/20 21:30	9/30/20 21:35	-7.41	9/30/20 21:30	9/30/20 21:35	2.77
9/30/20 21:35	9/30/20 21:40	-10.2	9/30/20 21:35	9/30/20 21:40	-7.40	9/30/20 21:35	9/30/20 21:40	2.78
9/30/20 21:40	9/30/20 21:45	-10.2	9/30/20 21:40	9/30/20 21:45	-7.40	9/30/20 21:40	9/30/20 21:45	2.76
9/30/20 21:45	9/30/20 21:50	-10.1	9/30/20 21:45	9/30/20 21:50	-7.35	9/30/20 21:45	9/30/20 21:50	2.77
9/30/20 21:50	9/30/20 21:55	-10.0	9/30/20 21:50	9/30/20 21:55	-7.24	9/30/20 21:50	9/30/20 21:55	2.75
9/30/20 21:55	9/30/20 22:00	-9.4	9/30/20 21:55	9/30/20 22:00	-6.86	9/30/20 21:55	9/30/20 22:00	2.59
9/30/20 22:00	9/30/20 22:05	-9.4	9/30/20 22:00	9/30/20 22:05	-6.85	9/30/20 22:00	9/30/20 22:05	2.54
9/30/20 22:05	9/30/20 22:10	-9.4	9/30/20 22:05	9/30/20 22:10	-6.80	9/30/20 22:05	9/30/20 22:10	2.59
9/30/20 22:10	9/30/20 22:15	-9.4	9/30/20 22:10	9/30/20 22:15	-6.84	9/30/20 22:10	9/30/20 22:15	2.58
9/30/20 22:15	9/30/20 22:20	-9.4	9/30/20 22:15	9/30/20 22:20	-6.86	9/30/20 22:15	9/30/20 22:20	2.50
9/30/20 22:20	9/30/20 22:25	-9.4	9/30/20 22:20	9/30/20 22:25	-6.83	9/30/20 22:20	9/30/20 22:25	2.55
9/30/20 22:25	9/30/20 22:30	-9.4	9/30/20 22:25	9/30/20 22:30	-6.83	9/30/20 22:25	9/30/20 22:30	2.57
9/30/20 22:30	9/30/20 22:35	-9.4	9/30/20 22:30	9/30/20 22:35	-6.81	9/30/20 22:30	9/30/20 22:35	2.60

	PIT-3693E Scrubber Top Pressure (for pressure drop calc)	5 min averages "WC		PIT-3693F Scrubber Bottom Pressure (for pressure drop calc)	5 min averages "WC		**Scrubber Pressure Drop (calculated)**	"WC
9/30/20 22:35	9/30/20 22:40	-9.4	9/30/20 22:35	9/30/20 22:40	-6.78	9/30/20 22:35	9/30/20 22:40	2.60
9/30/20 22:40	9/30/20 22:45	-9.4	9/30/20 22:40	9/30/20 22:45	-6.80	9/30/20 22:40	9/30/20 22:45	2.60
9/30/20 22:45	9/30/20 22:50	-9.4	9/30/20 22:45	9/30/20 22:50	-6.82	9/30/20 22:45	9/30/20 22:50	2.54
9/30/20 22:50	9/30/20 22:55	-9.4	9/30/20 22:50	9/30/20 22:55	-6.81	9/30/20 22:50	9/30/20 22:55	2.60
9/30/20 22:55	9/30/20 23:00	-9.5	9/30/20 22:55	9/30/20 23:00	-6.82	9/30/20 22:55	9/30/20 23:00	2.64
9/30/20 23:00	9/30/20 23:05	-9.5	9/30/20 23:00	9/30/20 23:05	-6.83	9/30/20 23:00	9/30/20 23:05	2.63
9/30/20 23:05	9/30/20 23:10	-9.5	9/30/20 23:05	9/30/20 23:10	-6.82	9/30/20 23:05	9/30/20 23:10	2.72
9/30/20 23:10	9/30/20 23:15	-9.5	9/30/20 23:10	9/30/20 23:15	-6.86	9/30/20 23:10	9/30/20 23:15	2.61
9/30/20 23:15	9/30/20 23:20	-9.4	9/30/20 23:15	9/30/20 23:20	-6.84	9/30/20 23:15	9/30/20 23:20	2.59
9/30/20 23:20	9/30/20 23:25	-9.4	9/30/20 23:20	9/30/20 23:25	-6.82	9/30/20 23:20	9/30/20 23:25	2.60
9/30/20 23:25	9/30/20 23:30	-9.4	9/30/20 23:25	9/30/20 23:30	-6.84	9/30/20 23:25	9/30/20 23:30	2.59
9/30/20 23:30	9/30/20 23:35	-9.4	9/30/20 23:30	9/30/20 23:35	-6.80	9/30/20 23:30	9/30/20 23:35	2.64
9/30/20 23:35	9/30/20 23:40	-9.4	9/30/20 23:35	9/30/20 23:40	-6.82	9/30/20 23:35	9/30/20 23:40	2.59
9/30/20 23:40	9/30/20 23:45	-9.5	9/30/20 23:40	9/30/20 23:45	-6.84	9/30/20 23:40	9/30/20 23:45	2.63
9/30/20 23:45	9/30/20 23:50	-9.5	9/30/20 23:45	9/30/20 23:50	-6.81	9/30/20 23:45	9/30/20 23:50	2.67
9/30/20 23:50	9/30/20 23:55	-9.5	9/30/20 23:50	9/30/20 23:55	-6.81	9/30/20 23:50	9/30/20 23:55	2.65
9/30/20 23:55	10/1/20 0:00	-9.4	9/30/20 23:55	10/1/20 0:00	-6.84	9/30/20 23:55	10/1/20 0:00	2.59

		hourly average			houlry average			hourly average
\\10.1.9.153\N:	Reboiler Heat Input	MMBtu/Hr		Stack Flu Gas Temperature (inlet to SCR)	deg C		Ammonia Injection Flow	LB/hr
9/29/20 10:00	9/29/20 11:00		9/29/20 10:00	9/29/20 11:00		9/29/20 10:00	9/29/20 11:00	
9/29/20 11:00	9/29/20 12:00	26.656	9/29/20 11:00	9/29/20 12:00	389.47	9/29/20 11:00	9/29/20 12:00	14.272
9/29/20 12:00	9/29/20 13:00	25.434	9/29/20 12:00	9/29/20 13:00	374.02	9/29/20 12:00	9/29/20 13:00	4.976
9/29/20 13:00	9/29/20 14:00	23.175	9/29/20 13:00	9/29/20 14:00	361.53	9/29/20 13:00	9/29/20 14:00	4.549
9/29/20 14:00	9/29/20 15:00	25.449	9/29/20 14:00	9/29/20 15:00	373.33	9/29/20 14:00	9/29/20 15:00	1.891
9/29/20 15:00	9/29/20 16:00	25.367	9/29/20 15:00	9/29/20 16:00	372.74	9/29/20 15:00	9/29/20 16:00	0.651
9/29/20 16:00	9/29/20 17:00	25.435	9/29/20 16:00	9/29/20 17:00	372.78	9/29/20 16:00	9/29/20 17:00	0.644
9/29/20 17:00	9/29/20 18:00	25.626	9/29/20 17:00	9/29/20 18:00	374.23	9/29/20 17:00	9/29/20 18:00	0.616
9/29/20 18:00	9/29/20 19:00	25.669	9/29/20 18:00	9/29/20 19:00	374.57	9/29/20 18:00	9/29/20 19:00	0.600
9/29/20 19:00	9/29/20 20:00	25.708	9/29/20 19:00	9/29/20 20:00	374.49	9/29/20 19:00	9/29/20 20:00	0.591
9/29/20 20:00	9/29/20 21:00	25.781	9/29/20 20:00	9/29/20 21:00	375.53	9/29/20 20:00	9/29/20 21:00	0.588
9/29/20 21:00	9/29/20 22:00	25.879	9/29/20 21:00	9/29/20 22:00	375.86	9/29/20 21:00	9/29/20 22:00	0.585
9/29/20 22:00	9/29/20 23:00	25.495	9/29/20 22:00	9/29/20 23:00	373.64	9/29/20 22:00	9/29/20 23:00	0.573
9/29/20 23:00	9/30/20 0:00	26.271	9/29/20 23:00	9/30/20 0:00	383.42	9/29/20 23:00	9/30/20 0:00	0.082
9/30/20 0:00	9/30/20 1:00	26.327	9/30/20 0:00	9/30/20 1:00	387.22	9/30/20 0:00	9/30/20 1:00	-0.009
9/30/20 1:00	9/30/20 2:00	26.349	9/30/20 1:00	9/30/20 2:00	387.70	9/30/20 1:00	9/30/20 2:00	-0.009
9/30/20 2:00	9/30/20 3:00	26.432	9/30/20 2:00	9/30/20 3:00	388.44	9/30/20 2:00	9/30/20 3:00	-0.009
9/30/20 3:00	9/30/20 4:00	26.432	9/30/20 3:00	9/30/20 4:00	388.90	9/30/20 3:00	9/30/20 4:00	-0.012
9/30/20 4:00	9/30/20 5:00	26.117	9/30/20 4:00	9/30/20 5:00	382.17	9/30/20 4:00	9/30/20 5:00	-0.014
9/30/20 5:00	9/30/20 6:00	14.891	9/30/20 5:00	9/30/20 6:00	329.97	9/30/20 5:00	9/30/20 6:00	-0.015
9/30/20 6:00	9/30/20 7:00	2.599	9/30/20 6:00	9/30/20 7:00	193.10	9/30/20 6:00	9/30/20 7:00	-0.016
9/30/20 7:00	9/30/20 8:00	24.814	9/30/20 7:00	9/30/20 8:00	339.73	9/30/20 7:00	9/30/20 8:00	2.966
9/30/20 8:00	9/30/20 9:00	25.197	9/30/20 8:00	9/30/20 9:00	374.30	9/30/20 8:00	9/30/20 9:00	4.936
9/30/20 9:00	9/30/20 10:00	24.884	9/30/20 9:00	9/30/20 10:00	375.11	9/30/20 9:00	9/30/20 10:00	3.188
9/30/20 10:00	9/30/20 11:00	24.890	9/30/20 10:00	9/30/20 11:00	374.56	9/30/20 10:00	9/30/20 11:00	0.694
9/30/20 11:00	9/30/20 12:00	24.868	9/30/20 11:00	9/30/20 12:00	375.81	9/30/20 11:00	9/30/20 12:00	3.824
9/30/20 12:00	9/30/20 13:00	24.657	9/30/20 12:00	9/30/20 13:00	370.87	9/30/20 12:00	9/30/20 13:00	3.845
9/30/20 13:00	9/30/20 14:00	24.564	9/30/20 13:00	9/30/20 14:00	368.00	9/30/20 13:00	9/30/20 14:00	0.913
9/30/20 14:00	9/30/20 15:00	24.589	9/30/20 14:00	9/30/20 15:00	367.27	9/30/20 14:00	9/30/20 15:00	0.913
9/30/20 15:00	9/30/20 16:00	24.785	9/30/20 15:00	9/30/20 16:00	367.73	9/30/20 15:00	9/30/20 16:00	0.892
9/30/20 16:00	9/30/20 17:00	24.839	9/30/20 16:00	9/30/20 17:00	368.31	9/30/20 16:00	9/30/20 17:00	1.814
9/30/20 17:00	9/30/20 18:00	24.954	9/30/20 17:00	9/30/20 18:00	369.09	9/30/20 17:00	9/30/20 18:00	4.895
9/30/20 18:00	9/30/20 19:00	25.107	9/30/20 18:00	9/30/20 19:00	370.50	9/30/20 18:00	9/30/20 19:00	4.924
9/30/20 19:00	9/30/20 20:00	25.302	9/30/20 19:00	9/30/20 20:00	372.45	9/30/20 19:00	9/30/20 20:00	4.959
9/30/20 20:00	9/30/20 21:00	25.324	9/30/20 20:00	9/30/20 21:00	373.20	9/30/20 20:00	9/30/20 21:00	4.964
9/30/20 21:00	9/30/20 22:00	25.385	9/30/20 21:00	9/30/20 22:00	372.93	9/30/20 21:00	9/30/20 22:00	4.977
9/30/20 22:00	9/30/20 23:00	25.529	9/30/20 22:00	9/30/20 23:00	374.26	9/30/20 22:00	9/30/20 23:00	5.002
9/30/20 23:00	10/1/20 0:00	25.619	9/30/20 23:00	10/1/20 0:00	375.26	9/30/20 23:00	10/1/20 0:00	5.015

