TECHNICAL MEMORANDUM

TO: EPA Docket No. EPA-HQ-OAR-2024-0303

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SUBJECT: Clean Air Act Section 112(d)(5) GACT Standard Analysis and CAA Section 112(d)(6) Technology Review for Fenceline Monitoring for Chemical Manufacturing Process Units Associated with the Chemical Manufacturing Area Sources NESHAP

1.0 INTRODUCTION

The U.S. Environmental Protection Agency (EPA) is proposing amendments to the National Emissions Standards for Hazardous Air Pollutants (NESHAP) for 40 CFR part 63, subpart VVVVVV that applies to Chemical Manufacturing Area Sources (CMAS). The CMAS NESHAP regulates the following nine area source categories:

- Agricultural Chemicals and Pesticide Manufacturing,
- Cyclic Crude and Intermediate Production,
- Industrial Inorganic Chemical Manufacturing,
- Industrial Organic Chemical Manufacturing,
- Inorganic Pigments Manufacturing,
- Miscellaneous Organic Chemical Manufacturing,
- Plastic Materials and Resins Manufacturing,
- Pharmaceutical Production, and
- Synthetic Rubber Manufacturing

This memorandum summarizes the Clean Air Act (CAA) section 112(d)(6) technology review for fenceline monitoring for pollutants currently regulated by the CMAS NESHAP In addition, this memorandum summarizes the results of the CAA section 112(d)(5) GACT analysis for fenceline monitoring for ethylene oxide (EtO) used, produced, stored, or emitted by chemical manufacturing process units (CMPUs) subject to the CMAS NESHAP or that would become subject to the CMAS NESHAP if EtO were to be added to Table 1 to 40 CFR part 63, subpart VVVVVV. The structure of this memorandum is as follows: section 2 presents background on the CMAS NESHAP and the CAA authority for setting GACT standards and conducting the technology review; section 3 provides a description and history of fenceline monitoring; section 4 presents the technology review for fenceline monitoring; section 5 presents the GACT standard analysis for fenceline monitoring for EtO used, produced, stored, or emitted from CMAS CMPUs; and section 6 includes relevant references. The EPA issued a series of memorandums addressing other CAA section 112(d)(5) or CAA section 112(d)(6) reviews of emission sources subject to the CMAS NESHAP. Each memorandum reviews controls and estimates the costs and environmental impacts for the identified control options. Refer to the docket to obtain a copy of each of these memorandums.

2.0 BACKGROUND

2.1 CMAS NESHAP

In general, the CMAS NESHAP applies to CMPUs at an area source of hazardous air pollutant (HAP) emissions[1] and if HAP listed in Table 1 to 40 CFR part 63, subpart VVVVVV are present in the CMPU. A CMPU includes all process vessels, equipment, and activities necessary to operate a chemical manufacturing process that produces a material or a family of materials described by North American Industry Classification System (NAICS) code 325. A CMPU consists of one or more unit operations and any associated recovery devices. A CMPU also includes each storage tank, transfer operation, surge control vessel, and bottoms receiver associated with the production of such NAICS code 325 materials. The affected source is the facility-wide collection of CMPUs and each heat exchange system and wastewater system associated with a CMPU.

As of May 1, 2024, there were 251 facilities that are area sources of HAP emissions in operation that are subject to the CMAS NESHAP (herein referred to as CMAS facilities). In addition, we are aware of 29 more facilities that would become subject to the CMAS NESHAP if EtO were to be added to Table 1 to 40 CFR part 63, subpart VVVVVV (herein referred to as CMAS EtO facilities). The list of facilities located in the United States that are area sources of HAP and part of at least one of the nine area source categories with processes subject to the CMAS NESHAP is available in “List of Facilities Subject to the CMAS NESHAP” (ERG, 2025).

