DATE: May 29, 2025

TO: Andrew Washburn, Environmental Protection Engineer, State/FESOPs Unit, Permits/BOA

FROM: David Coy, Modeling Unit, Permits/BOA

SUBJECT: Iron Mountain – Data Centers – Des Plaines, Cook County, Illinois – 031063AUJ, Permit Application # 23050030

Iron Mountain (IM) is applying for a Construction Permit for a new data center located at 1680 E Touhy Ave, Des Plaines, Illinois, 60018. The complex is classified as a synthetic minor source under federal air quality regulations. IM has also applied for a Federal Enforceable State Operating Permit (FESOP).

The data center would typically draw electricity from the local power grid, but it would be equipped with 23 diesel-fired emergency generators. IM provided modeling analysis for two options, the first option is: 1 CAT C32 generator and 22 critical Cummins C3000 D6e generator (referred to as Cummins Alternative) and the second option is: 1 CAT C32 generator and 22 critical CAT C175-16 generators (Referred to as CAT Alternative). The facility intends to install a mix of Cummins and CAT generators; these two homogeneous scenarios were modeled to ensure a conservative and protective analysis. The modeling submitted accounts for the mix of generators. These generators would operate only during emergencies when the data center is unable to draw electricity from the local power grid or for routine monthly maintenance and testing of the generators.

Since IM is located in an Environmental Justice (EJ) community and would have a permitted increase in emissions, the Illinois Environmental Protection Agency (IEPA) asked the proposed facility to submit an air quality analysis as part of its construction permit application. This is to ensure that the project would not violate or threaten existing National Ambient Air Quality Standards (NAAQS). In response, IM contracted Michael Baker International (MBI) to conduct a detailed air quality dispersion modeling analysis to assess the potential impact of the data center on air quality from emissions of carbon monoxide (CO), particulate matter (PM_{10} and $PM_{2.5}$), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), volatile organic compounds (VOC) and Hazardous Air Pollutants (HAPs).

The results of this modeling report results would depend on the implementation of several control measures as outlined below in the main dot entries:

- Testing would not involve running all generators simultaneously. Every four months, the data center would test one generator at 80% load for one hour.
- In the CAT alternative, the emergency generators would be limited to an equivalent of 65 hours per year at full load for CAT C32 generator and no more than 36 hours per year each at full load for the 22 CAT C175-16 generators.

- In the Cummins alternative, the emergency generators would be limited to the equivalent of 65 hours per year at full load for each of the 23 generators (1 CAT C32 and 22 Cummins C3000).

Modeling Unit Analysis

The air quality analysis was conducted by MBI, with the initial modeling report submitted on Sept 3rd, 2024. The analysis was based on emergency operations, limited to no more than 36 hours per year for the CAT alternative and 65 hours per year for the Cummins alternative, within any consecutive 12-month period.

MBI utilized the modeling methodology detailed in the main bullet points below:

- MBI used AERMOD (version 23132)[1], which is a federally approved regulatory model for air quality analysis. The Modeling Unit also used this version for their audit runs.

- Modeling input utilized IEPA and US EPA recommended default regulatory options to simulate phenomena such as atmospheric stability, plume rise and downwash. The model used five years of locally representative meteorological data. MBI used National Weather Service (NWS) meteorological data files for the years 2018 through 2022 from the National Center for Environmental Information (NCEI). This data came from the National Weather Service: surface data from O'Hare International Airport in Chicago and upper air data from the National Weather Service in Davenport, IA. The applicant processed the weather data using AERMET (version 23132).**1** Due to the consultant using outdated data, the Modeling Unit utilized meteorological data from the years 2019 through 2023 to ensure accurate results.

- AERMOD's terrain tool, AERMAP (version 18081), was used to find the elevation of receptors, sources, and buildings. This tool reads detailed elevation maps from the National Elevation Database (NED) provided by the United States Geological Survey (USGS). The site elevation at the proposed Iron Mountain facility is about 201.8 meters above sea level.