Appendix F

Reboiler/SCR Outlet

Location Koppers Naphthalene Distillation Plant - Cicero, IL
Source Reboiler/SCR Outlet - Condition 2
Project No. 20-1351

Run No.	1	
Date	9/29/20	
Status	VOID	
Start Time	14:33	
Stop Time	14:43	
Leak Check	Pass	
Traverse Point	Δ P (in. WC)	Ts (°F)
A1	0.27	580
2	0.30	581
3	0.32	581
4	0.34	583
5	0.35	584
6	0.33	584
7	0.33	583
8	0.29	579
B1	0.34	577
2	0.37	579
3	0.34	582
4	0.35	583
5	0.36	584
6	0.33	583
7	0.32	581
8	0.31	580

Square Root of ΔP, (in. WC)^1/2	(ΔP)^1/2	--
Average ΔP, in. WC	(ΔP)	--
Pitot Tube Coefficient	(Cp)	--
Barometric Pressure, in. Hg	(Pb)	--
Static Pressure, in. WC	(Pg)	--
Stack Pressure, in. Hg	(Ps)	--
Average Temperature, °F	(Ts)	--
Average Temperature, °R	(Ts)	--
Measured Moisture Fraction	(BWSmsd)	--
Moisture Fraction @ Saturation	(BWSsat)	--
Moisture Fraction	(BWS)	--
O2 Concentration, %	(O2)	--
CO2 Concentration, %	(CO2)	--
Molecuar Weight, lb/lb-mole (dry)	(Md)	--
Molecuar Weight, lb/lb-mole (wet)	(Ms)	--
Velocity, ft/sec	(Vs)	--
VFR at stack conditions, acfm	(Qa)	--
VFR at standard conditions, scfh	(Qsw)	--
VFR at standard conditions, scfm	(Qsw)	--
VFR at standard conditions, dscfm	(Qsd)	--

Alliance
SOURCE TESTING

Location Koppers Naphthalene Distillation Plant - Cicero, IL
Source Reboiler/SCR Outlet - Condition 2
Project No. 20-1351
Parameter(s): VFR
Console Type Meter Box

Run No.		1
Date		9/29/20
Status		VOID
Start Time		14:33
End Time		15:33
Run Time, min	(θ)	60
Meter ID		T9B
Meter Correction Factor	(Y)	0.995
Orifice Calibration Value	(ΔH @)	1.823
Max Vacuum, in. Hg		4
Post Leak Check, ft3/min (at max vac.)		0.002
Meter Volume, ft3		
0		0.000
5		3.010
10		6.931
15		10.332
20		13.672
25		17.120
30		20.330
35		23.510
40		26.660
45		29.120
50		32.320
55		36.450
60		40.758
65		
70		
75		
80		
85		
90		
95		
100		
105		
110		
115		
120		
Total Meter Volume, ft3	(Vm)	40.758

Temperature, °F		Meter	Probe	Filter	Vacuum	Imp. Exit
0		67	--	--	4	52
5		67	--	--	4	52
10		67	--	--	4	55
15		68	--	--	4	58
20		68	--	--	4	58
25		68	--	--	4	58
30		69	--	--	4	59
35		69	--	--	4	59
40		69	--	--	4	60
45		70	--	--	4	62
50		70	--	--	4	64
55		71	--	--	4	65
60		72	--	--	4	66
65		--	--	--	--	--
70		--	--	--	--	--
75		--	--	--	--	--
80		--	--	--	--	--
85		--	--	--	--	--
90		--	--	--	--	--
95		--	--	--	--	--
100		--	--	--	--	--
105		--	--	--	--	--
110		--	--	--	--	--
115		--	--	--	--	--
120		--	--	--	--	--
Average Temperature, °F	(Tm)	69	--	--	--	--
Average Temperature, °R	(Tm)	529	--	--	--	--
Minimum Temperature, °F		67	--	--	--	--
Maximum Temperature, °F		72	--	--	--	66

Barometeric Pressure, in. Hg	(Pb)	29.25
Meter Orifice Pressure , in. WC	(ΔH)	1.500
Meter Pressure, in. Hg	(Pm)	29.36
Standard Meter Volume, ft3	(Vmstd)	39.732

Analysis Type	Gravimetric			
Impinger 1, Pre/Post Test, mL	H2O	737.5	872.3	134.8
Impinger 2, Pre/Post Test, mL	H2O	751.6	756.0	4.4
Impinger 3, Pre/Post Test, mL	Empty	645.3	647.3	2.0
Impinger 4, Pre/Post Test, g	Silica	853.7	855.3	1.6

Volume Water Collected, mL	(Vlc)	142.8
Standard Water Volume, ft³	(Vwstd)	6.733
Moisture Fraction Measured	(BWS)	0.145
Gas Molecular Weight, lb/lb-mole (dry)	(Md)	29.58
DGM Calibration Check Value	(Yqa)	-0.7

Run 1 - CEMS Data

Alliance SOURCE TESTING

Location: Koppers Naphthalene Distillation Plant - Cicero, IL
Source: Reboiler/SCR Outlet - Condition 2
Project No.: 2020-1351
Date: 9/29/20

Time Unit Status	O_2 - Outlet % dry Void	CO_2 - Outlet % dry Void	NOx - Outlet ppmvd Void	SO_2 - Outlet ppmvd Void
14:33	7.72	7.88	54.74	0.10
14:34	7.72	7.87	54.83	0.09
14:35	7.69	7.89	54.96	0.10
14:36	7.70	7.89	54.94	0.08
14:37	7.72	7.89	54.93	0.10
14:38	7.72	7.89	54.74	0.10
14:39	7.73	7.89	55.05	0.07
14:40	7.71	7.90	55.20	0.08
14:41	7.72	7.89	55.02	0.10
14:42	7.72	7.89	55.16	0.10
14:43	7.78	7.86	54.75	0.08
14:44	7.82	7.82	54.58	0.10
14:45	7.82	7.84	54.65	0.10
14:46	7.82	7.82	54.58	0.10
14:47	7.76	7.84	54.66	0.08
14:48	7.70	7.89	55.06	0.10
14:49	7.74	7.87	54.95	0.10
14:50	7.74	7.87	54.92	0.10
14:51	7.75	7.87	55.04	0.10
14:52	7.75	7.88	55.03	0.10
14:53	7.73	7.88	55.19	0.10
14:54	7.69	7.91	55.23	0.10
14:55	7.71	7.89	55.21	0.10
14:56	7.76	7.86	55.03	0.10
14:57	7.74	7.88	55.13	0.10
14:58	7.71	7.89	54.82	0.10
14:59	7.77	7.86	54.81	0.10
15:00	7.77	7.85	54.93	0.10
15:01	7.75	7.87	55.13	0.10
15:02	7.67	7.91	55.39	0.10
15:03	7.61	7.94	55.20	0.10
15:04	7.77	7.84	54.80	0.10
15:05	7.85	7.80	54.62	0.10
15:06	7.87	7.79	54.60	0.10
15:07	7.86	7.80	54.93	0.10
15:08	7.81	7.83	54.78	0.10
15:09	7.85	7.80	54.51	0.10
15:10	7.89	7.79	54.78	0.10
15:11	7.86	7.81	54.78	0.10
15:12	7.82	7.82	55.00	0.10
15:13	7.85	7.80	54.90	0.11
15:14	7.87	7.78	54.64	0.10
15:15	8.20	7.60	51.34	0.10
15:16	8.89	7.15	53.02	0.10
15:17	7.84	7.84	55.17	0.10
15:18	7.79	7.82	55.29	0.10
15:19	7.81	7.82	55.24	0.10
15:20	7.85	7.81	55.13	0.10
15:21	7.86	7.80	55.15	0.10
15:22	7.81	7.82	55.30	0.10
15:23	7.80	7.83	55.65	0.10
15:24	7.82	7.81	55.37	0.10
15:25	7.80	7.82	55.44	0.10
15:26	7.78	7.83	55.38	0.10
15:27	7.79	7.82	55.37	0.10
15:28	7.75	7.84	55.31	0.10
15:29	7.89	7.76	54.55	0.10
15:30	8.12	7.68	51.90	0.10
15:31	9.24	7.03	49.65	0.10
15:32	9.26	7.09	49.43	0.10