2.2 CAA Authority

Section 112 of the CAA requires the EPA to establish technology-based standards for listed source categories of HAP. These technology-based standards are often referred to as NESHAP and are based on the maximum achievable control technology (MACT). Under CAA section 112(d)(5), the Administrator may, in lieu of standards requiring MACT under section 112(d)(2), elect to promulgate standards or requirements for area sources “which provide for the use of generally available control technologies [GACT] or management practices by such sources to reduce emissions of hazardous air pollutants.” Additional information on GACT is found in the Senate report on the legislation (Senate report Number 101–228, December 20, 1989), which describes GACT as:

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1 Area sources of HAP emissions have the potential to emit less than 10 tons per year of a single HAP or 25 tons per year of any combination of HAPs.

> "…methods, practices and techniques which are commercially available and appropriate for application by the sources in the category considering economic impacts and the technical capabilities of the firms to operate and maintain the emissions control systems."

Consistent with the legislative history, the EPA can consider costs and economic impacts in determining GACT. Determining what constitutes GACT involves considering the control technologies and management practices that are generally available to the area sources in the source category. GACT standards were set for the chemical manufacturing area source categories in 2009 (see 74 FR 56008, October 29, 2009). The CMAS NESHAP requires the use of GACT and establishes emission standards in the form of management practices for each CMPU as well as emission limits for certain emission sources including process vents and storage tanks. The rule also establishes management practices and other emission reduction requirements for wastewater systems and heat exchange systems.

The EPA is proposing additional GACT standards to regulate EtO emissions from equipment leaks, heat exchange systems, process vents, storage tanks, and wastewater located at chemical manufacturing area sources. This memorandum addresses GACT management practices for fugitive emissions of EtO (e.g., emissions of EtO from equipment leaks, storage tanks, wastewater, and other non-stack emission sources) that would become subject to the CMAS NESHAP if EtO is added to Table 1 to 40 CFR part 63, subpart VVVVVV, as proposed. In setting GACT, the EPA always looks to the standards applicable to major sources in the same industrial sector to determine if the control technologies and work practice standards are transferable and generally available to area sources. In appropriate circumstances, the EPA may also consider technologies and practices at area and major sources in similar categories to determine whether such technologies and practices could be considered generally available for the area source category at issue. In this case, the control technologies and management practices for process units are transferable because process units at major source chemical manufacturing facilities are essentially no different than process units at area source chemical manufacturing facilities.

Section 112 of the CAA contains provisions requiring the EPA to periodically revisit GACT standards. Specifically, paragraph 112(d)(6) states:

(6) REVIEW AND REVISION. – The Administrator shall review, and revise as necessary (taking into account developments in practices, processes, and control technologies), emissions standards promulgated under this section no less often than every 8 years.

To comply with this CAA requirement, the EPA conducted a technology review for the CMAS NESHAP. This memorandum addresses the technology review for fenceline monitoring for facilities subject to the CMAS NESHAP. For this exercise, we considered any of the following to be a "development":

- Any add-on control technology or other equipment that was not identified and considered during development of the original GACT standards.
- Any improvements in add-on control technology or other equipment (that were identified and considered during development of the original GACT standards) that could result in additional emissions reduction.

- Any work practice, management practice, or operational procedure that was not identified or considered during development of the original GACT standards.
- Any process change or pollution prevention alternative that could be broadly applied to the industry and that was not identified or considered during development of the original GACT standards.
- Any significant changes in the cost (including cost effectiveness) of applying controls (including controls the EPA considered during the development of the original GACT standards).

3.0 FENCELINE MONITORING

3.1 Fenceline Monitoring Concept

Fenceline monitoring refers to the placement of samplers along the perimeter of a facility to monitor pollutant concentrations. It is a proven and effective tool that can help account for emissions that are difficult to quantify, allowing a facility to more quickly identify leaks and other fugitive emissions to verify emissions estimates and to ensure compliance with applicable regulations. A fenceline management practice requires monitoring and limiting the concentration of pollutants surrounding a facility. It is intended to address the uncertainty related to emissions characterization for pollutants that are emitted as fugitive emissions and to limit annual emissions of these pollutants by limiting the average concentrations that can occur at a facility's fenceline to "action levels" comparative to annual emissions inventories. The action levels are typically set based on the highest expected concentrations at the fenceline based on modeling and compliance with EPA regulations using a surrogate HAP for fugitive emissions. If there is not a single fugitive HAP surrogate for a source category of concern, (e.g., benzene for petroleum refineries), EPA may focus its fenceline monitoring efforts on some of the more toxic HAP(s) emitted. Lasty, if the modeled action level is not able to be measured with current technologies, EPA will consider compliance with an action level that is enforceable and can be detected with certainty (i.e., three times the representative detection limit (RDL)), particularly for the most toxic compounds. In general, uncertainties in fugitive emissions estimates are related to the omission or mischaracterization of significant emission sources; among them are:

- Exclusion of nonroutine emissions such as Pressure Relief Device (PRD) releases;
- Omission of sources that are unexpected, not measured, or not considered part of the affected source, such as emissions from process sewers, wastewater systems, or other fugitive emissions;
- Improper characterization of sources for emission models and emission factors; and
- Inherent uncertainty in emissions estimation methodologies

These uncertainties in fugitive emissions quantification can produce significant differences between what is predicted by analytical tools and what is present in reality. We also note that time resolution is an important consideration, and long-term, continuous measurements techniques most closely approach the average concentrations that are predicted by our tools.

3.2 Fenceline Monitoring Case Study: Petroleum Refineries

Fenceline monitoring has been successfully applied to the petroleum refineries source category as a technique to manage and reduce fugitive emissions from various emission sources such as storage tanks, wastewater treatment systems, and leaking equipment. In 2015, EPA promulgated the RTR for the petroleum refineries source category and required that refineries monitor for benzene emissions by installing passive sorbent tube fenceline monitors and analyze the tubes using the procedures in Methods 325A and 325B of 40 CFR part 63, appendix A (referred to as Methods 325A/B hereafter). The sorbent tubes are deployed for a 14-day sample period and are replaced by a new set of sorbent tubes after the 14-day period, thus providing continuous sampling at the refinery fenceline. Procedures were provided to subtract background concentrations and contributions to the fenceline benzene concentrations from onsite non-refinery emission sources and offsite sources, so that the benzene concentrations measured were attributable to the refinery source category emission sources at the site. This benzene concentration difference is referred to as delta c (Δc).[2] The rule required that refineries install and operate the passive diffusive tube monitors by 2018 and report benzene emissions monitoring data to EPA beginning in May 2019. Additionally, the rule requires that refineries must prepare a root cause analysis to identify sources of high fenceline monitoring readings (readings where the annual average Δc exceeds the benzene action level) and then take appropriate corrective action to address the emission sources and reduce the fenceline concentration of benzene.

To date, EPA has received benzene fenceline monitoring data for more than five years, which are publicly available on WebFIRE and the Benzene Fenceline Monitoring Dashboard.[3] Using these data, EPA performed several time series analyses to observe the effects of the fenceline monitoring program on measured benzene fenceline concentrations over time. In particular, time series analyses were conducted to observe changes in (1) benzene concentrations across all fenceline monitors at refineries, (2) quarterly averages of annual average Δc for all facilities, and (3) maximums of annual average Δc for all facilities. Due to differences in the timing of the 2-week sampling period between different facilities, trends are easiest to communicate on a quarterly analysis basis.

Analysis of the benzene concentration data across all fenceline monitors demonstrates that benzene concentrations trended downward over time, from Quarter 1 of 2018 to Quarter 2 of 2022 (see Figure 1-A). Note that each quarterly data point in the graph represents 12,000-20,000 observation points, and regression analysis of the data explains approximately 70 percent of the fitted data in the regression model (R2 = 0.7). Data were also plotted as the quarterly average of annual average Δc for all facilities (n = 111) over time (see Figure 1-B). Over the time period

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2 Delta c, notated as Δc, represents the concentration difference between the highest measured concentration and lowest measured concentration for a set of samples in one sampling period. To elaborate, for each 2-week sampling episode, the facility would determine a Δc, calculated as the lowest sample value for benzene subtracted from the highest sample value for benzene. This approach aimed to subtract out the estimated contribution from emissions that did not originate from the facility. The Δc for the most recent year of samples (26 sampling periods) is averaged to calculate an annual average Δc. The annual average Δc is determined on a rolling basis, meaning that it is updated every two weeks with each new sample. This rolling annual average Δc is then compared against a concentration action level.