- MBI utilized a cartesian grid to distribute a total of 1110 receptors, with receptors placed every 50 meters along the proposed facility's fence line. The following receptors grid densities in Table 1 were applied:

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[1] A new version of AERMOD, AERMAP, and AERMET (v. 24142) has been released, but it is not expected to impact the results of this modeling analysis. Therefore, the use of AERMOD (v. 23132), AERMET (v. 23132), and AERMAP (v. 18081) was approved for this analysis since the modeling was submitted before the release of the new versions.
Tillerson, Clint (2024, November 20) *Release of the Regulatory AERMOD Modeling System (AERMOD, AERMET, and AERMAP), AERSURFACE, and AERPLOT (Version 24142), and MMIF (Version 4.1.1).* US EPA https://gaftp.epa.gov/air/aqmg/scram/models/preferred/aermod/AERMOD_24142_transmittal_memo.pdf

Table 1
Receptor Grid

Discrete Cartesian Grid Format	
Spacing	**Range**
50 m	Fenceline out to 1 km.
1 km	1 km to 10 km.

- Building downwash effects on plumes from the stacks at the proposed facility were considered in the model using US EPA's Building Profile Input Program (BPIPRM version 04274). The dimension and locations of buildings and structures, including heights and coordinates, were provided by the proposed facility.

- MBI selected the urban modeling option in their analysis. Separately, The Modeling Unit, conducted its own review, which included performing an Auer's Analysis to characterize the area surrounding the proposed facility and determine whether the AERMOD urban option should be applied. The Modeling Unit developed its Auer's Analysis using 2021 National Land Cover Data (NLCD) within a 3-km radius of the proposed facility following the guidelines in Appendix W, Section 7.2.1.1 (b)(i).[2] The results of the Modeling Unit's analysis indicated that the surrounding area is 55.84% urban. Based on these findings, the Modeling Unit also used the urban modeling option.

- The US EPA's Appendix W, section 4.2.3.4 outlines the three tiers for modeling the conversion of NOx to NO_2:

    - Tier 1: Assumes that all the NOx emitted from the source's emissions units is converted to NO_2.
    - Tier 2: Uses a representative atmospheric equilibrium default value, developed from conversion ratios based on monitored NOx and NO_2 concentrations.
    - Tier 3: Allows for a detailed analysis using either the Ozone Limiting Method (OLM) or the Plume Volume Ratio Method (PVMRM) as regulatory screening options in AERMOD. These methods account for Ozone titration chemistry and the resulting NO_2 concentrations.

    MBI applied a Tier 2 approach to model NO_2. MBI used the regulatory default Ambient Ratio Method (ARM2) option in AERMOD, which utilized Ambient NO_2/NOx ratios ranging from 0.5 (lower limit) to 0.9 (upper limit).

- The modeling analysis included 23 emergency generators operating simultaneously, representing the worst-case scenario. For testing and maintenance, the proposed facility would not typically operate all 23 engines at once. The modeled emission rates varied depending on the pollutant and the averaging period. The pollutants analyzed included SO_2, NO_2, CO, PM_{10}, $PM_{2.5}$, and HAPs**.** The 1-hour NO_2 standard exceeded the NAAQS,

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[2] Appendix W to Part 51, *Guideline on Air Quality Models,* 40 CFR 51 (2023).

prompting further analysis using AERMOD MAXDCONT[3] to assess the contribution of individual sources. For the other pollutants, modeling results showed compliance with the respective NAAQS.

- For annual averaging periods**,** the 100% load condition was modeled. Emissions for each generator were annualized based on 65 hours per year of emergency operation**.** The hourly emissions in lb/hr were multiplied by the 65 hours of emergency operation and then divided by 2000 to convert the result to tons per year (TPY)**.**

- The modeling for the 1-hour SO_2**,** 1-hour CO**,** PM_{10}, $PM_{2.5}$, and HAPs standards was based on the 65 hours per year of emergency operation, and all results were below the respective NAAQS and the HAPs thresholds.

