ILLINOIS ENVIRONMENTAL PROTECTION AGENCY
1021 NORTH GRAND AVENUE EAST, P.O. BOX 19276, SPRINGFIELD, ILLINOIS 62794-9276 · (217) 782-3397
JB PRITZKER, GOVERNOR JAMES JENNINGS, ACTING DIRECTOR

MEMORANDUM

Date: June 13, 2025

To: Jason Schnepp, Construction Unit Manager, Permits/BOA

From: Tamara Stewart, Modeling Unit/BOA

Subject: Modeling Analysis for Alto Pekin (ID 179060ACR) – Construction Permit Application 05010062

Background

On November 1, 2005, the Illinois Environmental Protection Agency (IEPA) issued a construction/Prevention of Significant Deterioration (PSD) Approval permit for a dry mill expansion project at the production facility in Pekin next to the existing corn wet milling and ethanol production facility that is currently owned and operated by Alto Pekin, LLC (AP).[1] AP began operation of the dry mill expansion project in 2008.

The initial PSD preconstruction permit issued by the IEPA included Best Available Control Technology (BACT) for several emission units. The initial BACT limits included a 0.05 lb/mmBtu limit on emissions of nitrogen oxide (NOx) from the exhaust of a natural gas-fired thermal oxidizer/boiler ("oxidizer/boiler") used to provide emission control for the process and to supply steam for the dry mill.[2]

AP submitted an application to revise the construction permit/PSD Approval (received June 12, 2019) to increase the NOx BACT limit for the oxidizer/boiler to 0.075 lb/mmBtu. AP made this request because they are unable to consistently meet the NOx BACT limit. This is because the initial application did not account for the process NOx generated in the feed dryers in its proposed NOx BACT limit. Safety concerns also limit AP's ability to operate the oxidizer/boiler at lower NOx levels, including operating the oxidizer/boiler at reduced oxygen levels. For pollutants other than NOx, AP is not requesting any change in the permitted emissions of the oxidizer/boiler.

After a review of the application materials was discussed with the United States Environmental Protection Agency (USEPA), the IEPA requested an air quality modeling analysis from AP demonstrating compliance with the national ambient air quality standards (NAAQS) for ozone (8-hour), $PM_{2.5}$ (annual and 24-hr) and NO_2.[3]

---

[1] The plant was previously owned or operated by Aventine Renewable Energy, Inc. and Pacific Ethanol Pekin.

[2] The emission rates used in the original 2005 modeling analysis were based on a proposed limit of 0.08 lb/mmBtu, but the permit was issued at a lower emission limit of 0.05 lb/mmBtu.

[3] EPA Request for Determination on Best Available Control Technology (BACT) Issues – Ogden Martin Tulsa Municipal Waste Incinerator Facility ("If a revision to the permit is determined to be appropriate, the revision must also address all other PSD requirements which may be affected by an allowable increase

Modeling Review

The Modeling Unit reviewed the air quality modeling files and additional materials submitted by RTP Environmental Associates, Inc. (RTP), on behalf of AP. RTP's modeling procedure conformed with generally accepted air dispersion modeling practices (*Guideline on Air Quality Models,* 40 CFR Part 51, Appendix W) and with recommendations made by the Modeling Unit.

Modeling based on historic PSD requirements was received July 27, 2022. Updated modeling based on the most recent PSD requirements was received April 7, 2024. On May 6, 2024, the NAAQS for $PM_{2.5}$ was lowered from 12.0 to 9.0 micrograms/cubic meter. This prompted AP to resubmit modeling considering higher stacks for the Milling Baghouse and Feed Cooling baghouse (from 135 ft to 145 ft), reduced operation time of feed storage operations, and limits for $PM_{2.5}$ emissions, which would enable AP to meet the requirements of the new $PM_{2.5}$ NAAQS standard. Updated modeling to demonstrate compliance with the updated $PM_{2.5}$ NAAQS was received July 24, 2024. On March 19, 2025, AP sent revised modeling information considering a reduction in permitted emissions at the feed cooling baghouse. The lower permitted emissions would further reduce the $PM_{2.5}$ concentrations and would continue to show total concentrations below the SIL.

- RTP used American Meteorological Society/Environmental Protection Agency Regulatory Model (AERMOD, version 23132) in conjunction with five consecutive years of regionally representative meteorological data (2019-2023: Peoria International Airport, Peoria, Illinois surface observations; National Weather Service office, Logan County Airport, Lincoln, Illinois upper air soundings). The applicant's meteorological data was processed with AERMET, version 23132. The Modeling Unit audit runs used meteorological data from the same surface and upper air stations and were also processed with AERMET, version 23132.

