ILLINOIS ENVIRONMENTAL PROTECTION AGENCY
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MEMORANDUM

Date: April 3, 2025

To: Benjamin Tapscott, Construction Unit/State Permits/BOA

From: Jason Tran, Modeling Unit, Permits/BOA

Subject: Viridis Chemical Co., ID 143065BYP, Permit Application

Viridis Chemical Co. (Viridis) submitted an initial Construction Permit application package on December 9, 2024, for a proposed relocation of an existing ethyl acetate (EA) plant in Columbus, Nebraska to Peoria, Illinois. The plant will be collocated with an existing ethanol plant owned and operated by the BioUrja Group (BioUrja). The proposed Viridis facility will manufacture EA from ethanol received from either the neighboring plant or from rail cars. The proposed Viridis plant will be treated as a separate source from the BioUrja plant. Viridis will remain independent from BioUrja in managing environmental permitting and environmental responsibilities.

The proposed plant will be in Peoria, Peoria County, IL 61602. The center of the Viridis facility is in Universal Transverse Mercator (UTM) Zone 16, at approximately 279,936 meters (m) Easting and 4,506,345 m Northing.

As of the date of this permitting decision, Viridis is in an area of Environmental Justice ("EJ") concern as identified using Illinois EPA EJ Start. In addition, the issued permit would provide for increases in permitted emissions of criteria pollutants, including nitrogen oxides (NOx), carbon monoxide (CO), volatile organic compounds (VOCs), particulate matter (PM) and sulfur dioxide (SO_2). Consequently, the Illinois EPA requested Viridis to submit an air quality analysis as part of its permit application to ensure the project would not threaten or compromise existing National Ambient Air Quality Standards (NAAQS) for any pollutant with an increase in permitted emissions.

In response to Illinois EPA's request, Viridis had PROtect, LLC (PROtect) conduct an air quality review of $PM_{2.5}$, PM_{10}, SO_2, NOx, and CO., SO_2, and VOC emissions. PROtect also conducted an air quality review for hazardous air pollutants (HAPs).

Modeling Unit Review

PROtect initially submitted an air quality analysis summary for the Viridis plant along with its modeling files to the Modeling Unit electronically on February 5th, 2025. PROtect subsequently submitted a revised analysis summary along with its updated modeling files to the Modeling Unit

on March 24th, 2025. The following main dot entries identify key aspects of the modeling methodology used in this analysis:

- PROtect used AERMOD (v. 24142), the AMS/USEPA Regulatory Model. AERMOD is a federally approved regulatory model appropriate for use in an air quality analysis of this nature. The audit runs conducted by the Modeling Unit used v. 24142.

- Modeling inputs utilized by 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. The Modeling Unit obtained National Weather Service (NWS) meteorological data files for years 2020 through 2024 from the National Centers for Environmental Information (NCEI) which consisted of surface data collected at the General Wayne A. Downing Peoria International Airport in Peoria, Illinois, and upper air data collected at Davenport Municipal Airport in Davenport, Iowa. Surface and upper air stations were selected because of their proximity and representativeness to the project site in Peoria. The Modeling Unit provided the applicant with meteorology data processed with AERMET (v. 24142) in its review.

- PROtect 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. The elevation at the project site is approximately 141 meters above mean sea level.

- PROtect used a Cartesian grid in their distribution of 1,252 receptors. The following receptor grid densities were used:
    - 50 m spacing of receptors along the site to its boundary line.
    - 100 m spacing of receptors from the boundary line meters out to 1,000 meters.
    - 250 m spacing of receptors from 1,000 meters to 2,500 meters.
    - 500 m spacing of receptors from 2,500 meters to 5000 meters.
    - 1000 m spacing of receptors from 5,000 meters to 10,000 meters.

- PROtect selected the urban modeling option in their analysis. The Modeling Unit conducted an Auer's Analysis as part of its review to characterize the area surrounding Viridis and determine whether the AERMOD urban option should be implemented. The Modeling Unit developed its Auer's Analysis using 2021 National Land Cover Data (NLCD) within a 3-km radius of the site. Results of the analysis showed that the surrounding area is 31.8% rural and 68.2% urban.

- PROtect opted to include volume sources for its $PM_{2.5}$ and PM_{10} modeling. The volume sources are used to represents the typical values of a vehicles transporting on the haul roads that are within the Viridis plant. The parameters are set to represent the dimensions of a typical vehicle at a length of 4.19 meters, width of 2.37 meter, and the height of 2.55 meters. The volume source emissions for $PM_{2.5}$ and PM_{10} are 0.0006 and 0.0023 tons per year (TPY), respectively.

- PROtect 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. Any buildings with sloped roofs in the plant are represented as tiered structures in the model.

- 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, PROtect 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.

Source Impact Analysis

PROtect performed a source impact analysis to determine if more detailed modeling would be required for SO_2, $PM_{2.5}$, PM_{10}, and CO averaging period. PROtect modeled the average allowable emission from the project, with additional $PM_{2.5}$ and PM_{10} emissions from haul roads included as volume source emission in their respective models. The results of this analysis are compared against significant impact levels for each pollutant and averaging period. The modeling analysis indicated that all pollutants did not exceed their respective Significant Impact Levels (SIL) thresholds. The results of this analysis can be found in **Table 1** below:

Table 1
Source Impact Analysis Results – Conducted by PROtect

Pollutant	Averaging Period	Maximum Modeled Impact ($\mu g/m^3$)	Significant Impact Level ($\mu g/m^3$)
NO_2	1-hour	5.80397	7.52
	8-hour	0.16141	1.0
SO_2	1-hour	0.04633	7.85
	3-hour	0.12008	25
CO	1-hour	22.3363	2000
	8-hour	5.56673	500
$PM_{2.5}$	24-hour	0.49599 (1)	1.2
	Annual	0.04549 (1)	0.2
PM_{10}	24-hour	0.7789 (2)	5.0

(1) The maximum model impact also includes secondary $PM_{2.5}$ concentrations and volume source emissions.
(2) The maximum model impact also includes PM_{10} volume source emissions.