3 See https://awsedap.epa.gov/public/extensions/Fenceline_Monitoring/Fenceline_Monitoring.html?sheet=MonitoringDashboard.

from Quarter 1 of 2019 to roughly Quarter 1 of 2021, the quarterly average of annual average Δc decreased from approximately 6 micrograms per cubic meter (μg/m^3) to 4 μg/m^3, and then stabilized at about 4 μg/m^3 from Quarter 1 of 2021 to Quarter 2 of 2022. EPA also observed a downward trend and stabilization of quarterly maximums of annual average Δc for all facilities (n = 111) (see Figure 1-C), with quarterly maximums of annual average Δc decreasing from approximately 290 μg/m^3 in Quarter 1 of 2019 down to approximately 20 μg/m^3 in Quarter 2 of 2021 and stabilizing thereafter.

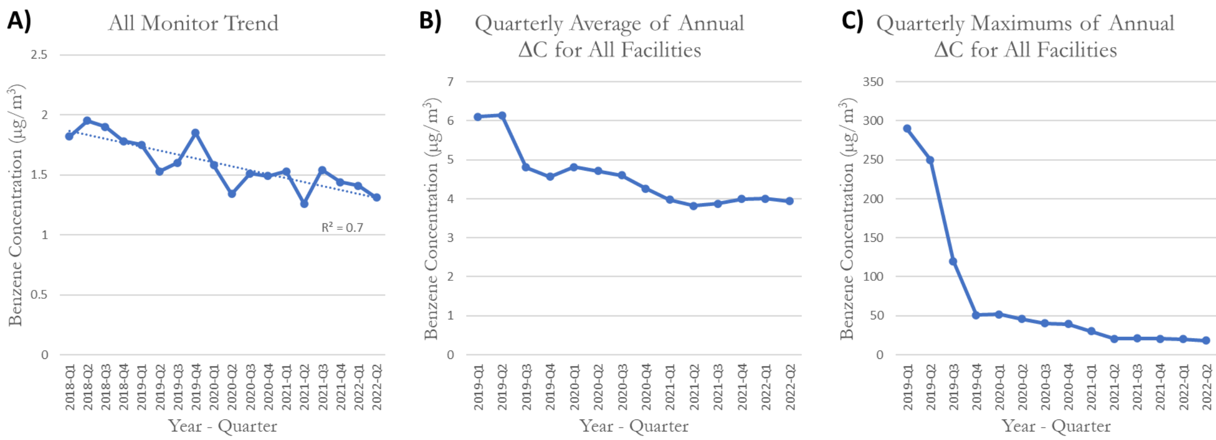

Figure 1. Analysis of Trends in Fenceline Monitoring Data. *Time series demonstrating changes in (A) benzene concentrations across all monitors, (B) quarterly average of annual average Δc for all facilities, and (C) quarterly maximums of annual average Δc for all facilities.*

These data show that petroleum refineries have reduced benzene concentrations, and therefore, emissions, at the fenceline by an average of approximately 30 percent since the inception of the monitoring program. It is important to note that because benzene is ubiquitous and found in most process streams at refineries, monitoring and the work practice of limiting benzene concentrations at the fenceline will also yield similar reductions of all organic compounds (e.g., VOC) emitted from fugitive emission sources at a refinery. These reductions are primarily attributed to the work practice standard, and not from the addition of controls as a result of the Refinery Sector RTR. These results illustrate that the fenceline monitoring work practice standard is an effective tool in reducing emissions from petroleum refineries and maintaining these reductions on an ongoing basis for these sources.

3.3 Fenceline Monitoring for Major Source Chemical Plants

As part of a recent rulemaking for the Synthetic Organic Chemical Manufacturing Industry (SOCMI) source category subject to the Hazardous Organic NEHSAP (HON) and various source categories subject to the Group I Polymers and Resins (P&R I) NESHAP (see 89 FR 42932, May 16, 2024), the EPA finalized a fenceline monitoring work practice standard requiring owners and operators to monitor for any of six specific HAP (i.e., benzene, 1,3-butadiene, ethylene dichloride, vinyl chloride, EtO, and chloroprene) if their affected source uses, produces, stores, or emits any of them, and to conduct root cause analysis and corrective action upon exceeding the annual average concentration action level set forth for each HAP.