Parameter	O_2 - Outlet	CO_2 - Outlet	NOx - Outlet	SO_2 - Outlet
Uncorrected Run Average (C_{obs})	-	-	-	-
Cal Gas Concentration (C_{MA})	10.0	10.00	125.0	25.0
Pretest System Zero Response	0.00	0.05	0.19	0.01
Posttest System Zero Response	0.07	0.04	0.19	0.00
Average Zero Response (Co)	0.0	0.0	0.2	0.0
Pretest System Cal Response	9.94	9.90	125.23	25.30
Posttest System Cal Response	9.98	9.89	124.81	25.28
Average Cal Response (C_M)	10.0	9.9	125.0	25.3
Corrected Run Average (Corr)	-	-	-	-

Location: Koppers Naphthalene Distillation Plant - Cicero, IL
Source: Reboiler/SCR Outlet - Condition 2
Project No.: 2020-1351
Date: 9/29/20

Time Unit Status	Temperature °C Void	Pressure atm Void	Ammonia - Outlet ppmvw Void	BWS - Outlet % (wet) Void
14:33				
14:34	190.7	0.893	1.3	15.1
14:35	190.7	0.893	1.2	15.4
14:36	190.7	0.893	1.2	15.3
14:37	190.7	0.893	1.1	15.2
14:38	190.7	0.893	1.1	15.1
14:39	190.7	0.893	1.0	15.1
14:40	190.7	0.893	1.0	15.1
14:41	190.7	0.893	1.0	15.3
14:42	190.7	0.893	1.0	15.1
14:43	190.7	0.893	0.9	15.0
14:44	190.7	0.894	0.9	14.8
14:45	190.7	0.893	0.9	15.1
14:46	190.7	0.893	0.9	15.2
14:47	190.7	0.893	0.8	15.1
14:49	190.7	0.893	0.9	15.2
14:50	190.7	0.893	0.8	15.1
14:51	190.7	0.893	0.8	15.1
14:52	190.7	0.893	0.7	15.2
14:53	190.7	0.893	0.8	15.1
14:54	190.7	0.893	0.7	15.2
14:55	190.7	0.893	0.7	15.2
14:56	190.7	0.893	0.7	15.2
14:57	190.7	0.893	0.7	15.2
14:58	190.7	0.894	0.7	15.1
14:59	190.6	0.893	0.7	15.3
15:00	190.6	0.893	0.6	15.2
15:01	190.6	0.893	0.6	15.5
15:02	190.6	0.893	0.6	15.0
15:03	190.7	0.893	0.6	15.2
15:04	190.7	0.893	0.5	15.1
15:05	190.7	0.893	0.6	15.2
15:06	190.7	0.894	0.5	15.3
15:07	190.7	0.893	0.5	15.4
15:08	190.7	0.893	0.5	15.3
15:10	190.7	0.894	0.5	15.0
15:11	190.7	0.893	0.5	15.3
15:12	190.7	0.895	0.5	14.8
15:13	190.7	0.894	0.5	15.0
15:14	190.6	0.893	0.4	15.2
15:15	190.6	0.893	0.4	15.2
15:16	190.7	0.893	0.5	15.2
15:17	190.7	0.893	0.5	15.0
15:18	190.7	0.893	0.4	15.0
15:19	190.7	0.894	0.4	14.9
15:20	190.7	0.894	0.4	14.4
15:21	190.7	0.894	0.4	15.0
15:22	190.7	0.894	0.4	14.8
15:23	190.7	0.894	0.4	14.7
15:24	190.7	0.893	0.4	15.2
15:25	190.6	0.894	0.4	14.6
15:26	190.6	0.893	0.4	15.6
15:27	190.6	0.894	0.4	15.0
15:28	190.7	0.894	0.4	14.9
15:29	190.7	0.894	0.3	15.0
15:30	190.7	0.894	0.3	15.0
15:32	190.7	0.894	0.3	15.2
15:33	190.7	0.894	0.3	15.0

Parameter	Temperature	Pressure	Ammonia - Outlet	BWS - Outlet
Run Average	-	-	-	-

Alliance SOURCE TESTING

Bias/Drift Determinations

Location: Koppers Naphthalene Distillation Plant - Cicero, IL
Source: Reboiler/SCR Outlet - Condition 2
Project No.: 2020-1351

Parameter	O_2 - Outlet	CO_2 - Outlet	NOx - Outlet	SO_2 - Outlet
Run 1 Date 9/29/20				
Span Value	20.0	19.8	250.0	50.0
Instrument Zero Cal Response	0.0	0.0	0.2	0.0
Instrument Mid Cal Response	10.0	9.9	125.2	25.3
Pretest System Zero Response	0.0	0.1	0.2	0.0
Posttest System Zero Response	0.1	0.0	0.2	0.0
Pretest System Mid Response	9.9	9.9	125.2	25.3
Posttest System Mid Response	10.0	9.9	124.8	25.3
Bias (%)				
Pretest Zero	0.0	0.3	0.0	0.0
Posttest Zero	0.4	0.2	0.0	0.0
Pretest Span	0.1	0.1	0.0	0.0
Posttest Span	0.1	0.0	0.2	0.0
Drift (%)				
Zero	0.4	0.1	0.0	0.0
Mid	0.2	0.1	0.2	0.0

Main Stack

Alliance
SOURCE TESTING

Isokinetic Field Data

Location:	Koppers Naphthalene Distillation Plant - Cicero, IL	Start Time:	14:33	Source:	Main Stack - Condition 2 Natural Gas
Date:	9/29/20 Run 1 VOID	End Time:	16:39	Project No.:	2020-1351 Parameter: PM/CPM

STACK DATA (EST)		EQUIPMENT		STACK DATA (EST)		FILTER NO.	STACK DATA (FINAL)		MOIST. DATA
Moisture:	18.0 % est.	Meter Box ID:	5828	Est. Tm:	70 °F	13205	Pb:	29.25 in. Hg	Vlc (ml)
Barometric:	29.25 in. Hg	Y:	1.013	Est. Ts:	150 °F		Pg:	-0.07 in. WC	506.1
Static Press:	-0.07 in. WC	ΔH @ (in.WC):	1.555	Est. ΔP:	0.03 in. WC		O_2:	9.9 %	K-FACTOR
Stack Press:	29.24 in. Hg	Probe ID:	PR-606-0	Est. Dn:	0.546 in.		CO_2:	6.1 %	42.572
CO_2:	9.7 %	Liner Material:	glass	Target Rate:	0.80 scfm				
O_2:	8.6 %	Pitot ID:	PT-606-0						
N_2/CO:	81.7 %	Pitot Cp/Type:	0.840 S-type						
Md:	29.90 lb/lb-mole	Nozzle ID:	SS-602-4 SS						
Ms:	27.75 lb/lb-mole	Nozzle Dn (in.):	0.520						

LEAK CHECK:	Pre	Mid 1	Mid 2	Mid 3	Post
Leak Rate (cfm):	0.000	--	--	--	0.000
Vacuum (in Hg):	15	--	--	--	10
Pitot Tube:	Pass	--	--	--	Pass

Check Pt.	Initial	Final	Corr.
Mid 1 (cf)			--
Mid 2 (cf)			--
Mid 3 (cf)			--
Mid-Point Leak Check Vol (cf):			--

Sample Pt.	Sample Time (minutes) Begin	End	Dry Gas Meter Reading (ft³)	Pitot Tube ΔP (in WC)	Gas Temperatures (°F) DGM Average	Stack	Orifice Press. ΔH (in. WC) Ideal	Actual	Pump Vac (in. Hg)	Gas Temperatures (°F) Probe	Filter	Imp Exit	Aux	% ISO	Vs (fps)
					Amb. --	Amb. --				Amb. --	Amb. --	Amb. --	Amb. --		
A1	0.00	5.00	271.760	0.050	64	148	2.11	2.10	7	264	258	56	66	99.8	13.90
2	5.00	10.00	276.015	0.055	65	150	2.32	2.30	8	250	250	53	67	99.6	14.60
3	10.00	15.00	280.470	0.050	66	150	2.11	2.10	7	247	241	59	68	99.2	13.92
4	15.00	20.00	284.710	0.045	67	151	1.90	1.90	7	247	249	67	69	99.5	13.22
5	20.00	25.00	288.750	0.040	69	151	1.70	1.70	6	251	247	66	70	99.7	12.46
6	25.00	30.00	292.585	0.035	69	150	1.49	1.50	6	261	251	65	68	99.8	11.65
7	30.00	35.00	296.180	0.040	70	151	1.70	1.80	7	252	244	65	67	99.2	12.46
8	35.00	40.00	300.000	0.030	71	150	1.28	1.30	5	257	241	65	67	98.5	10.78
9	40.00	45.00	303.300	0.030	71	150	1.28	1.30	5	235	245	65	68	100.5	10.78
10	45.00	50.00	306.665	0.030	71	150	1.28	1.30	6	251	230	64	68	99.9	10.78
11	50.00	55.00	310.010	0.030	70	150	1.28	1.30	6	243	228	60	69	100.4	10.78
12	55.00	60.00	313.365	0.035	70	150	1.49	1.50	7	242	229	58	68	95.7	11.65
B1	60.00	65.00	316.820	0.060	67	149	2.54	2.50	9	261	245	58	67	94.4	15.24
2	65.00	70.00	321.250	0.060	67	149	2.54	2.50	9	259	248	56	67	96.2	15.24
3	70.00	75.00	325.765	0.060	68	150	2.54	2.50	9	250	250	60	68	99.8	15.25
4	75.00	80.00	330.450	0.065	66	149	2.74	2.70	10	257	246	62	69	93.4	15.86
5	80.00	85.00	335.000	0.060	67	149	2.54	2.50	9	250	249	64	70	97.6	15.24
6	85.00	90.00	339.580	0.050	66	149	2.11	2.10	8	257	248	62	71	99.8	13.91
7	90.00	95.00	343.850	0.040	67	151	1.69	1.70	7	253	255	62	71	100.7	12.46
8	95.00	100.00	347.710	0.040	67	150	1.69	1.70	7	256	255	62	72	95.4	12.45
9	100.00	105.00	351.370	0.035	68	150	1.48	1.50	6	256	255	60	72	105.1	11.65
10	105.00	110.00	355.150	0.025	69	150	1.06	1.10	5	248	252	59	73	99.6	9.84
11	110.00	115.00	358.185	0.025	68	150	1.06	1.10	5	251	252	57	73	102.7	9.84
12	115.00	120.00	361.310	0.025	68	147	1.07	1.10	5	255	254	57	73	108.1	9.82
	Final DGM:		364.605												