The modeling for the 1-hour NO_2 standard showed concentrations above the NAAQS. As a result, further analysis was conducted using AERMOD MAXDCONT to calculate the contribution of individual sources to the total concentration to determine if it exceeded the significant impact level (SIL) threshold. This approach follows the US EPA guidance on the 1-hour NO_2 NAAQS and uses Tier II NO_2 analysis (ARM2)**.** The modeling results showed that the 1-hour NO_2 exceeded the NAAQS, prompting this additional analysis to better understand the contribution from the emergency generators.

Significant Impact Analysis

MBI conducted a significant impact analysis to determine whether more detailed modeling was required for any of the criteria pollutants (NO_2, SO_2, CO, $PM_{2.5}$, and PM_{10}) associated with the project. Modeling for each pollutant was performed using AERMOD, and the allowable emission rates and corresponding averaging periods were calculated. The concentrations due to on-site sources were then compared to the SIL for each pollutant and averaging period, as shown in Table 2 below.

[3] US EPA (2011). *Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-hour NO_2 National Ambient Air Quality Standard* https://www.epa.gov/sites/default/files/2020-10/documents/clarificationmemo_appendixw_hourly-no2-naaqs_final_06-28-2010.pdf

Table 2
Significant Impact Modeling Results

Pollutant	Averaging Period	Modeled Concentration CAT Alternative (μg/m^3)	Modeled Concentration Cummins Alternative (μg/m^3)	Standard (μg/m^3)	Cumulative Modeling Required?
PM_{10}	24-hour	0.50	0.39	5	No
	Annual	0.11	0.09	1	No
$PM_{2.5}$	24-hour	0.50	0.33	1.2	No
	Annual	0.11	0.09	0.13	No
NO_2	1-hour	37.23	69.65	7.5	Yes
	Annual	5.75	10.17	1	Yes
CO	1-hour	4.53	3.62	2000	No
	8-hour	3.19	2.51	500	No
SO_2	1-hour	0.04	0.09	7.85	No
	3-hour	0.04	0.08	25	No

Model results for all averaging periods of PM_{10}, $PM_{2.5}$, CO, SO_2, were below their respective SILs, so no further analysis was required for these pollutants. As indicated in Table 2, peak modeled concentrations produced by the proposed emission source would cause significant impacts for the hourly and annual averaging time for NO_2.

Secondary $PM_{2.5}$ and Ozone Impacts

Precursor emissions of NOx, and SO_2, chemically react with the atmosphere to form secondary $PM_{2.5}$. Meanwhile, precursor emissions of NOx and VOM chemically react with the atmosphere to form secondary ozone (O_3). For secondary $PM_{2.5}$ emissions, MBI followed the US EPA memorandum, *Clarification on the Development of Modeling Emission Rates for Precursors (MERPs) as a Tier 1 Demonstration Tool for Ozone and $PM_{2.5}$ under the PSD Permitting Programs.*[4] Since both the annual and 24-hour $PM_{2.5}$ concentrations are below significant emission levels, further calculation of secondary contributions to $PM_{2.5}$ is not required for this analysis. According to this guidance, when the concentrations of primary pollutants like $PM_{2.5}$ are below the applicable significant emission levels the secondary contributions from precursor pollutants are not necessary to evaluate. This guidance establishes that if the primary pollutant concentrations are below the significant emission levels, it is considered unnecessary to perform additional calculations for the secondary formation of $PM_{2.5}$, as the contributions are not expected to cause or significantly contribute to a violation of air quality standards.

[4] US EPA (2024). Clarification on the Development of Modeled Emission Rates for Precursors (MERPs) as a Tier 1 Demonstration Tool for Ozone and $PM_{2.5}$ under the PSD Permitting Program https://www.epa.gov/sites/default/files/2020-09/documents/epa-454_r-19-003.pdf.

