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MEMORANDUM

Date: May 28, 2025

To: Andrew Washburn, FESOP/LOP Unit, Permits/BOA

From: Rain Sevenshadows and Jada Strother, Modeling Unit, Permits/BOA

Subject: International Paper Montgomery, State ID: 089055AAK, Permit Application #24100022

International Paper Company (IP) located at 1001 Knell Road, Montgomery, IL in Kane County, owns and operates a corrugated box manufacturing facility. IP currently operates the primary manufacturing equipment under a Federally Enforceable State Operating Permit (FESOP) #07010009. Centering coordinates for this facility are in Universal Transverse Mercator (UTM) Zone 16 at coordinates 387,678 meters (m) Easting and 4,620,945 meters (m) Northing. IP retained ALL4, LLC (ALL4) to assist with a construction permit application #24100022, submitted on the 25th of October 2024. The application requests authorization to construct a new Mini Flexographic Folder Gluer and Rotary Die Cutter in replacement of similar units currently authorized under the FESOP.

Since IP, as of the date of this modeling memorandum, is located in an Environmental Justice (EJ) community and would have a permitted increase in emissions, Illinois Environmental Protection Agency (IEPA) requested that IP perform an air quality modeling analysis in support of its construction permit application to confirm the project would not threaten or compromise existing National Ambient Air Quality Standards (NAAQS) from emissions of particulate matter (PM_{10} and $PM_{2.5}$). ALL4 performed an air quality dispersion modeling analysis of the proposed increases in emissions of particulate matter ($PM_{2.5}$ and PM_{10}) requested by IP.

Modeling Unit Audit

ALL4 submitted an air quality analysis report on October 25th, 2024. ALL4 then submitted a revised report with respective modeling files on December 12th, 2024, clarifying modeling processes for annual $PM_{2.5}$ SIL and NAAQS analysis. Then ALL4 submitted an updated modeling report on April 23rd, 2025, with updates on $PM_{2.5}$ emissions. ALL4 then submitted an updated modeling report on May 13th, 2025. The following main dot entries identified key aspects of the modeling methodology used in ALL4 and the Modeling Unit's analyses:

- ALL4 used AERMOD (v. 24142), AERMOD is a federally approved regulatory model appropriate for use in an air quality analysis of this nature. The audit runs done by the Modeling Unit also used this version.

- While updated versions[1] of AERMAP, and AERMET (v. 24142) have been released, the update would not impact the results of this modeling process. Therefore, the use of AERMET (v. 23132) and AERMAP (v. 18081) was accepted for this analysis. Audit runs conducted by the Modeling Unit used AERMOD (v. 24142), AERMET (v. 24142) and AERMAP (v. 24142).

- Modeling inputs utilized IEPA and USEPA recommended default regulatory options, which simulate phenomena such as atmospheric stability, plume rise, and downwash. The modeling analysis incorporated five years of locally representative meteorology. In its early review, the Modeling Unit and ALL4 obtained National Weather Service (NWS) meteorological (MET) data files for years 2019 through 2023, from the National Centers for Environmental Information (NCEI) which consisted of surface data collected at the surface station at the Chicago O'Hare International Airport, and upper air data collected at the National Weather Surface station at the Davenport Airport in Iowa. Surface and upper air stations were selected because of their proximity and representativeness to the project site in Kane County. In the Modeling Unit's review, model runs were completed with meteorological data files for years 2019 through 2023 and for years 2020 through 2024. Differences were negligible when comparing the two data sets. The Modeling Unit proceeded with the use of updated AERMET (v. 24142) information along with meteorological data files for years 2020 through 2024 in its audit review.

- ALL4 processed National Elevation Data (NED) terrain elevations from United States Geographical Survey (USGS) using the AERMAP (v. 18081) version to develop the receptor terrain elevations and hill height scales required by AERMOD. The site elevation at the facility is approximately 196 m above mean sea level.

- ALL4 used a Cartesian grid in their distribution of 2,041 receptors. The following receptor grid densities were used:
    - 25 m spacing along fence line
    - 50 m spacing from facility boundary to 500 m.
    - 100 m spacing from 500 m to 1,500 m.
    - 250 m spacing from 1,500 m to 3,000 m.
    - 500 m spacing from 3,500 m to 5,000 m.

- ALL4 selected the rural modeling option in their analysis. The Modeling Unit conducted an Auer's Analysis, using 2021 National Land Cover Data (NLCD) within a 3-kilometer (km) radius of the facility, as part of its review to characterize the area surrounding the facility and determine whether the AERMOD rural option should be implemented.

[1] 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).* USEPA

Results of the analysis showed that the surrounding area is 35% urban and 65% rural. Thus, confirming that the use of the rural modeling option by ALL4 is acceptable, the Modeling Unit audit also utilized the rural modeling option in its analysis.

- ALL4 used USEPA's Building Profile Input Program (BPIPPRM) to account for downwash effects of on-site structures. All on-site nearby buildings were included in the modeling analysis.