RESULTS	Run Time	Vm	ΔP	Tm	Ts	Max Vac	ΔH	%ISO	BWS	Y_{qa}
	120.0 min	92.845 ft³	0.04 in. WC	68.0 °F	149.8 °F	10	1.796 in. WC	--	--	--

Alliance SOURCE TESTING

Location: Koppers Naphthalene Distillation Plant - Cicero, IL
Source: Main Stack - Condition 2 Natural Gas
Project No.: 2020-1351
Date: 9/29/20

Time Unit Status	O_2 - Outlet % dry Void	CO_2 - Outlet % dry Void	CO - Outlet ppmvd Void	NOx - Outlet ppmvd Void	SO_2 - Outlet ppmvd Void	VOM - Outlet ppmvw Void
14:33	9.55	6.21	25.06	45.02	-0.09	2.58
14:34	9.54	6.22	25.42	45.15	-0.06	0.56
14:35	9.55	6.22	25.96	44.96	-0.07	0.00
14:36	9.54	6.22	25.59	45.09	0.00	1.58
14:37	9.52	6.23	24.31	45.23	-0.07	0.68
14:38	9.51	6.24	25.55	45.33	-0.12	0.00
14:39	9.52	6.23	25.82	45.20	-0.03	0.00
14:40	9.52	6.23	25.08	45.23	-0.06	0.03
14:41	9.56	6.21	25.82	45.11	-0.06	0.11
14:42	9.61	6.18	25.71	44.92	-0.01	0.00
14:43	9.62	6.18	25.69	44.81	-0.10	0.10
14:44	9.62	6.18	25.94	44.77	-0.09	0.00
14:45	9.59	6.19	25.30	44.63	-0.08	1.04
14:46	9.54	6.22	24.78	44.93	-0.06	0.93
14:47	9.58	6.20	25.40	45.04	-0.07	0.00
14:48	9.58	6.21	26.64	44.91	-0.03	0.00
14:49	9.57	6.21	24.28	44.94	-0.09	0.00
14:50	9.57	6.21	26.05	44.96	-0.09	0.21
14:51	9.55	6.22	25.76	45.02	-0.02	0.47
14:52	9.53	6.23	24.87	45.17	-0.05	0.04
14:53	9.54	6.22	26.53	44.96	-0.07	0.00
14:54	9.58	6.20	24.03	45.08	-0.06	0.00
14:55	9.56	6.21	25.56	44.95	-0.10	0.00
14:56	9.54	6.23	25.37	44.98	-0.11	0.00
14:57	9.58	6.20	26.43	44.86	-0.07	0.00
14:58	9.59	6.19	25.03	44.81	-0.03	0.00
14:59	9.57	6.20	24.86	45.05	-0.03	0.00
15:00	9.80	6.08	24.37	43.96	-0.03	0.22
15:01	10.29	5.80	22.27	41.85	-0.12	0.55
15:02	10.42	5.73	23.33	41.37	-0.13	0.00
15:03	10.46	5.71	22.45	41.39	-0.14	0.00
15:04	10.47	5.70	22.27	41.27	-0.06	0.00
15:05	10.45	5.71	22.42	41.52	-0.10	0.01
15:06	10.42	5.73	22.24	41.50	-0.06	0.00
15:07	10.47	5.70	19.84	41.16	-0.10	0.27
15:08	10.46	5.70	21.27	41.48	-0.10	0.00
15:09	10.45	5.71	22.18	41.49	-0.02	0.26
15:10	10.44	5.72	24.49	41.41	-0.06	0.00
15:11	10.44	5.72	23.30	41.51	-0.02	0.00
15:12	10.32	5.79	23.73	42.13	0.04	0.00
15:13	10.10	5.91	24.20	43.08	0.02	0.00
15:14	10.20	5.85	22.51	42.45	0.00	0.00
15:15	10.18	5.86	23.59	42.56	0.01	0.00
15:16	10.17	5.87	25.04	42.80	0.05	0.00
15:17	10.19	5.86	23.94	42.70	0.02	0.00
15:18	10.24	5.83	24.24	42.62	-0.02	0.00
15:19	10.23	5.84	22.67	42.71	-0.03	0.00
15:20	10.21	5.85	21.02	42.52	-0.05	0.00
15:21	10.18	5.87	21.91	42.92	-0.01	0.00
15:22	10.20	5.85	21.92	42.90	-0.03	0.00
15:23	10.21	5.85	22.44	42.75	-0.04	0.00
15:24	10.19	5.86	22.02	42.77	0.00	0.00
15:25	10.19	5.86	21.36	42.84	-0.04	0.00
15:26	10.18	5.86	21.77	42.65	-0.06	0.00
15:27	10.14	5.88	23.11	42.79	-0.05	0.00
15:28	10.19	5.86	24.16	42.69	-0.01	0.00
15:29	9.86	6.05	23.20	44.32	0.03	0.00
15:30	9.76	6.10	24.35	44.75	0.04	0.00
15:31	9.74	6.11	26.10	44.57	-0.01	0.00
15:32	9.69	6.14	24.19	44.48	-0.05	0.00
15:33	9.66	6.16	25.03	44.55	-0.07	0.00
15:34	9.71	6.13	26.22	44.52	-0.05	0.00
15:35	9.72	6.12	25.74	44.84	0.00	0.00
15:36	9.85	6.05	25.42	43.93	-0.04	0.00
15:37	9.77	6.09	22.06	44.17	0.00	0.00
15:38	9.78	6.09	24.07	44.11	0.07	0.00
15:39	9.76	6.10	23.84	44.29	0.02	0.00
15:40	9.81	6.07	24.81	44.26	0.00	0.00
15:41	9.64	6.17	23.36	44.74	0.01	0.00
15:42	9.69	6.15	23.30	44.47	0.09	0.00
15:43	9.80	6.08	24.02	44.09	0.00	0.00
15:44	9.83	6.07	24.97	44.05	0.08	0.00
15:45	9.91	6.03	26.27	43.80	0.10	0.00
15:46	9.99	5.98	23.88	43.45	0.08	0.00
15:47	10.00	5.97	24.39	43.53	0.00	0.00
15:48	10.08	5.93	24.06	43.35	0.02	0.00
15:49	9.82	6.08	23.64	44.19	0.01	0.00
15:50	9.72	6.14	22.78	44.75	0.06	0.00

Alliance SOURCE TESTING

Location: Koppers Naphthalene Distillation Plant - Cicero, IL
Source: Main Stack - Condition 2 Natural Gas
Project No.: 2020-1351
Date: 9/29/20

Time Unit Status	O_2 - Outlet % dry Void	CO_2 - Outlet % dry Void	CO - Outlet ppmvd Void	NOx - Outlet ppmvd Void	SO_2 - Outlet ppmvd Void	VOM - Outlet ppmvw Void
15:51	9.69	6.15	23.44	45.03	0.13	0.00
15:52	9.70	6.14	26.21	44.84	0.08	0.00
15:53	9.70	6.14	24.34	44.99	0.03	0.00
15:54	9.66	6.16	25.73	44.83	0.02	0.00
15:55	9.77	6.10	23.70	44.62	0.08	0.00
15:56	9.82	6.07	23.73	44.16	0.04	0.00
15:57	9.89	6.03	23.36	43.96	-0.01	0.00
15:58	9.73	6.12	24.42	44.56	0.07	0.00
15:59	9.80	6.08	24.01	44.36	-0.03	0.00
16:00	9.71	6.13	25.65	44.64	-0.02	0.00
16:01	9.68	6.15	24.73	44.93	0.05	0.00
16:02	9.70	6.14	23.71	44.87	0.07	0.00
16:03	9.75	6.11	24.55	44.71	0.10	0.00
16:04	9.76	6.10	23.19	44.81	0.05	0.00
16:05	9.76	6.10	23.48	44.57	0.01	0.00
16:06	9.72	6.12	23.90	44.81	0.00	0.00
16:07	9.77	6.09	22.44	44.68	0.02	0.00
16:08	9.74	6.11	24.71	44.54	0.02	0.00
16:09	9.76	6.10	24.19	44.53	-0.01	0.00
16:10	9.69	6.14	22.99	45.02	-0.02	0.00
16:11	9.73	6.11	24.23	45.07	0.04	0.00
16:12	9.70	6.13	22.31	45.32	0.02	0.00
16:13	9.72	6.13	22.94	45.36	0.08	0.00
16:14	9.71	6.13	23.28	45.26	0.07	0.00
16:15	9.63	6.18	22.02	45.57	0.03	0.00
16:16	9.65	6.17	25.60	45.43	0.05	0.00
16:17	9.70	6.14	23.40	45.63	0.13	0.00
16:18	9.71	6.14	23.37	45.57	0.05	0.00
16:19	9.66	6.16	22.03	45.43	0.07	0.00
16:20	9.69	6.14	23.20	45.10	0.08	0.00
16:21	9.64	6.17	23.78	45.59	0.00	0.00
16:22	9.62	6.19	24.11	45.58	0.14	0.00
16:23	9.66	6.17	23.36	45.65	0.09	0.00
16:24	9.77	6.10	24.94	45.40	0.10	0.00
16:25	9.79	6.09	23.90	45.55	0.10	0.00
16:26	9.63	6.18	22.41	45.89	0.09	0.00
16:27	9.67	6.16	25.00	45.51	0.10	0.00
16:28	9.68	6.15	24.11	45.77	0.10	0.00
16:29	9.62	6.19	23.92	45.74	0.10	0.00
16:30	9.58	6.21	24.34	45.82	0.16	0.00
16:31	9.64	6.18	24.44	45.68	0.20	0.00
16:32	5.99	3.25	12.60	24.81	0.13	0.00