MBI also used revised and updated 40 CFR Part 51, Appendix W, as well as US EPA guidance to address precursor emission impacts to O_3. Ozone precursors are VOM and NOx. MBI used the Tier 1 approach (MERPS) to assesses ozone impacts. This methodology uses conservative assumptions about baseline conditions for NOx and VOM using photochemical modeling results, and combined with increases from the proposed project, predicts an increase in O_3 concentrations. The hypothetical source selected for this analysis was Porter County, IN based on a 500 tpy emission level and 10-meter stack height. MERPs for NOx and VOM were calculated from US EPA. Table 3 below presents the calculated impacts for the two project alternatives. The first alternative (CAT) considers project emissions of 297.01 tpy of NOx and 10.79 tpy of VOMs. The second alternative (Cummins) considers project emissions of 276.62 tpy of NOx and 5.28 tpy of VOMs.

Table 3
Tier I MERPs Analysis Results Ozone

Pollutant	Alternative	Averaging Time	SIL	Secondary Contribution ppb		Total Concentration
				NO_2	VOM	
Ozone	**CAT**	8-hour	1 ppb	0.698	0.008	0.706 ppb
	Cummins	8-hour	1 ppb	0.650	0.004	0.655 ppb

The total predicted ozone impacts from both project alternatives are below the 1 ppb SIL for 8-hour ozone.

Cumulative Impact Analysis

The results of the significant impact analysis show further analysis is required to evaluate the project’s impact against the 1-hour and annual NO_2 NAAQS. MBI developed a cumulative modeling analysis that incorporated background concentration from monitored concentrations and nearby emissions inventory sources that were not accounted for in the monitoring data.

The background monitors were selected based on their proximity and representativeness of the area surrounding the proposed facility. The background concentrations are displayed in Table 4 below.

Table 4
Monitored Background Concentrations

AQS ID	Location	Pollutant	Averaging Period	Modeled Statistic	Design Values				Units
					2021	2022	2023	2021-2023	
17-031-3103	Schiller Park, IL	NO_2	1-hour	98th percentile of daily max 1-hour concentration	54.3	51.6	54.1	53.3	ppb
			Annual	98th percentile of daily max 1-hour concentration	17.14	17.21	17.01	17.2	ppb

MBI was provided an inventory source from the Modeling Unit that included sources located within a 10 km radius from the proposed facility. For the 1-hour NO_2 analysis, intermittent sources were
excluded from the nearby sources inventory based on guidance issued by the US EPA.[5]

Table 5 shows the MBI results for the cumulative NAAQS analysis for NO_2 for CAT alternative.

Table 5
Modeled Results for NAAQs CAT Alternative

Pollutant	Averaging Period	Modeled Statistic	Modeled Concentration (μg/m³)	Background Concentration (μg/m³)	Total Concentration (μg/m³)	Standard (μg/m³)	Standard Exceeded?
NO_2	1-hour	5-Year Mean of the Annual 8th High	168.49	109.13	277.62	188	Yes
	Annual	Maximum	13.73	35.4	49.13	100	No

Table 6 shows the MBI results for the cumulative NAAQS analysis for NO_2 for Cummins alternative.

[5] US EPA (2011). *Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-hour NO_2 National Ambient Air Quality Standard* https://www.epa.gov/sites/default/files/2020-10/documents/clarificationmemo_appendixw_hourly-no2-naaqs_final_06-28-2010.pdf

Table 6
Modeled Results for NAAQs Cummins Alternative

Pollutant	Averaging Period	Modeled Statistic	Modeled Concentration (μg/m³)	Background Concentration (μg/m³)	Total Concentration (μg/m³)	Standard (μg/m³)	Standard Exceeded?
NO_2	1-hour	5-Year Mean of the Annual 8th High	280.35	109.13	389.48	188	Yes
	Annual	Maximum	13.72	35.4	49.12	100	No

NAAQS Modeling Results

The Modeling Unit audit confirmed the results of MBI's analysis, indicating that annual NO_2 concentration would be below the NAAQS, while the 1-hour NO_2 concentration would exceed the standard. For the cumulative analysis, modeled project impacts were combined with background concentrations obtained from local air monitoring stations (Schiller Park), selected for its proximity to the project site and availability of NO_2 data. Design values from 2021 to 2023 were used in the analysis.