Owners and operators are required to conduct passive diffusive tube fenceline monitoring for benzene, 1,3-butadiene, chloroprene, and ethylene dichloride in accordance with the requirements in 40 CFR part 63, subpart H and EPA Methods 325A/B to 40 CFR part 63, appendix A. The action levels, based on an annual average Δc, are:

- Benzene: 9 $\mu g/m^3$.
- 1,3-butadiene: 3 $\mu g/m^3$.
- Chloroprene: 0.8 $\mu g/m^3$ for sources subject to the HON and 0.3 $\mu g/m^3$ for Neoprene Production sources subject to the P&R I NESHAP.
- Ethylene dichloride: 4 $\mu g/m^3$.

Owners and operators are required to monitor the concentrations of EtO and vinyl chloride using canister sampling in accordance with the requirements in 40 CFR part 63, subpart H and EPA Method 327 to 40 CFR part 63, appendix A.[4] The action levels, based on an annual average Δc, are:

- EtO: 0.2 $\mu g/m^3$.
- Vinyl chloride: 3 $\mu g/m^3$.

The primary action levels for benzene, 1,3-butadiene, ethylene dichloride, chloroprene, and vinyl chloride correspond to the modeled concentrations resulting from compliance with the process emission standards promulgated in the final rule and/or levels that HON-subject sources are largely already meeting. The secondary action level for chloroprene for Neoprene Production sources subject to the P&R I NESHAP and the action level for EtO are both based on three times the RDL due to current monitoring detection capabilities.[5]

The work practice standard requires the initiation of root cause analysis upon exceeding the annual average concentration as determined on a rolling average every sampling period (e.g., for EtO, the 24-hour sample collection period is every 5 calendar days). The root cause analysis is an assessment conducted through a process of investigation to determine the primary underlying cause and other contributing causes of an exceedance of the action level. If the underlying causes of the action level exceedance are deemed to be from sources under the control of the owner or operator, the owner or operator is required to take corrective action to address the underlying cause of the exceedance and to bring the annual average Δc back below the action level as expeditiously as possible. Completion of the root cause analysis and initial corrective action is required within 45 days of determining that the annual average Δc exceeded the action level. If the owner or operator requires longer than 45 days to implement the corrective actions identified by the root cause analysis, the owner or operator is required to submit a corrective action plan no later than 60 days after completion of the root cause analysis. The work practice standard also includes burden reduction measures to allow owners and

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[4] In the same action (see 89 FR 42932, May 16, 2024), EPA also finalized EPA Method 327 to 40 CFR part 63, appendix A as a canister sampling and analysis method that provides procedures for measuring trace levels of targeted VOC (including organic HAP) in ambient air.

[5] For more details on how the RDL for EtO was developed please refer to the document *Representative Detection Limit (RDL) for Ethylene Oxide Using a Modified Version of Method TO-15A* (EPA, 2023).

operators monitoring for certain pollutants to skip fenceline measurement periods for specific monitors with a history of measurements that are at or below certain specified action levels.

After completion of the initial corrective action, if the Δc for the next sampling period for samples collected by EPA Methods 325A/B or the next three sampling periods for samples collected by EPA Method 327 are below the action level, then the corrective action is assumed to have fixed the problem, and the owner and/or operator has no further obligation for additional corrective action. However, if the Δc for the subsequent sampling periods after initial corrective action is over the action level, then the owner or operator must submit a corrective action plan and schedule for implementing changes within 60 days after receiving the analytical results. The owner or operator is required to include the implementation of real-time sampling techniques to locate the primary and other contributing causes of the exceedance in the corrective action plan. While the action level(s) are based on annual average concentrations, once an action level is exceeded, each sampling period that exceeds the action level contributes to the Δc remaining above the action level. An investigation must be conducted following these high biweekly periods to determine the root cause and, if appropriate, to correct the root cause expeditiously in order to bring the annual average Δc below the action level.