Parameter	O_2 - Outlet	CO_2 - Outlet	CO - Outlet	NOx - Outlet	SO_2 - Outlet	VOM - Outlet
Uncorrected Run Average (C_{obs})	-	-	-	-	-	-
Cal Gas Concentration (C_{MA})	10.0	10.0	50.0	50.0	20.0	12.0
Pretest System Zero Response	0.00	0.01	0.00	0.20	0.00	0.00
Posttest System Zero Response	0.02	0.02	-0.70	0.40	0.20	-0.10
Average Zero Response (Co)	0.0	0.0	-0.4	0.3	0.1	-0.1
Pretest System Cal Response	9.90	9.90	49.20	50.00	19.90	11.80
Posttest System Cal Response	9.86	9.80	49.24	50.10	19.80	11.90
Average Cal Response (C_M)	9.9	9.9	49.2	50.1	19.9	11.9
Corrected Run Average (Corr)	-	-	-	-	-	-

Alliance SOURCE TESTING

Bias/Drift Determinations

Location: Koppers Naphthalene Distillation Plant - Cicero, IL
Source: Main Stack - Condition 2 Natural Gas
Project No.: 2020-1351

Parameter	O_2 - Outlet	CO_2 - Outlet	CO - Outlet	NOx - Outlet	SO_2 - Outlet	VOM - Outlet
Run 1 Date 9/29/20						
Span Value	20.0	19.8	100.0	100.0	40.0	25.0
Instrument Zero Cal Response	-0.1	0.0	-1.0	0.0	0.0	0.1
Instrument Mid Cal Response	9.8	9.9	50.0	50.6	20.0	11.8
Pretest System Zero Response	0.0	0.0	0.0	0.2	0.0	0.0
Posttest System Zero Response	0.0	0.0	-0.7	0.4	0.2	-0.1
Pretest System Mid Response	9.9	9.9	49.2	50.0	19.9	11.8
Posttest System Mid Response	9.9	9.8	49.2	50.1	19.8	11.9
Bias (%)						
Pretest Zero	0.3	0.1	1.0	0.2	0.0	NA
Posttest Zero	0.4	0.1	0.3	0.4	0.5	NA
Pretest Span	0.4	0.1	0.8	0.6	0.3	NA
Posttest Span	0.2	0.4	0.8	0.5	0.5	NA
Drift (%)						
Zero	0.1	0.1	0.7	0.2	0.5	0.4
Mid	0.2	0.5	0.0	0.1	0.2	0.4

Thermal Oxidizer

Location Koppers Naphthalene Distillation Plant - Cicero, IL
Source TO-5 Inlet - Condition 2
Project No. 2020-1351

Run No.	1	
Date	9/29/20	
Status	VOID	
Start Time	14:55	
Stop Time	15:11	
Leak Check	Pass	
Traverse Point	**Δ P (in. WC)**	**Ts (°F)**
A1	0.0005	85
2	0.0008	84
3	0.0006	84
4	0.0008	82
5	0.0007	83
6	0.0009	83
7	0.0007	84
8	0.0006	83
B1	0.0004	83
2	0.0006	82
3	0.0008	82
4	0.0007	83
5	0.0004	85
6	0.0009	84
7	0.0003	84
8	0.0005	83

Alliance
SOURCE TESTING

Location Koppers Naphthalene Distillation Plant - Cicero, IL
Source TO-5 Inlet - Condition 2
Project No. 2020-1351
Parameter(s): VFR
Console Type Meter Box

Run No.		1				
Date		9/29/20				
Status		VOID				
Start Time		14:33				
End Time		15:33				
Run Time, min	(θ)	60				
Meter ID		2026				
Meter Correction Factor	(Y)	1.002				
Orifice Calibration Value	(ΔH @)	1.773				
Max Vacuum, in. Hg		3				
Post Leak Check, ft3/min (at max vac.)		0.000				
Meter Volume, ft3						
0		58.174				
5		61.910				
10		65.570				
15		69.188				
20		72.815				
25		76.510				
30		80.210				
35		84.340				
40		88.100				
45		91.000				
50		95.510				
55		98.990				
60		102.050				
Total Meter Volume, ft3	(Vm)	43.876				
Temperature, °F		Meter	Probe	Filter	Vacuum	Imp. Exit
0		67	--	--	3	41
5		68	--	--	3	43
10		69	--	--	3	44
15		70	--	--	3	44
20		70	--	--	3	44
25		70	--	--	3	44
30		70	--	--	3	44
35		70	--	--	3	44
40		71	--	--	3	44
45		71	--	--	3	45
50		72	--	--	3	45
55		72	--	--	3	45
60		73	--	--	3	45
Average Temperature, °F	(Tm)	70	--	--	--	--
Average Temperature, °R	(Tm)	530	--	--	--	--
Minimum Temperature, °F		67	--	--	--	--
Maximum Temperature, °F		73	--	--	--	45
Barometeric Pressure, in. Hg	(Pb)	29.25				
Meter Orifice Pressure , in. WC	(ΔH)	1.700				
Meter Pressure, in. Hg	(Pm)	29.38				
Standard Meter Volume, ft3	(Vmstd)	42.981				
Analysis Type		Gravimetric				
Impinger 1, Pre/Post Test, mL		H2O		706.2	706.6	0.4
Impinger 2, Pre/Post Test, mL		H2O		733.5	734.2	0.7
Impinger 3, Pre/Post Test, mL		Empty		567.0	568.8	1.8
Impinger 4, Pre/Post Test, g		Silica		734.5	743.7	9.2
Volume Water Collected, mL	(Vlc)	12.1				
Standard Water Volume, ft^3	(Vwstd)	0.571				
Moisture Fraction Measured	(BWS)	0.013				
Gas Molecular Weight, lb/lb-mole (dry)	(Md)	28.84				
DGM Calibration Check Value	(Yqa)	-1.7				

Run 1 - CEMS Data

Location: Koppers Naphthalene Distillation Plant - Cicero, IL
Source: TO-5 Inlet - Condition 2
Project No.: 2020-1351
Date: 9/29/20

Time Unit Status	O_2 - Inlet % dry Void	CO_2 - Inlet % dry Void	VOM - Inlet ppmvw Void
14:33	20.76	0.01	144.53
14:34	20.76	0.01	146.86
14:35	20.76	0.01	144.86
14:36	20.76	0.01	145.57
14:37	20.76	0.01	144.77
14:38	20.76	0.01	141.89
14:39	20.76	0.01	140.32
14:40	20.76	0.01	141.39
14:41	20.76	0.01	139.02
14:42	20.76	0.01	142.93
14:43	20.76	0.01	137.44
14:44	20.76	0.01	139.48
14:45	20.76	0.01	136.69
14:46	20.76	0.01	135.27
14:47	20.76	0.01	134.99
14:48	20.76	0.01	136.78
14:49	20.76	0.01	138.26
14:50	20.76	0.01	144.25
14:51	20.76	0.01	150.54
14:52	20.76	0.01	156.94
14:53	20.75	0.01	166.57
14:54	20.75	0.01	183.61
14:55	20.76	0.01	196.07
14:56	20.75	0.01	206.66
14:57	20.75	0.01	214.33
14:58	20.75	0.01	219.16
14:59	20.75	0.01	220.62
15:00	20.75	0.01	216.30
15:01	20.75	0.01	211.30
15:02	20.75	0.01	207.58
15:03	20.75	0.01	199.98
15:04	20.75	0.01	199.45
15:05	20.75	0.01	203.35
15:06	20.75	0.01	200.36
15:07	20.75	0.01	203.78
15:08	20.75	0.01	209.55
15:09	20.75	0.01	215.13
15:10	20.75	0.01	216.59
15:11	20.75	0.01	220.57
15:12	20.75	0.01	224.96
15:13	20.75	0.01	219.33
15:14	20.75	0.01	219.18
15:15	20.75	0.01	218.89
15:16	20.75	0.01	222.75
15:17	20.75	0.01	220.76
15:18	20.75	0.01	223.69
15:19	20.75	0.01	218.64
15:20	20.75	0.01	225.08
15:21	20.75	0.01	224.53
15:22	20.75	0.01	219.88
15:23	20.75	0.01	223.97
15:24	20.75	0.01	223.80
15:25	20.75	0.01	222.57
15:26	20.75	0.01	222.65
15:27	20.75	0.01	221.01
15:28	20.75	0.01	215.43
15:29	20.75	0.01	207.01
15:30	20.76	0.01	194.33
15:31	20.75	0.01	188.02
15:32	20.75	0.01	176.59

Parameter	O_2 - Inlet	CO_2 - Inlet	VOM - Inlet
Uncorrected Run Average (C_{obs})	-	-	-
Cal Gas Concentration (C_{MA})	10.0	9.9	250.0
Pretest System Zero Response	0.02	0.00	0.09
Posttest System Zero Response	0.01	0.00	0.27
Average Zero Response (Co)	0.0	0.0	0.2
Pretest System Cal Response	9.95	9.87	123.17
Posttest System Cal Response	9.93	9.81	124.31
Average Cal Response (C_M)	9.9	9.8	123.7
Corrected Run Average (Corr)	-	-	NA

Alliance SOURCE TESTING

Bias/Drift Determinations

Location: Koppers Naphthalene Distillation Plant - Cicero, IL
Source: TO-5 Inlet - Condition 2
Project No.: 2020-1351