The results showed that the combined modeled and background concentrations for annual NO_2 would not exceed the NAAQS. However, the 1-hour NO_2 concentrations did exceed the standard for both project alternatives, leading to a MAXDCONT analysis to evaluate source contributions. sources.

Generator Selection and Analysis

The highest one-hour NO_2 concentration was observed at a nearby site location due to an off-site source. Therefore, the on-site and off-site sources were divided into two groups to calculate their individual contributions to the total NO_2 concentration. The AERMOD MAXDCONT feature was used to evaluate these contributions. If the contribution from the on-site source group would not exceed the SIL for one-hour NO_2, it would not contribute to the exceedance of the one-hour NO_2 NAAQS.

Based on the modeling results, the on-site source group would exceed the SIL threshold of 7.52 μg/m³ if all generators ran simultaneously. However, generator testing would not occur with all generators running at once. Every four months, the data center would operate a single generator at 80% load for one hour, and to be conservative, the analysis assumes the generator is operating at full capacity (100% load). A screening analysis was conducted to identify which generator would produce the highest one-hour NO_2 concentration at receptor locations. The generator that would contribute the highest NO_2 concentration for the CAT Alternative was G10 (the tenth generator counting from the south), while for the Cummins Alternative**,** it was G5 (the fifth generator counting from the south).

Further AERMOD modeling with only the selected generators (G10 for CAT and G5 for Cummins) running at full load was conducted. The results of this modeling are shown in Table 7, which outlines the simulation conditions.

Table 7
Modeled Results MAXDCONT

Pollutant	Alternative	Averaging Period	Selected generator	Modeled Concentration MAXDCONT ($\mu g/m^3$)	Standard ($\mu g/m^3$)	>SIL
NO_2	CAT	1-hour	G10	5.44	7.5	No
	Cummins	1-hour	G5	6.80	7.5	No

The maximum on-site source contribution to the total concentration would not exceed the SIL threshold of 7.52 $\mu g/m^3$ for one-hour NO_2, as shown in Table 7.

Air Toxic Analysis

MBI conducted a modeling analysis for Acrolein, Benzene, Formaldehyde, and Naphthalene emissions from the generators. The total annual emissions of each of these four substances would exceed those of all other HAPs. The modeled impacts were then compared to reference concentrations from the Minnesota Department of Health's Health-Based Guidance for Air Site Assessment and Consultation Unit, as well as the US EPA’s Integrated Risk Information System.

The results of MBI’s analysis are displayed in Table 8 for CAT alternative. All modelled concentrations were below their respective reference concentrations.

Table 8
Modeled Results for HAPs CAT Alternative

Pollutant	CAS	Averaging Period	Modeled Statistic	Modeled Concentration ($\mu g/m^3$)	Risk	Standard ($\mu g/m^3$)	> HAPs	Reference
Acrolein	107-02-8	24-hour	High 1st High Over 5 Years	0.00021	Acute	5	No	Minnesota (1)
	107-02-8	Annual	High 1st High Over 5 Years	0.000040	Sub chronic	1	No	Minnesota (1)
Benzene	71-43-2	24-hour	High 1st High Over 5 Years	0.02052	Acute	30	No	Minnesota (1)
	71-43-2	Annual	High 1st High Over 5 Years	0.00418	Chronic	30	No	US EPA(2)
Formaldehyde	50-00-0	24-hour	High 1st High Over 5 Years	0.00208	Acute	50	No	Minnesota (1)
	50-00-0	Annual	High 1st High Over 5 Years	0.00042	Chronic	9	No	US EPA(2)
Naphthalene	91-20-3	24-hour	High 1st High Over 5 Years	0.00343	Acute	200	No	Minnesota (1)
	91-20-3	Annual	High 1st High Over 5 Years	0.0007	Chronic	3	No	US EPA(2)