- RTP processed National Elevation Data (NED) terrain elevations from USGS using the most recent version of AERMAP (v. 18081) to develop the receptor terrain elevations and hill height scales required by AERMOD.

- Newer versions of AERMOD, AERMAP, and AERMET (v. 24142)[4] have been released; the newer versions will not impact the results of this modeling analysis. Therefore, the use of AERMOD (v. 23132), AERMET (v. 23132), and AERMAP (v. 18081) was accepted for this analysis.

- The area surrounding the facility is predominantly open water, cultivated crops, and low intensity developed. RTP defined the area as rural based on its land cover assessment.

---

in permitted or newly regulated emissions (e.g. protection of the standards and increments, additional impacts, and monitoring)." The initial PSD permit was issued on November 1, 2005, prior to the promulgation of the ozone (8-hour) and $PM_{2.5}$ (annual and 24-hr) standards.

[4] 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.

Modeling Unit conducted an independent Auer's analysis using 2021 National Land Cover Data (NLCD) and determined that the area surrounding the AP facility was approximately 73% rural and 27% urban. Modeling Unit results confirm that running AERMOD without implementing the urban option is appropriate.

- NO_2 modeling options consist of multiple tiers. Tier 1 assumes that all NOx emitted from emission units at the source converts to NO_2. Tier 2 is based upon a representative atmospheric equilibrium default value that was developed using conversion ratios generated from monitored concentrations of NOx and NO_2. Tier 3 allows the user to perform a detailed analysis using either the Ozone Limiting Method (OLM) or the Plume Volume Molar Ratio Method (PVMRM) regulatory screening options in AERMOD. These options consider the chemical mechanism of ozone titration and the resulting NO_2 concentrations. Based on the submitted modeling files, RTP used a Tier 2 approach to model NO_2. RTP selected the regulatory default Ambient Ratio Method (ARM2) option in AERMOD which uses a range of ambient NO_2/NOx ratios, with 0.5 as the lower limit and 0.9 as the upper limit.

- RTP distributed receptors across multiple Cartesian grids. RTP spaced receptors 50 meters (m) apart along AP's fence line, with a nested grid of receptors expanding beyond the property line with the following densities:

    - 50 m spacing from the property line to 500 meters (m)
    - 100 m spacing from 500 m to 1 km
    - 250 m spacing from 1 km to 2.5 km
    - 500 m spacing from 2.5 km to 5 km

- Stack heights for existing sources are less than Good Engineering Practice (GEP) stack height, and RTP used USEPA's Building Profile Input Program (BPIP-Prime) to determine building parameters for modeling building wake effects.

Significant Impact Analysis

RTP performed a significant impact analysis to determine whether more detailed modeling would be required to address the NAAQS for ozone (O_3), $PM_{2.5}$ and NO_2 associated with this project. RTP modeled the allowable emission rates for each pollutant and averaging period. Modeled concentrations were compared against significant impact levels (SIL) for each pollutant and averaging period. The results of this analysis are displayed in **Table 1** below. The total concentrations for each pollutant were below the SIL for the respective average periods; therefore, no further modeling was needed.

Table 1
Significant Impact Analysis Results

Pollutant	Averaging Period	Total Concentration	Significant Impact Level
NO_2	1-hour	6.98 μg/m^3	7.52 μg/m^3
NO_2	Annual	0.25 μg/m^3	1.0 μg/m^3
$PM_{2.5}$	24-hour	1.0 μg/m^3	1.2 μg/m^3
	Annual	0.12 μg/m^3	0.13 μg/m^3
O_3	8-hour	0.099 ppb	1.0 ppb

Ozone and Secondary $PM_{2.5}$ Formation

Precursor emissions of NOx, SO_2, and VOM chemically react with the atmosphere to form secondary $PM_{2.5}$ and ozone (O_3). The AERMOD dispersion model cannot estimate secondary formation of pollutants due to the complex chemistry and meteorological conditions involved. Secondary formation of pollutants requires complex photochemical modeling techniques. To analyze the formation of secondarily formed $PM_{2.5}$ and O_3 on their respective NAAQS, RTP followed the methodology outlined in the USEPA 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.*[5] RTP's approach, utilizing this methodology, incorporates model results from hypothetical photochemical modeling analyses, which are available through the USEPA's MERPs View Qlik tool.[6]

RTP utilized a hypothetical source located in Putnam, Illinois as it produced the worst-case scenario estimates of secondary $PM_{2.5}$ and O_3. The hypothetical source with a stack height of 10 m, and source emissions of 500 tons/year for the precursor pollutants in this case, NOx, SO_2 and VOM was utilized in the modeling analysis. RTP's results were based upon an increase in potential NOx emissions from 54.80 to 68.99 tpy and assumed no increase in potential emissions of SO_2 and VOM due to the BACT revision.[7]

[5] 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.
[6] USEPA (2019). MERPs View Qlik. *Support Center for Regulatory Atmospheric Modeling (SCRAM).* Retrieved from: https://www.epa.gov/scram/merps-view-qlik.