Parameter	O_2 - Inlet	CO_2 - Inlet	VOM - Inlet
Run 1 Date 9/29/20			
Span Value	20.0	19.8	500.0
Instrument Zero Cal Response	0.0	0.0	0.1
Instrument Mid Cal Response	10.0	9.9	249.7
Pretest System Zero Response	0.0	0.0	0.1
Posttest System Zero Response	0.0	0.0	0.3
Pretest System Mid Response	10.0	9.9	123.2
Posttest System Mid Response	9.9	9.8	124.3
Bias (%)			
Pretest Zero	0.1	0.0	NA
Posttest Zero	0.1	0.0	NA
Pretest Span	0.1	0.2	NA
Posttest Span	0.2	0.5	NA
Drift (%)			
Zero	0.1	0.0	0.0
Mid	0.1	0.3	0.2

Location Koppers Naphthalene Distillation Plant - Cicero, IL
Source TO-5 Outlet - Condition 2
Project No. 2020-1351

Run No.	1	
Date	9/29/20	
Status	VOID	
Start Time	15:15	
Stop Time	15:25	
Leak Check	Pass	
Traverse Point	Δ P (in. WC)	Ts (°F)
A1	0.019	426
2	0.028	426
3	0.033	426
4	0.038	426
5	0.020	425
6	0.021	426
7	0.043	426
8	0.032	426
B1	0.017	426
2	0.024	426
3	0.006	426
4	0.000	426
5	0.021	426
6	0.033	426
7	0.013	426
8	0.038	426

Alliance
SOURCE TESTING

Location Koppers Naphthalene Distillation Plant - Cicero, IL
Source TO-5 Outlet - Condition 2
Project No. 2020-1351
Parameter(s): VFR
Console Type Meter Box

Run No.		1				
Date		9/29/20				
Status		VOID				
Start Time		14:33				
End Time		15:33				
Run Time, min	(θ)	60				
Meter ID		1369				
Meter Correction Factor	(Y)	1.009				
Orifice Calibration Value	(ΔH @)	1.803				
Max Vacuum, in. Hg		2				
Post Leak Check, ft3/min (at max vac.)		0.000				
Meter Volume, ft3						
0		600.220				
5		602.950				
10		605.780				
15		608.450				
20		611.230				
25		614.000				
30		616.790				
35		619.500				
40		622.210				
45		625.110				
50		627.640				
55		630.540				
60		633.000				
Total Meter Volume, ft3	(Vm)	32.780				
Temperature, °F		Meter	Probe	Filter	Vacuum	Imp. Exit
0		70	--	--	2	64
5		70	--	--	2	62
10		70	--	--	2	61
15		70	--	--	2	60
20		70	--	--	2	59
25		70	--	--	2	59
30		70	--	--	2	59
35		70	--	--	2	59
40		70	--	--	2	60
45		70	--	--	2	60
50		70	--	--	2	62
55		70	--	--	2	64
60		70	--	--	2	65
Average Temperature, °F	(Tm)	70	--	--	--	--
Average Temperature, °R	(Tm)	530	--	--	--	--
Minimum Temperature, °F		70	--	--	--	--
Maximum Temperature, °F		70	--	--	--	65
Barometeric Pressure, in. Hg	(Pb)	29.25				
Meter Orifice Pressure , in. WC	(ΔH)	1.000				
Meter Pressure, in. Hg	(Pm)	29.32				
Standard Meter Volume, ft3	(Vmstd)	32.293				
Analysis Type		Gravimetric				
Impinger 1, Pre/Post Test, mL		H2O		744.0	780.8	36.8
Impinger 2, Pre/Post Test, mL		H2O		859.7	861.1	1.4
Impinger 3, Pre/Post Test, mL		Empty		767.9	768.1	0.2
Impinger 4, Pre/Post Test, g		Silica		1004.5	1010.4	5.9
Volume Water Collected, mL	(Vlc)	44.3				
Standard Water Volume, ft^3	(Vwstd)	2.089				
Moisture Fraction Measured	(BWS)	0.061				
Gas Molecular Weight, lb/lb-mole (dry)	(Md)	--				
DGM Calibration Check Value	(Yqa)	--				

Location: Koppers Naphthalene Distillation Plant - Cicero, IL
Source: TO-5 Outlet - Condition 2
Project No.: 2020-1351
Date: 9/29/20

Time Unit Status	O_2 - Outlet % dry Void	CO_2 - Outlet % dry Void	SO_2 - Outlet ppmvd Void	VOM - Outlet ppmvw Void
14:33	15.56	2.99	0.00	1.13
14:34	15.56	3.00	0.00	1.19
14:35	15.54	2.99	0.00	1.25
14:36	15.52	3.01	0.00	1.09
14:37	15.54	3.00	0.00	1.38
14:38	15.53	3.01	0.00	1.29
14:39	15.51	3.01	0.00	1.22
14:40	15.53	3.00	0.00	1.38
14:41	15.53	3.00	0.00	1.24
14:42	15.55	3.00	0.00	1.35
14:43	15.54	2.99	0.00	1.40
14:44	15.52	3.01	0.00	1.15
14:45	15.54	3.00	0.00	1.34
14:46	15.51	3.02	0.00	1.03
14:47	15.57	2.99	0.00	1.44
14:48	15.55	3.00	0.00	1.24
14:49	15.51	3.02	0.00	1.00
14:50	15.57	2.99	0.00	1.33
14:51	15.52	3.01	0.00	1.04
14:52	15.56	2.99	0.00	1.20
14:53	15.56	3.00	0.00	1.13
14:54	15.54	3.01	0.00	1.03
14:55	15.56	2.99	0.00	1.22
14:56	15.56	3.00	0.00	1.20
14:57	15.54	3.01	0.00	1.10
14:58	15.54	3.00	0.00	1.14
14:59	15.56	3.00	0.00	1.06
15:00	15.53	3.01	0.00	1.06
15:01	15.57	2.99	0.00	1.23
15:02	15.54	3.00	0.00	1.05
15:03	15.55	3.00	0.00	1.10
15:04	15.55	3.00	0.00	1.10
15:05	15.52	3.02	0.00	1.14
15:06	15.52	3.01	0.00	0.93
15:07	15.54	3.00	0.00	0.96
15:08	15.52	3.02	0.00	1.03
15:09	15.55	3.00	0.00	1.32
15:10	15.55	3.01	0.00	1.26
15:11	15.54	3.01	0.00	1.19
15:12	15.59	2.97	0.00	1.34
15:13	15.53	3.01	0.00	0.97
15:14	15.60	2.98	0.00	1.22
15:15	15.57	2.99	0.00	1.19
15:16	15.57	2.99	0.00	1.21
15:17	15.57	2.99	0.00	1.27
15:18	15.56	2.98	0.00	1.16
15:19	15.55	3.00	0.00	1.05
15:20	15.55	3.00	0.00	1.01
15:21	15.51	3.02	0.00	0.98
15:22	15.57	2.98	0.00	1.45
15:23	15.51	3.01	0.00	1.04
15:24	15.52	3.01	0.00	1.14
15:25	15.54	3.00	0.00	1.20
15:26	15.50	3.01	0.00	1.27
15:27	15.54	2.99	0.00	1.41
15:28	15.57	2.98	0.00	1.35
15:29	15.56	2.99	0.00	1.11
15:30	15.59	2.98	0.00	1.44
15:31	15.57	2.98	0.00	1.35
15:32	15.56	2.99	0.00	1.36

Parameter	O_2 - Outlet	CO_2 - Outlet	SO_2 - Outlet	VOMC - Outlet
Uncorrected Run Average (C_{obs})	-	-	-	-
Cal Gas Concentration (C_{MA})	10.0	10.0	20.0	12.0
Pretest System Zero Response	0.00	0.00	0.06	-0.20
Posttest System Zero Response	0.00	0.00	0.09	-0.30
Average Zero Response (Co)	0.0	0.0	0.1	-0.3
Pretest System Cal Response	9.90	10.00	19.61	11.80
Posttest System Cal Response	9.90	10.00	19.57	11.60
Average Cal Response (C_M)	9.9	10.0	19.6	11.7
Corrected Run Average (Corr)	-	-	-	-

Alliance SOURCE TESTING

Bias/Drift Determinations

Location: Koppers Naphthalene Distillation Plant - Cicero, IL
Source: TO-5 Outlet - Condition 2
Project No.: 2020-1351

Parameter	O_2 - Outlet	CO_2 - Outlet	SO_2 - Outlet	VOM - Outlet
Run 1 Date 9/29/20				
Span Value	20.0	19.8	40.0	25.0
Instrument Zero Cal Response	0.0	0.1	0.0	0.0
Instrument Mid Cal Response	10.0	10.0	20.2	11.8
Pretest System Zero Response	0.0	0.0	0.1	-0.2
Posttest System Zero Response	0.0	0.0	0.1	-0.3
Pretest System Mid Response	9.9	10.0	19.6	11.8
Posttest System Mid Response	9.9	10.0	19.6	11.6
Bias (%)				
Pretest Zero	0.0	0.5	0.2	NA
Posttest Zero	0.0	0.5	0.2	NA
Pretest Span	0.5	0.0	1.5	NA
Posttest Span	0.5	0.0	1.6	NA
Drift (%)				
Zero	0.0	0.0	0.1	0.4
Mid	0.0	0.0	0.1	0.8

Last Page of Report

Attachment Y

January 2024 Deviation Report

Response to Violation Notice A-2023-00162

Koppers Inc.

KOPPERS
Koppers Inc.
Carbon Materials and Chemicals
3900 South Laramie Avenue
Cicero, IL 60804-4523
Tel 708 222 3483
Fax 708 656 6079
www.koppers.com

1/23/2024

Illinois Environmental Protection Agency
Bureau of Air
Compliance Section (MC 40)
PO Box 19276
Springfield, IL 62794-9276

RE: Deviation Report
Koppers Inc., Stickney Plant
ID Number: 031300AAJ

To Whom It May Concern:

Koppers Inc. (Koppers) operates a chemical manufacturing plant in Stickney, Illinois under Clean Air Act Permit Program (CAAPP) Permit # 96030134. Condition 5.7 of the CAAPP permit requires Koppers to provide prompt notice to the Illinois Environmental Protection Agency (IEPA) of deviations from CAAPP permit requirements.

The reports are to describe the event, the probable cause of the deviations, any corrective actions or preventive measures taken, and steps to avoid future deviations. The attached Table(s) summarize deviations from a requirement of the CAAPP permit or another requirement as noted.