For additional details of how EPA developed the fenceline monitoring work practice standard for the HON and P&R I NESHAP, including Method 327 to 40 CFR part 63, appendix A, see the document titled *Clean Air Act Section 112(d)(6) Technology Review for Fenceline Monitoring located in the SOCMI Source Category that are Associated with Processes Subject to HON and for Fenceline Monitoring that are Associated with Processes Subject to Group I Polymers and Resins NESHAP* (ERG, 2022).

4.0 TECHNOLOGY REVIEW FOR NON-ETO POLLUTANTS

Given the similarities between CMAS CMPUs and CMPU sources that are subject to the HON or P&R I NESHAP, we evaluated the application of fenceline monitoring as a development in practices, processes and control technologies pursuant to CAA section 112(d)(6). Non-EtO pollutants for which there are established EPA Methods to measure fenceline concentrations and which are one of the 15 urban HAP regulated as part of the CMAS NESHAP include 1,3-butadiene, 1,3-dichloropropene, ethylene dichloride, and chloroform. We reviewed the 2017 National Emissions Inventory to determine whether CMAS facilities reported emissions of 1,3-butadiene, chloroform 1,3-dichloropropene, and ethylene dichloride. Based on this review, we determined that none of these pollutants are ubiquitous to any of the nine source categories regulated by the CMAS NESHAP and therefore cannot act as surrogate HAP for fugitive emissions. In addition, most CMAS facilities that report emissions of 1,3-butadiene, chloroform, 1,3-dichloropropene, and ethylene dichloride from the source categories report small amounts of these HAP from fugitive sources. Most of the reported emissions are attributed to non-source categories emission sources.

While there are EPA Methods to measure the fenceline concentration of other pollutants such as benzene and vinyl chloride, these pollutants are not one of the 15 urban HAP included in Table 1 in 40 CFR part 63, subpart VVVVVV. For other pollutants on Table 1, either an EPA Method has not been fully validated for fenceline monitoring or additional research is necessary to determine the correct methodology.

Based on this information, a fenceline monitoring program for fugitive emissions of non-EtO HAP does not appear to be a development for consideration under CAA section 112(d)(6) for sources subject to the CMAS NESHAP.

5.0 GACT STANDARDS

5.1 EtO as a Surrogate HAP

While none of the pollutants discussed in section 4.0 are ubiquitous to any of the source categories currently regulated by the CMAS NESHAP, in the proposed tenth source category, Chemical Manufacturing with Ethylene Oxide, EtO should be present in most CMPU process streams. Therefore, the EPA expects that all facilities will have equipment in EtO service and that fugitive emissions from the affected CMPUs will contain EtO. As such, for CMPUs in EtO service, EtO can act as a surrogate pollutant to all HAP to ensure the fugitive emission controls and practices in place are effective. This approach is consistent with the approach used for the petroleum refineries source category, as discussed in section 3.2.

In addition, while collecting data, the EPA observed discrepancies in the concentrations of EtO predicted at a facility's fenceline based on modeling emissions inventories and concentrations measured via cannisters (EPA, 2023). In 90 percent of cases, the measured concentrations were greater than the modeled concentrations, sometimes by an order of magnitude. Given the similarities between sources subject to the HON and the P&R I NESHAP and those subject to the CMAS NESHAP, it is reasonable to assume to that this discrepancy exists for area sources as well.

Also, there is already an EPA Method established for measuring EtO concentrations at the fenceline. As EtO can act as a surrogate HAP for the Chemical Manufacturing with Ethylene Oxide source category and there is an observed need to verify emissions data due to discrepancies in modeled fenceline concentrations and measured fenceline concentrations at similar sources, a fenceline monitoring program for EtO is reasonable to consider. Aspects of the program are considered further in sections 5.2, 5.3, and 5.4 of this memorandum.