(1) Minnesota Department of Health (MDH) Reference Exposure Levels (REL) are established for pollutants based on exposure durations.
(2) US EPA Integrated Risk Information System (IRIS)

The results of MBI's analysis are displayed in Table 9 for Cummins alternative. All modelled concentrations were below their respective reference concentrations.

Table 9
Modeled results for HAPs Cummins Alternative

Pollutant	CAS	Averaging Period	Modeled Statistic	Modeled Concentration ($\mu g/m^3$)	Risk	Standard ($\mu g/m^3$)	> HAPs	Reference
Acrolein	107-02-8	24-hour	High 1st High Over 5 Years	0.00021	Acute	5	No	Minnesota (1)
	107-02-8	Annual	High 1st High Over 5 Years	0.000040	Sub chronic	1	No	Minnesota (1)
Benzene	71-43-2	24-hour	High 1st High Over 5 Years	0.0198	Acute	30	No	Minnesota (1)
	71-43-2	Annual	High 1st High Over 5 Years	0.0041	Chronic	30	No	US EPA(2)
Formaldehyde	50-00-0	24-hour	High 1st High Over 5 Years	0.00209	Acute	50	No	Minnesota (1)
	50-00-0	Annual	High 1st High Over 5 Years	0.00043	Chronic	9	No	US EPA(2)
Naphthalene	91-20-3	24-hour	High 1st High Over 5 Years	0.00346	Acute	200	No	Minnesota (1)
	91-20-3	Annual	High 1st High Over 5 Years	0.00072	Chronic	3	No	US EPA(2)

(1) Minnesota Department of Health (MDH) Reference Exposure Levels (REL) are established for pollutants based on exposure durations.
(2) US EPA Integrated Risk Information System (IRIS)

Summary

The facility performed air dispersion modeling using two bounding worst-case scenarios to assess potential impacts from the operation of 23 emergency generators. While the facility intends to use a mix of CAT (1 CAT C32 and 22 CAT C175-16) and Cummins model (1 CAT C32 and 22 Cummins C3000), the modeling evaluated two homogeneous scenarios to ensure a conservative and protective analysis.

Based on the applicant's submittal and the Modeling Unit's review of the MBI air quality modeling, the analysis confirms that the proposed operations would not exceed the NAAQS for $PM_{2.5}$, PM_{10}, NO_2 (annual), SO_2, CO, and ozone, or the toxic-based HAP standards for Acrolein, Benzene, Formaldehyde, and Naphthalene.

For 1- hour NO_2 concentrations, under specific testing conditions where a single generator is operating at full load, the contribution from the onsite source group may approach the permissible concentration level but the overall impact is anticipated to remain within acceptable limits. Exceedances of the SIL are not expected under standard operating conditions.

This conclusion is contingent upon the inclusion of the following operational limits and conditions in the permit:

- CAT Alternative:
  - The CAT C32 generator shall be limited to no more than 65 hours per year at full load.
  - Each of the 22 CAT C175-16 generators shall be limited to no more than 36 hours at full load.
- Cummins Alternative:
  - Each of the 23 generators (1 CAT C32 and 22 Cummins C3000) shall be limited to no more than 65 hours per year at full load.
- Testing Protocol:
  - During testing of any emergency generator, no other unit shall operate during this time; instead, only one generator may be operated at a time for testing purposes.
  - One generator shall be tested every four months at 80% for one hour.

Given that both modeled scenarios reflect worst-case operating conditions and emissions remain below applicable thresholds, re-modeling of mixed configurations is not warranted.

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