If there are any questions concerning this report, please contact Sidney Lipp of Koppers at (708) 427-6980.

Sincerely,

Seth Herring
Plant Manager

Table 1: Naphthalene Plant Summary of Deviations
30-Day Report

Start Time	End Time	Deviation Period (Minutes)	Duration Period (Hours)	Regulation/Permit Condition (see footnote)	Emission Rate[1] (lb/hr)	Emission (lbs)	Cause of the Event	Corrective/Preventive Action Taken
1/4/24 9:03 AM	1/4/24 9:24 AM	21.00	0.35	8,9	2.1	0.7	TO was running but atmospheric valve, XV-3671B, opened to bypass to atmosphere. Unsure why the valve opened but we were quickly able to close the valve.	Lined up process waste gas (PWG) through the scrubber
1/10/24 10:41 AM	1/10/24 12:45 PM	124.00	2.07	8,9	2.1	4.3	Attempted to fix the TO drop out leg level indicator by steaming it out. This caused the float to get stuck at 100%, which kicked out the TO. Got the TO to start and back up to temperature, but unable to line up PWG. After 124 minutes of being unable to line up PWG the vacuum pumps were shutoff. Acid washer was already down at this time.	Shutdown and did not start up until PWG was lined up
1/12/24 7:54 AM	1/12/24 10:08 AM	134.00	2.23	8,9	2.1	4.7	TO shutdown to pull positioner off of the cooling air damper to use to repair the Tar TO.	Restarted the TO and lined up PWG
1/13/24 1:12 PM	1/13/24 6:45 PM	333.00	5.55	8,9	2.1	11.7	TO kicked out due to low DP across the velocity section	Restarted the TO and lined up PWG
1/15/24 10:53 PM	1/16/24 2:19 AM	206.00	3.43	8,9	2.1	7.2	TO kicked out due to low DP across the velocity section	Kept the vacuum pump off until TO issues are resolved
1/19/24 4:38 PM	1/20/24 4:40 AM	722.00	12.033	8,9	2.1	25.3	TO kicked out from a high level in the KO pot, T-675. Once restarted, the TO struggled to get up to temperature so PWG could be lined up.	Shutdown the vacuum pump. Programming to automatically shutdown when the timer expires has been activated.

Footnotes
Emissions are based on September 2020 stack test assuming 98% control.

Regulation/Permit Conditions

1	CP#14100012 - Permit condition 2.2.1.a. (Naphthalene Plant Tanks)
2	IAC 35, § 218.302 (TO control if VOM emissions are >8 lbs/hr)
3	CP#15080025 - Permit condition 1.a. and/or 5.a. (Tube Heater #1 emission limit)
4	CP# 08040005 - Permit condition 4(b) (Pitch Tanks. 98% control)
5	CP#11100041 - Permit condition 1.a and/or 5.b. (Tube Heater #2 emission limit)
6	CP#00040051 - Permit condition 2.d. (Tar TO. 98% Control Requirement requirement)
7	35 Ill. Adm. Code 218.966(a) (81% control, Tar Distillation Process)

Table 2: Tar Plant Summary of Deviations
30-Day Report

Start Time	End Time	Deviation Period (Minutes)	Regulation/Permit Condition (see footnote)	Emission Rate (lb/hr)	Emission (lbs)	Cause of the Event	Corrective/Preventive Actions Taken
12/24/23 7:18 AM	12/24/23 8:42 AM	84.00	1,6	1.7	2.4	Lost emergency fire suppression steam supply	For process safety reasons TO was shutdown, Tar and Napthalene and Acid Washer units were shutdown
1/7/24 8:14 AM	1/7/24 8:49 AM	35.00	6	3.2	1.9	Malfunction of pressure instrument on Unit 1 caused vent valve on #2 fume system open to ATM	Repair the instrument, updated the PLC logic
1/10/24 11:58 AM	1/10/24 5:02 PM	304.00	2,6	9.3	47.1	Malfunction of control valve on Tar TO resulted in Tar TO shutdown. Barge unloading to T-101 was underway when the Tar TO shutdown. Barge loading had to continue to avoid other environmental impacts.	Complete project to Automatically Shutdown of Tar Units when Tar TO shutsdown
1/10/24 9:29 PM	1/10/24 10:14 PM	45.00	6	3.1	2.4	Malfunction of pressure instrument on Unit 1 caused vent valve on #2 fume system open to ATM	Repair the instrument, updated the PLC logic
1/10/24 11:00 PM	1/10/24 11:51 PM	51.00	6	4.6	3.9	Malfunction of control valve on Tar TO resulted in Tar TO shutdown	Complete project to Automatically Shutdown of Tar Units when Tar TO shutsdown
1/12/24 6:30 AM	1/12/24 6:32 AM	2.00	6	6.6	0.2	Malfunction of control valve on Tar TO resulted in Tar TO shutdown	Complete project to Automatically Shutdown of Tar Units when Tar TO shutsdown

Footnotes

Regulation/Permit Conditions

1 CP#14100012 - Permit condition 2.2.1.a. (Naphthalene Plant Tanks)
2 IAC 35, § 218.302 (TO control if VOM emissions are >8 lbs/hr)
3 CP#15080025 - Permit condition 1.a. and/or 5.a. (Tube Heater #1 emission limit)
4 CP# 08040005 - Permit condition 4(b) (Pitch Tanks, 98% control)
5 CP#11100041 - Permit condition 1.a and/or 5.b. (Tube Heater #2 emission limit)
6 CP#00040051 - Permit condition 2.d. (Tar TO, 98% Control Requirement requirement)
7 35 Ill. Adm. Code 218.966(a) (81% control, Tar Distillation Process)
8 CP#14100012 - Permit condition 2.1.5(a) (Naphthalene Plant Emission Limit)
9 35 Ill. Adm. Code 218.966(a) (Naphthalene TO, 81% control requirement)
10 CAAPP 96030134 - Permit Condition 7.7.9(f) Total sulfur content of naphthalene feed based on daily sampling.

Table 3: PAA Plant Summary of Deviations
30-Day Report

Date	Regulation/Permit Condition (see footnote)	Description	Cause of the Event	Corrective/Preventive Action Taken	Comments
11/30/2023	10	The naphthlene feed sample was nct taken.	Operator error - sample was not taken.	Operators are instructed to take a sample at midnight and the lab/environmental will follow up if a sample is not received allowing more time remaining in the day for a daily sample.	Emissions of SO2 from the process were well below the permit limit as measured by the SO2 CEMS. Naphthlane feed from the storage tanks to the reactors was not sampled on 11/30/2023, however, sample results from the Naphalene Plant to storage show the wt% sulfur was less than 0.8 wt%. Baased on the CEMS aand the Naphthalene Plant sampling the SO_2 permitted emission limit was not exceeded.

Footnotes
Regulation/Permit Conditions

1 CP#14100012 - Permit condition 2.2.1.a. (Naphthalene Plant Tanks)
2 IAC 35, § 218.302 (TO control if VOM emissions are >8 lbs/hr)
3 CP#15080025 - Permit condition 1.a. and/or 5.a. (Tube Heater #1 emission limit)
4 CP# 08040005 - Permit condition 4(b) (Pitch Tanks. 98% control)
5 CP#11100041 - Permit condition 1.a and/or 5.b. (Tube Heater #2 emission limit)
6 CP#00040051 - Permit condition 2.d. (Tar TO, 98% Control Requirement requirement)
7 35 Ill. Adm. Code 218.966(a) (81% control, Tar Distillation Process)
8 CP#14100012 - Permit condition 2.1.5(a) (Naphthalene Plant Emission Limit)
9 35 Ill. Adm. Code 218.966(a) (Naphthalene TO, 81% control requirement)
10 CAAPP 96030134 - Permit Condition 7.7.9(f) Total sulfur content of naphthalene feed based on daily sampling.

Attachment Z

Plot Plan

Response to Violation Notice A-2023-00162

Koppers Inc.