Significant Impact Analysis

ALL4 performed a significant impact analysis to determine if more detailed modeling would be required for any $PM_{2.5}$ and PM_{10} averaging period. ALL4 modeled the allowable emission rates for 24-hour $PM_{2.5}$, annual $PM_{2.5}$, and 24-hour PM_{10}. The results of this analysis are compared against the Significant Impact Levels (SILs) for each pollutant and averaging period. The results of this analysis can be found in **Table 1**. The Modeling Unit's results can be found in **Table 2**.

Table 1
Source Impact Analysis Results by ALL4 in µg/m^3

Pollutant	Averaging Period	Maximum Modeled Impact	Significant Impact Level
$PM_{2.5}$	24-Hour	2.22	1.2
	Annual	0.31	0.13
PM_{10}	24-Hour	6.26	5

Table 2
Source Impact Analysis Results by the Modeling Unit in µg/m^3

Pollutant	Averaging Period	Maximum Modeled Impact	Significant Impact Level
$PM_{2.5}$	24-Hour	2.20(1)	1.2
	Annual	0.31(1)	0.13
PM_{10}	24-Hour	6.47	5

(1) The maximum model impact also includes secondary $PM_{2.5}$ concentrations.

The results from both ALL4's analysis and the Modeling Unit's audit found that impacts for 24-hour $PM_{2.5}$, annual $PM_{2.5}$, and 24-hour PM_{10} would be above their respective SILs, and further analysis was necessary.

Secondary $PM_{2.5}$ Formation

The Modeling Unit considered the precursor emission increases of NO_x, and SO_2 to evaluate the contribution of secondarily formed $PM_{2.5}$. The total values presented below for $PM_{2.5}$ consider contributions from both "primary" and "secondary" $PM_{2.5}$. While primary $PM_{2.5}$ is composed of ash, soot, dust and other inherently solid materials, the constituents of secondary $PM_{2.5}$ are emitted initially in gaseous form, and eventually form solid particles as they chemically react in the atmosphere. Aside from lesser amounts of organic compounds, constituents of secondary $PM_{2.5}$ are primarily composed of nitrates and sulfates. Through chemical processes, NO_x and SO_2 transform into nitrates and sulfates, major species for $PM_{2.5}$.

The Modeling Unit calculated projected contributions of secondary $PM_{2.5}$ following guidance[2,3,4] from USEPA on modeled emission rates for precursors (MERPs). The USEPA guidance outlines the use of photochemical modeling results for hypothetical sources in conjunction with annual project emission rates of $PM_{2.5}$ to estimate expected secondary contributions to $PM_{2.5}$. MERPs for NO_x and SO_2, are applicable to IP. For its analysis, using USEPA's Qlik[5], the Modeling Unit chose a representative hypothetical source in Putnam County, Illinois.

Values shown in **Table 3** are based upon MERPs associated with project emissions of 3.2 tons per year (tpy) of NO_x and 0.1 tpy of SO_2.

[2] USEPA (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*. Office of Air Quality Planning and Standards, Research Triangle Park, NC.

[3] USEPA (2019). *Guidance on the Use of Modeled Emission Rates for Precursors (MERPs) as a Tier 1 Demonstration Tool for Ozone and $PM_{2.5}$ under the PSD Permitting Program*. Publication No. EPA 454/R–19–003. Office of Air Quality Planning and Standards, Research Triangle Park, NC.

[4] USEPA (2022). *Guidance for Ozone and Fine Particulate Matter Permit Modeling*. Publication No. EPA 454/R–22–005. Office of Air Quality Planning and Standards, Research Triangle Park, NC.

[5] https://www.epa.gov/scram/merps-view-qlik

Table 3
MERPs Analysis for Secondary $PM_{2.5}$

Pollutant	Averaging Period	Concentration ($\mu g/m^3$)
$PM_{2.5}$	24-hour	0.000352
	Annual	0.000017

The project is not significantly impacting concentrations of $PM_{2.5}$ from secondary formation estimated in the MERPs analysis tables above. The secondary $PM_{2.5}$ concentrations listed in **Table 3** from precursor emissions of NO_x and SO_2 were added to the modeled concentrations in **Table 2**.

NAAQS Analysis

A cumulative NAAQS analysis was conducted by ALL4 for 24-hour $PM_{2.5}$, annual $PM_{2.5}$, and 24-hour PM_{10}. ALL4 utilized receptors with modeled concentration exceedances from the SIL analysis for 24-hour PM_{10}. ALL4 utilized the full receptor grid for 24-hour $PM_{2.5}$ and annual $PM_{2.5}$. Background design values were used for all pollutants and their respective averaging periods. ALL4 developed a cumulative modeling analysis that incorporated nearby emission inventory sources not represented by the background monitor concentration.

The Modeling Unit developed a cumulative modeling analysis that incorporated nearby sources. The Modeling Unit utilized the receptors with modeled concentration exceedances from the SIL analysis for 24-hour PM_{10}. 24-hour $PM_{2.5}$ and annual $PM_{2.5}$ used the full receptor grid. Background design values were used by the Modeling Unit for all pollutants and their respective averaging period.