5.2 Availability of Fenceline Monitoring

We find fenceline monitoring via EPA Method 327 to be "generally available" per the language of CAA section 112(d)(5). Canister measurements for EtO have been possible since 1999 via Method TO-15. While EPA Method 327 was finalized in May 2024 as part of the revisions to the HON (see 89 FR 42932); many of the practices, media, and instrumentation necessary for the analysis have been available since 2019 via an update to Method TO-15, Method TO-15A. EPA Method 327 codifies the best practices of Method TO-15A and mandates enhanced QA/QC approaches, such as a regular validation of the sampling media, site verification for the sampling, defined hold times, and ongoing field and spike blanks to evaluate performance. In addition, development of logistics and practices to support EPA Method 327 laboratory analysis will also be occuring alongside other, similar chemical manufacturing rulemakings. Lastly, as a practice, placing monitors around a facility to measure fugitive emissions has been required as part of the Petroleum Refineries NESHAP (40 CFR part 63, subpart CC) since 2018. Given the monitoring technology has been available for several decades and the methodology, while new, is an adjustment to a well understood 2019 method to ensure the validity of samples, we find EPA Method 327 to be "generally available" per the language of CAA section 112(d)(5).

Both root cause analysis and corrective action already take place at facilities where large emission events occur. When an event occurs, the source will be determined and will be fixed. This is a regular part of operation and thus root cause analysis and corrective action are already available to every facility potentially impacted by the fenceline monitoring management practice.

5.3 Establishment of the EtO Action Level

The facility-wide emissions inventory used as part of the risk assessment for this rulemaking acted as the general basis for setting the action level. The modeling files can be found as part of the risk assessment in the docket for this action (EPA, 2025) and are believed to represent the most current emissions inventory for chemical manufacturing area sources currently subject to or who will become subject to the CMAS NESHAP given the addition of EtO to Table 1 in 40 CFR part 63, subpart VVVVVV. This inventory was used to estimate the amount of HAP emissions at each facility after implementation of the proposed EtO controls via a "post-control" approximation.

The post-control modeling of facility-wide EtO emissions from those facilities currently subject to or who will become subject to the CMAS NESHAP if EtO is added to Table 1 of 40 CFR part 63, subpart VVVVVV, assumes full compliance with the proposed standards and was used to approximate EtO concentrations at the fenceline of each facility via the American Meterological Society/EPA Regulatory Model dispersion modeling system (AERMOD). The AERMOD is a Gaussian plume dispersion model that is preferred by EPA for modeling point, area, and volume sources of continuous air emissions from facility applications. The model is used to develop annual average ambient concentrations through the simulation of hour-by-hour dispersion from the emission sources into the surrounding atmosphere. Hourly emission rates used for this simulation are generated by evenly dividing the total annual emission rate from the inventory into the 8,760 hours of the year. Concentrations are estimated by the model at a set of polar grid receptors (P) centered on the facility as well as surrounding census block centroid receptors (C) extending from the facility outward to 50 kilometers. The EPA generally assumes that the nearest offsite receptor is the best representation of each facility's fenceline concentration. Only receptors (either the polar or census block) that are estimated to be outside the facility fenceline are considered in determining the maximum action level concentrations for each facility. In some cases, due to variability in facility layouts and fenceline shapes, the default polar grid receptor may not be spatially sufficient to fully resolve the maximum ambient concentrations. In these instances, we include additional user receptors (U) along the fenceline, outside of facility property, at approximately 50 meter spacing to more accurately estimate concentrations at these facilities. The fenceline receptors used in this modeling are provided in the *Fenceline_User_Receptors.xlsx* file, which is located in the rule docket.

After modeling each facility, it was found that almost all (i.e., 32 of 33 facilities) fell at or below three times the RDL for EtO, 0.2 $\mu g/m^3$, which is currently the lowest method detection limit that can be measured with reasonable certainty. Table 1 details the facilities with the highest modeled concentrations of EtO observed as part of the post-control analysis. Figure 2 shows the value and location of the maximum off-site facility-level annual average concentration of EtO at the facility with the highest off-site modeled value in this analysis.