IEPA also reviewed other averaging periods that were not conducted by PROtect. The models for the other averaging periods were based on the same emission rates for its respective pollutants. The analysis indicated that all pollutants are also below their respective SIL thresholds. The results can be found in **Table 2** below:

Table 2
Source Impact Analysis Results – Conducted by IEPA

Pollutant	Averaging Period	Maximum Modeled Impact ($\mu g/m^3$)	Significant Impact Level ($\mu g/m^3$)
SO_2	24-hour	0.05938	5.0
	Annual	0.00327	1.0
PM_{10}	Annual	0.04864(1)	1.0

(1) The maximum model impact also includes PM_{10} volume source emissions.

Based on the modeling concentration listed in **Table 1** and **Table 2**, it was determined that additional analysis for NAAQS is not needed due to the modeled concentrations for the criteria pollutants were below their respective SIL threshold concentrations.

Ozone and Secondary $PM_{2.5}$ Formation

Illinois EPA considered the precursor emission increases of NOx, SO_2, and VOM to evaluate the impact on the NAAQS from secondarily formed O_3 and $PM_{2.5}$. Results from the analysis were compared against SILs for O_3 and $PM_{2.5}$ to determine if further analysis should be completed.

To estimate the O_3 and secondary $PM_{2.5}$ formation, a Tier 1 demonstration was performed following guidance[1,2,3] from USEPA on modeled emission rates for precursors (MERPs). This approach utilizes air quality modeling results from hypothetical sources with precursor emission estimates to evaluate the project's impacts against SILs for O_3 and $PM_{2.5}$.

Illinois EPA elected to use a representative hypothetical source located in Putnam County, Illinois at approximately 60 kilometers away from the Viridis plant. Illinois EPA concluded that impacts were less than significant for all averaging periods of $PM_{2.5}$ and O_3.

Table 3 shows Illinois EPA's estimated secondary $PM_{2.5}$ impacts. The calculated concentrations were based on project emissions of 13.231 TPY of NOx and 0.001 TPY of SO_2.

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

Pollutant	Averaging Period	Concentration ($\mu g/m^3$)	SIL ($\mu g/m^3$)
$PM_{2.5}$	24-hour	0.001339	1.2
	Annual	0.000194	0.13

[1] 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.
[2] 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.
[3] 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.

Table 4 shows Illinois EPA's estimated O_3 impacts compared to the SIL. The calculated concentrations were based on project emissions of 13.231 TPY of NOx and 68.070 TPY of VOCs.

Table 4
MERPs Analysis for Ozone

Pollutant	Averaging Period	Concentration (ppb)	SIL (ppb)
O_3	8-hour	0.052	1.0

The project is not significantly impacting concentrations of O_3 or $PM_{2.5}$ from secondary formation estimated in the MERPs analysis tables above.

Air Toxics Analysis

As part of the air quality analysis for Viridis, the Modeling Unit requested the facility evaluate the impacts of toxic air pollutant emissions from the facility. PROtect provided the Modeling Unit with emission calculations for potential HAP emissions from the facility. The Modeling Unit performed a screening analysis using the Air Emissions Risk Analysis (AERA) Guidance[4]. It was determined from the use of the Minnesota Pollution Control Agency Risk Assessment Screening Spreadsheet (RASS) that Viridis should conduct a dispersion modeling analysis for emissions of Cadmium, hexavalent Chromium (Chromium VI), and 1,4-Dichlorobenzene.

The Modeling Unit provided PROtect with reference concentration levels for this pollutant from Michigan's Department of Environment, Great Lakes, and Energy (EGLE).

The results of PROtect's analysis based on the adjusted emission rates are displayed in **Table 5** below. All modeled concentrations were below their respective reference concentrations:

[4] Minnesota Pollution Control Agency. (2024) Air Emissions Risk Analysis (AERA) Guidance. Retrieved from https://www.pca.state.mn.us/sites/default/files/aq9-18.pdf.

Table 5
HAPs Analysis Results

Pollutant	CAS Number	Averaging Period	Maximum Modeled Impact ($\mu g/m^3$)	Threshold ($\mu g/m^3$)	Reference
1,4-Dichlorobenzene	106-46-7	Annual	0.00001	800	EGLE ITSL(1)
Cadmium	7440-43-9	Annual	0.00001	0.0006	EGLE IRSL(2)
Chromium (VI)	18540-29-9	Annual	0.00001	0.1	EGLE ITSL(1)

(1) ELGE Initial Threshold Screening Level (ITSL) are established for pollutants based on exposure durations.
(2) ELGE Initial Risk Screening Level (IRSL) are established for possible, probable, or known human carcinogen based on exposure durations.

Summary

The Modeling Unit has reviewed the air quality analysis provided by PROtect on behalf of Viridis. The Modeling Unit audit of this analysis confirms that Viridis's proposed operations do not exceed the SIL thresholds for any NO_2, CO, SO_2, PM_{10}, and $PM_{2.5}$ averaging times. The audit also confirms that emissions of VOM, NO_2, and SO_2 will not have significant impacts on $PM_{2.5}$ and ozone formation. Lastly, the audit confirms the emissions of HAPs are within safe limits.

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