Background Concentrations for PM_{10} and $PM_{2.5}$

The selection of background monitors, **Table 4**, was based on the facility's location and the similarities in surrounding terrain. The following monitors were selected for use in this analysis:

- For 24-hour PM_{10}, the Modeling Unit and ALL4 used data collected from the Washington high school monitor (AQS ID 17-031-0022) in the southern side of the Chicago metropolitan area. The monitor is located about 68 km south-east of the facility in a well-developed area with residential, commercial, and industrial facilities. It is near interstate highways and major state routes. While the facility is in an area mainly surrounded by neighborhood streets, significant state routes are to the south and west. Overall, the monitor offers a conservative representation of the conditions surrounding the facility. Therefore, it was selected to represent the background levels of PM_{10}.

- For 24-hour and annual $PM_{2.5}$, the Modeling Unit and ALL4 use data collected from the Kane County Health Department ambient monitor in Aurora, Illinois (AQS ID 17-089-0007). The monitor is located just under 6 km north-east of the facility in an area with primarily undeveloped farmland and mixed vegetation, with a few residences. The monitor offers a conservative representation of the conditions surrounding the facility. Therefore, it was selected to represent the background levels.

Table 4
Background Monitoring Values µg/m^3

Pollutant	Monitor ID	Averaging Period	2022	2023	2024	Design Value
$PM_{2.5}$	17-089-0007	24-Hour (1)	18	25.9	14.6	19.5
		Annual (2)	9.1	9.4	6.8	8.4
PM_{10}	17-031-0022	24-Hour (3)	79	120	65	120

(1) The average of the 98th percentile concentrations per year over 3 years of monitoring data
(2) The annual arithmetic mean concentration averaged over 3 years of monitoring data.
(3) Highest 2nd high concentration over 3 years of monitoring data.

$PM_{2.5}$ and PM_{10} Cumulative Analysis

ALL4 was provided an inventory of sources from the Modeling Unit that included sources located within a 10 km radius from the center of the site.

- For 24-hour PM_{10}, ALL4 included the offsite sources within 10km for comparison to the NAAQS.

- For 24-hour $PM_{2.5}$ and annual $PM_{2.5}$, ALL4 decided to exclude nearby sources in the NAAQS analysis due to the prevailing winds from the south-west direction transporting pollution from the nearby sources to the Kane County monitor located in the north-east. The nearby sources surrounding the monitor extend a 6 km radius towards the facility, while the facility's receptors, for both annual and 24-hour, grids extend less than 170 m from the edge of the facility. Therefore, with winds from the south-west, the monitor is capturing both facility emissions and emissions from nearby sources.

ALL4's maximum modeled impacts were combined with the background concentrations and subsequently compared to the NAAQS. **Table 5**, below, represents ALL4's NAAQS results for each pollutant and their averaging periods respectively. **Table 6** below shows the Modeling Unit's NAAQS results.

Table 5
NAAQS Analysis Results by ALL4 in µg/m^3

Pollutant	Averaging Period	Maximum Modeled Impact	Background Concentration	Total Concentration	NAAQS
$PM_{2.5}$	24-Hour	1.53(1)	19.5	21	35
	Annual	0.31(2)	8.4	8.7	9
PM_{10}	24-Hour	20.80(3)	120	140.8	150

(1) Average of the 8th highs over 5 years of meteorological data.
(2) Average of the 1st highs per year over 5 years of meteorological data.
(3) Sixth highest concentration over 5 years of meteorological data.

Table 6
NAAQS Analysis Results by the Modeling Unit in µg/m^3

Pollutant	Averaging Period	Maximum Modeled Impact	Background Concentration	Total Concentration	NAAQS
$PM_{2.5}$	24-Hour	1.53(1)	19.50	21.03	35
	Annual	0.31(2)	8.40	8.71	9
PM_{10}	24-Hour	20.823)	120.00	140.82	150

(1) Average of the 8th highs over 5 years of meteorological data.
(2) Average of the 1st highs per year over 5 years of meteorological data.
(3) Sixth highest concentration over 5 years of meteorological data.

The Modeling Unit audit confirms that the combined model-predicted impacts with background concentrations for all averaging periods of $PM_{2.5}$ and PM_{10} were below their respective NAAQS. Annual $PM_{2.5}$ would not be above the NAAQS based on the model predictions.

Summary

Based upon the applicant's submittal and the Modeling Unit's audit, **Table 6**, of ALL4's modeling results, the air quality analysis confirm that the proposed operations would not exceed the NAAQS for any averaging periods of $PM_{2.5}$ and PM_{10}. ALL4's modeling results demonstrate that the proposed project would meet the air quality standards for $PM_{2.5}$ and PM_{10} and its averaging periods evaluated. The audit does confirm that emissions of NO_2, and SO_2 will not have significant impacts on secondary $PM_{2.5}$ formation.

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