Ozone Impacts

Table 2 summarizes the Ozone impacts for the permit revision at the AP facility.

Table 2
MERPs Analysis for Ozone

Pollutant	Averaging Time	Concentration	SIL
Ozone	8-Hour	0.099 ppb	1.0 ppb

RTP has shown that the proposed changes to the NOx emissions limits would result in ozone impacts below the 1.0 ppb SIL. Accordingly, the proposed changes to the NOx emissions limits would not result in an exceedance of NAAQS for ozone.

Secondary $PM_{2.5}$

The secondary $PM_{2.5}$ results displayed in **Table 3** summarize the MERPs analysis that was performed for the proposed revisions.

Table 3
MERPs Analysis for $PM_{2.5}$

Pollutant	Averaging Time	Modeled Concentration	Secondary Concentration	Total Concentration	SIL
$PM_{2.5}$	24-Hour	1.01	0.013 μg/m^3	1.0	1.2 μg/m^3
	Annual	0.115	0.001 μg/m^3	0.12	0.13 μg/m^3

The secondary $PM_{2.5}$ concentrations were added to the modeled, or primary, $PM_{2.5}$ concentrations for each respective averaging period for comparison to the $PM_{2.5}$ SIL. The combined primary and secondary results were 1.0 μg/m^3 for 24-hour $PM_{2.5}$ and 0.12 μg/m^3 for annual $PM_{2.5}$ shown in **Table 1**. These results confirmed that the total concentrations for 24-hour $PM_{2.5}$ and annual $PM_{2.5}$ were below the SIL for their respective average periods, so no further modeling was needed. [8]

[8] The Modeling Unit's results were similar to the RTP values. The Modeling Unit modeled concentration for 24-hour $PM_{2.5}$ was 1.02 μg/m^3 and for annual $PM_{2.5}$ was 0.117 μg/m^3. The Modeling Unit modeled concentration for 1-hour NO_2 was 6.87 μg/m^3 and for annual NO_2 was 0.248 μg/m^3.

Additional Impacts Analysis

The PSD regulations require an additional impacts analysis that evaluates changes in air quality from local growth due to the construction and/or modification of a proposed source. This analysis also assesses the potential for visibility impairment and provides assurance that impacts on soil and vegetation will not exceed appropriate ecological soil screening levels (Eco-SSLs).

Growth Impacts Analysis

RTP stated that AP did not expect any changes in the labor pool due to the proposed revisions to the BACT limits. Therefore, no impacts due to growth were expected. The Modeling Unit agreed with this observation.

Nitrogen Deposition Analysis

To address the impacts that NOx emissions from the AP facility would have on soil and vegetation, RTP used AERMOD to calculate a maximum deposition rate of nitrogen. Only gaseous nitrogen deposition was calculated because there was not an increase in particulate matter (PM). RTP selected critical background thresholds of 5.05 kg/ha/yr from the National Atmospheric Deposition Program 2017. Combining modeled nitrogen deposition of 6.08E-05 kg/ha/yr and background nitrogen deposition rates of 5.05 kg/ha/yr yielded cumulative values of 5.05 kg/ha/yr. This value was compared to the lowest of the World Health Organization (WHO) Nitrogen Critical Loads for Neutral-Acid Species Rich Grasslands which is 20.0 kg/ha/yr.[9] RTP calculated value was below the WHO standard. The Modeling Unit confirmed this data. The Modeling Unit agreed with RTP's interpretation that nitrogen levels from gaseous deposition are within acceptable levels.

Soils and Vegetation Analysis

RTP assessed the potential impacts on soils that could result from the revision to the BACT limit.

A Soil Survey of the area on approximately 91,000 acres in size centered on the AP facility completed by United States Department of Agriculture (USDA) shows that the soil types near the facility occur in patterns called associations. There are four main associations that comprise 70% of the soils in the study area. The four associations are: Rozea-Keomah-Silvan, Rozeta-Stronghurst, Hickory-Strawn-Marseilles, and Onarga-Jasper-Dakota. The main characteristics of these soil associations are crops and pasture.