LCH-2663

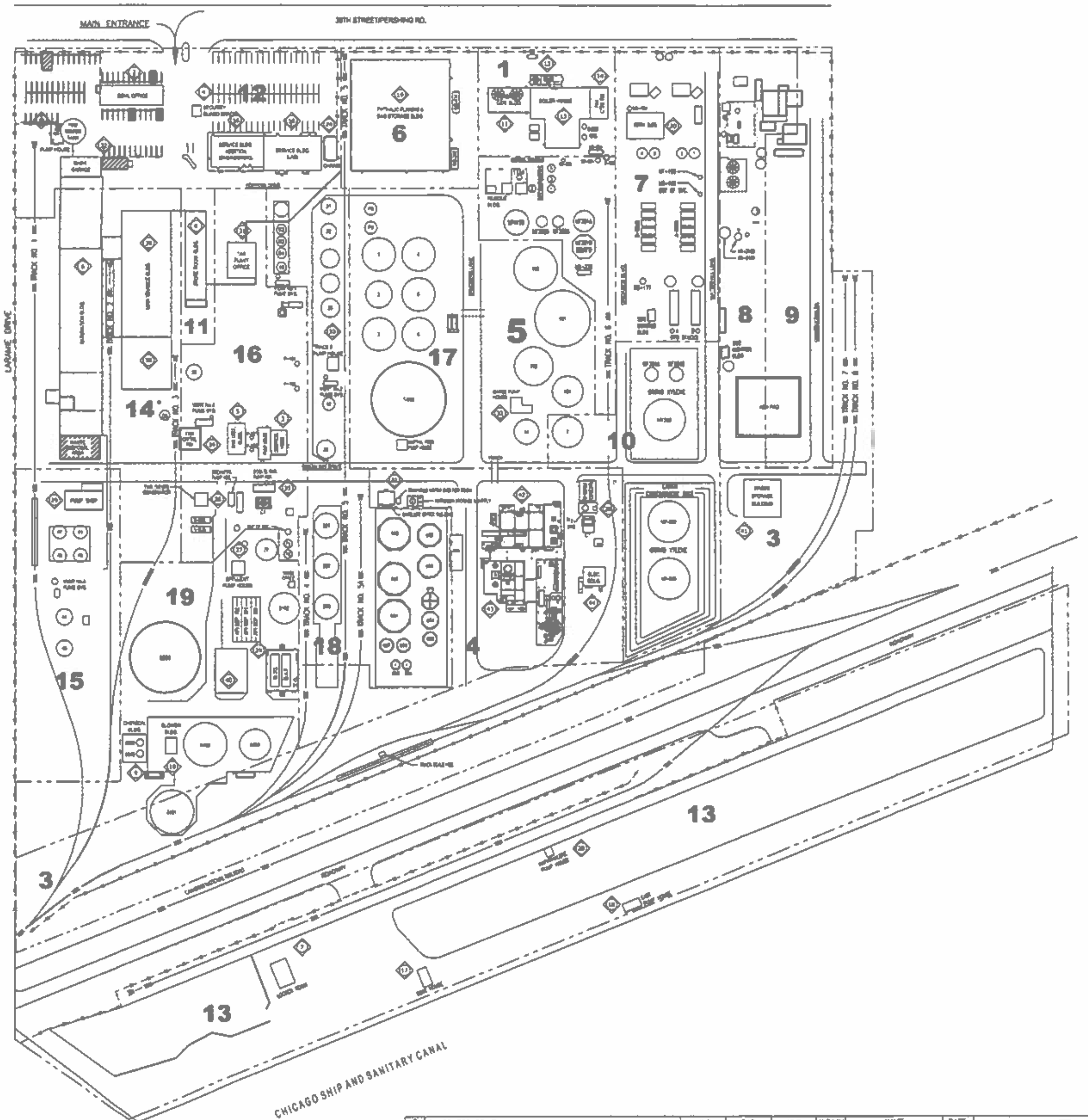
FILE ID.: LCH-2663R11

TANK DESCRIPTIONS & COMMODITIES

TAR PLANT
T-1 PETRO FEED TANK, MODIFIED PET TAR
T-2 TAR STORAGE TANK
T-3 FEED TANK,TAR/RCO COAL TAR DISTILLATE
T-4 CCOT TAR FEED TANK
T-5 CCOT TAR FEED TANK
T-6 CCOT TAR FEED TANK
T-14 SOLVENT/DECANT OIL STORAGE TANK
T-701 CCOT STORAGE TANK / CRUDE COKE OVEN TAR
T-23 LDO PRODUCTION TANK, LIGHT DISTILLATE OIL
T-25 NSR STORAGE TANK, NAPHTHALENE STILL RESIDUE
T-42 OFF-SPEC PITCH SHUTDOWN TANK
T-31 PET DISTILLATE PRODUCTION TANK
T-32 HDO PRODUCTION TANK, COAL TAR DISTILLATE
P8 PSB PRODUCTION TANK, PAVEMENT SEALER BASE
P9 PSB PRODUCTION TANK, PAVEMENT SEALER BASE
T-33 PSB PRODUCTION TANK, PAVEMENT SEALER BASE
D-5 DRUMMING TANK, OUT OF SERVICE
T-40 NSR STORAGE TANK, OUT OF SERVICE
T-62 PSB PRODUCTION TANK, OLD STYLE PITCH
T-63 STORAGE TANK, OUT OF SERVICE
T-64 STORAGE TANK, OUT OF SERVICE
T-41 ELEVATED PITCH PRODUCTION TANK
T-49 ELEVATED PITCH PRODUCTION TANK, PETRO
T-47 ELEVATED PITCH PRODUCTION TANK
T-48 ELEVATED PITCH PRODUCTION TANK
T-44 PITCH PRODUCTION TANK
T-46 PITCH PRODUCTION TANK
T-75 PSV HEADER TANK (OUT OF SERVICE)
T-76 PSV HEADER TANK
T-100 CCOT STORAGE TANK
T-101 CCOT STORAGE TANK
T-102 CCOT STORAGE TANK
T-301 CREOSOTE STORAGE TANK
T-302 CREOSOTE STORAGE TANK
T-303 CREOSOTE STORAGE TANK

NAPHTHALENE PLANT
T-649 RCO STORAGE TANK 1.
T-650 RCO STORAGE TANK 2.
T-651 STORAGE TANK
T-654 AFO STORAGE TANK
T-660 SOLVENT STORAGE TANK
T-662 NSR STORAGE TANK 1, NAPHTHALENE STILL RESIDUE
T-663 NSR STORAGE TANK 2, NAPHTHALENE STILL RESIDUE
T-664 NAPHTHALENE STORAGE TANK
T-666 OFF-SPEC NAPHTHALENE STORAGE TANK
T-667 BULK LIQUID FUEL STORAGE TANK
T-678 WASTE WATER TANK

PHTALIC ANHYDRIDE (PAA) PLANT
MF-300 ORTHO XYLENE TANK
MF-303 ORTHO XYLENE TANK
MF-301A REFINED PAA STORAGE TANK
MF-301B CRUDE PAA STORAGE TANK (OUT OF SERVICE)
MF-302A REFINED PAA DAY TANK (EAST)
MF-302B REFINED PAA DAY TANK (WEST)
MF-304A ORTHO XYLENE DAY TANK
MF-304B ORTHO XYLENE DAY TANK
MF-308 NAPHTHALENE STORAGE TANK
MF-4150 CRUDE PAA STORAGE TANK
T-7 NAPHTHALENE DAY TANK
MS-108 NSR STORAGE TANK, NAPHTHALENE STILL RESIDUE
MS-171 CAUSTIC SODA TANK (SODIUM HYDROXIDE)
MS-203 PAA STRIPPER OVERHEAD RECEIVER TANK
MS-204 MARLOTHERM OIL STORAGE TANK
MS-4204 MARLOTHERM OIL EXPANSION TANK
MS-300 FIRE SUPRESSION FOAM TANK
MS-330 PAA RESIDUE EXHAUSTER FEED TANK
MS-3106 MOBILETHERM COLD OIL TANK
MS-3108 MOBILETHERM HOT OIL TANK
MS-308 FLAKER FEED TANK, PAA REFINED
1134 PREFLASH VESSEL
1136 STRIPPER FEED TANK



AREA DESIGNATION & DESCRIPTION
BOLD NUMBERS INDICATE PLANT AREAS AS FOLLOWS:
1 BOILERHOUSE & CONTROL ROOM
2 —
3 INBOUND TRACK AREA & RESIDUE STORAGE
4 NAPHTALINE DISTILLATION
5 PAA DISTILLATION
6 PAA FLAKER AREA
7 PAA OXIDATION A & B TRAINS
8 UTILITIES
9 OPEN SPACE
10 PAA R/M TANK FARM
11 PLANT STORE ROOM
12 SERVICES AREA & PARKING
13 SHIPPING TERMINAL
14 MAINTENANCE AND SATURATION BUILDINGS
15 TAR PLANT CARBON PITCH LOADING
16 TAR PLANT DISTILLATION
17 TAR PLANT EAST TANK FARM
18 TAR PLANT WEST TANK FARM
19 WASTE WATER TREATMENT AREA

BUILDING LIST

◇ DENOTES BUILDING NO.		
	BUILDING NAME:	DWG. No.
1	—	—
2	ADMINISTRATION BUILDING	BLDG. 2
3	COMPRESSOR HOUSE	BLDG. 3
4	GUARD SHACK	BLDG. 4
5	DISTILLATION BUILDING	BLDG. 5
6	SATURATION BUILDING	BLDG. 6
7	OFFICE AND LOCKER ROOM, TERMINAL	BLDG. 7
8	RECEIVING AND STOREROOM	BLDG. 8
9	CHEMICAL BUILDING	BLDG. 9
10	BLOWER BUILDING	BLDG. 10
11	TURBINE GENERATOR BUILDING	BLDG. 11
12	DIESEL GEN. BOILER HOUSE OFFICE/MAINT.	BLDG. 12
13	BOILER HOUSE	BLDG. 13
14	PAA CONTROL ROOM	BLDG. 14
15	SERVICE BUILDING GRADE FLOOR	BLDG. 15
16	SERVICE BUILDING SECOND FLOOR	BLDG. 16
17	TERMINAL BOAT HOUSE	BLDG. 17
18	TERMINAL EAST PUMP HOUSE	BLDG. 18
19	PHTHALIC FLAKER BUILDING	BLDG. 19
20	DEMINERALIZER BUILDING	BLDG. 20
21	NAPHTHALENE BUILDING	BLDG. 21
22	GARAGE	BLDG. 22
23	FIRE PUMP HOUSE	BLDG. 23
24	GARAGE	BLDG. 24
25	DAF BUILDING	BLDG. 25
26	INSULATION SHOP	BLDG. 26
27	EFFLUENT PUMP HOUSE	BLDG. 27
28	NAPHTHALENE PUMP HOUSE	BLDG. 28
29	PUMP SHOP	BLDG. 29
30	—	BLDG. 30
31	TAR PLANT OFFICE	BLDG. 31
32	BARGE PUMP HOUSE	BLDG. 32
33	TRACK 5 PUMP HOUSE	BLDG. 33
34	TAR CONTROL ROOM	BLDG. 34
35	COOLING TOWER PUMP HOUSE	BLDG. 35
36	DECANTER PUMP HOUSE	BLDG. 36
37	—	—
38	COVERED DOCK	BLDG. 38
39	MAINTENANCE BUILDING	BLDG. 39
40	WASTE STORAGE	—
41	HAZARDOUS WASTE STORAGE	—
42	NAPHTHALENE PROCESS BUILDING	BLDG. 42
43	NAPHTHALENE EXTRACTION BUILDING	BLDG. 43
44	NAPHTHALENE ELECTRICAL BUILDING	BLDG. 44

REFERENCE	DWG NO.

REV.	DESCRIPTION	DRAWN BY	CHECKED BY	APPR'D BY	DATE
11	ISSUED FOR REVIEW	JLG	DAD	HLS	08/27/12
10	IFR T-101 PROJECT	JLG	DW	DAD	08/09/21
9	ISSUED FOR CONSTRUCTION	JLC	RLB	DAD	03/18/21

NAME: J.E. BAYLE — DATE: 08/30/12 — RT/JL

KOPPERS

CHICAGO — PLANT AREAS BUILDING LOCATIONS — 3900 S. LARAMIE, STICKNEY, IL

N.T.S.

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