RTP presented that most agricultural lands are routinely fertilized with approximately with 100 to 300 kg/ha of nitrogen each year which far exceeds most NO_2 pollution even in heavily polluted areas. The modeled nitrogen deposition of 6.08E-05 kg/ha/yr for the project is extremely small compared to the amount of fertilizer expected to be applied in the project area.

[9] WHO Regional Office for Europe (2000). Indirect effects of acidifying compounds on natural systems: critical loads. In *Air Quality Guidelines for Europe* (Chapter 13). Retrieved from: http://www.euro.who.int/__data/assets/pdf_file/0007/123100/AQG2ndEd_13cidcomp.pdf?ua=1.

From this information, RTP concluded that soils in the area would not be adversely affected by the revision to the BACT limit. The Modeling Unit agreed with this conclusion.

Vegetation Survey

There were approximately 230,000 acres of crops harvested in Peoria County and approximately 354,000 harvested in Tazewell County in 2022. The major cash crops grown were corn and soybeans.

RTP conducted a literature search to document the potential impact of NO_2 emissions from the revision to the BACT limit on vegetation and to identify any potentially sensitive receptors with significant commercial or recreational value. RTP determined that there wasn't any particularly sensitive vegetation of significant commercial or recreational value. While RTP concluded the revision to the BACT limit would result in a small impact to ambient concentrations, any such impact would not have an adverse impact on vegetation.

Studies documenting the effects of NO_2 on agricultural crops with economic importance have yielded the following information. Wheat showed no ill effects on yield from concentrations ranging up to 1,880 $\mu g/m^3$ for 3-hour exposure periods. Soybean appeared to be the most sensitive with no effect on yield for concentration under 940 $\mu g/m^3$.[10] The effects of NO_2 on forest species was also investigated. The investigation showed that the Eastern White pine would have damage after 4-hour exposures for 35 days at concentrations of 376 $\mu g/m^3$.[11]

RTP concluded, based on the project's modeled peak 1-hour NO_2 concentration of 6.98 $\mu g/m^3$ for the proposed revision to the BACT limit, there would not be any detrimental effects to vegetation in the vicinity of AP. The Modeling Unit agreed with RTP's conclusion.

Visibility

As part of its additional impacts analysis, RTP examined how the project would affect visibility at Class I and Class II areas. The closest Class I areas to the AP facility are the Mammoth Cave National Park (Kentucky) and the Mingo Wilderness Area (Missouri). The Mammoth Cave National Park is approximately 398 km south-southeast of the AP facility and the Mingo Wilderness area is approximately 484 km south of the AP facility. Because of the distance between the project site and the nearest Class I areas, emissions from the proposed facility are not expected to have adverse impacts on visibility at the nearest Class I areas.

RTP ran an analysis with VISCREEN utilizing increases in emissions from the project for the primary pollutant associated with Class II visibility concerns, NOx. The Class II visibility analysis was performed for the General Wayne A. Downing Peoria International Airport. This area is located approximately 11 km north of the AP facility. The Modeling Unit audit confirmed the results of this analysis. The Modeling Unit agrees with RTP's assessment that Class II visibility impacts would not be anticipated with the proposed revision.

[10] "Air Quality Criteria for Oxides of Nitrogen," USEPA Pub. No. 600/8-91/O49bF (August 1993).
[11] Id.

Summary

The applicant's discussion of visibility impacts, local growth due to facility construction, and effect on vegetation and soils is acceptable. Based upon the applicant's submittal and the Modeling Unit's review, the air quality analysis for the proposed BACT revision satisfies PSD requirements with the following restraints:

- Higher stacks for the Milling Baghouse and Feed Cooling baghouse (from 135 ft to 145 ft);
- Operating limit of 4,380 hours/year for feed storage operations;
- $PM_{2.5}$ emission limit of 0.28 lb/hour for the milling units controlled by baghouse C-30;
- $PM_{2.5}$ emission limit of 0.01 lb/hour for fermentation operations controlled by the CO_2 scrubber;
- $PM_{2.5}$ emission limit of 2.96 lb/hour for the oxidizer/boiler;
- $PM_{2.5}$ emission limit of 0.88 lb/hour for the feed cooling and transport system controlled by baghouse C-70; and
- $PM_{2.5}$ emission limit of 0.14 lb/hour for the feed storage and loadout systems controlled by baghouse C-90.

cc: Jason Schnepp, CAAPP Construction Unit Manager, Permits/BOA
Bill Marr, Section Manager, Permits/BOA
Tamara Stewart, Modeling Unit Working Supervisor, Permits/BOA