Table 1: Modeled Post-Control EtO Concentrations for Facilities Currently Subject to or That Will Become Subject to the CMAS NESHAP with the Addition of EtO to Table 1 of 40 CFR Part 63, Subpart VVVVVV

Facility ID	Max Concentration (μg/m^3)	Receptor Type	Latitude	Longitude
202098082111	0.4	U	39.09498768	-94.69631195
10003588911	0.2	U	39.69308	-75.5422
480395633711	0.2	U	28.957	-95.3346
220477451011	0.08	PG	30.24819	-91.0895
291097281511	0.06	U	36.9639	-93.7977
482914030311	0.03	PG	30.00169	-94.9536
551054953611	0.03	PG	42.77948	-88.9684
130132812911	0.02	PG	33.99938	-83.7857
450836564511	0.02	PG	34.91599	-81.9267
551056479611	0.02	PG	42.67032	-89.0418

Figure 2. *Maximum Facility-level Annual Average EtO Concentration Adjacent to Facility ID 202098082111.*

The EPA is proposing to establish the action level for CMAS EtO facilities subject to the fenceline monitoring management practice to be three times the RDL for EtO, 0.2 µg/m^3. We note that this action level does not correlate to any metric related to risk.

The EPA acknowledges that the proposed action level is below the maximum modeled fenceline concentration for EtO after implementation of the proposed standards (for one facility); however, the EPA has identified a high degree of uncertainty associated with the emissions inventory associated with the one facility modeled above the 0.2 µg/m^3 action level. The facility only reported a single, fugitive EtO record as part of their emissions inventory, which likely does not accurately represent the full breadth of EtO sources onsite. While a post-control scenario was applied, similar to the other facilities considered, the EPA was unable to fully anticipate the impact of the EtO specific controls required by this action for this one facility. Fugitive emissions, which are typically the drivers of fenceline concentrations of pollutants, are being addressed by this action in form of more stringent instrument monitoring for both equipment and heat exchangers in EtO service, requiring control of EtO laden process vents, storage tanks, and wastewater, and prohibiting the release of EtO to the atmosphere from PRDs in EtO service. These sources were not specifically identified in the emissions inventory and thus, a post-control analysis of the fenceline concentration does not take into consideration the full improvements that will be seen at a facility complying with the provisions. As such, the EPA expects the facility will experience additional reductions beyond those quantified as part of the post-control analysis. These uncertainties, in combination with the fact that over 90 percent of the facilities modeled are already achieving the proposed action level based on a post-control scenario indicates that 0.2 μg/m^3 is both reasonable and attainable for CMAS EtO facilities.

5.4 Cost of Fenceline Monitoring for EtO via Method 327

Our cost estimate for implementing the same EtO fenceline monitoring work practice standard that is in the HON for the CMAS NESHAP follows the cost analysis already discussed in the document titled *Clean Air Act Section 112(d)(6) Technology Review for Fenceline Monitoring located in the SOCMI Source Category that are Associated with Processes Subject to HON and for Fenceline Monitoring that are Associated with Processes Subject to Group I Polymers and Resins NESHAP* (ERG, 2022).

In summary, EPA conducted three different cost evaluations for Method 327: (1) the total annual cost for laboratory work, (2) the total annual cost for facility sampling, and (3) the total capital investment for a meteorological station. Table 2 details the cost evaluation of the total annual laboratory costs for fenceline monitoring. Since EPA Method 327 is a newly finalized fenceline monitoring standard, the cost evaluation was conducted utilizing new cost information provided by a quote from Eastern Research Group, Inc.'s (ERG) laboratory services group. The quote includes both the cost of the analytical equipment and materials (canisters, etc.) as well as man-hour estimates for performing the analyses. Recurring costs include the cost (man-hours) for collecting the samples, and the cost of analyzing the samples (and any materials consumed). The evaluation assumes that sampling will occur every five days (approximately 73 times per year), with eight canisters, one method blank, and one duplicate, collected for each sampling session. The analysis also assumes that three field blanks and three trip blank analyses will be conducted for each applicable facility annually.

Table 2. Total Annual Laboratory Costs (in 2022$) for Fenceline Monitoring under Method 327[1,2]

Item #	Item Description	Number of Samples	Cost Per Item (includes shipping), $	Total Annual Cost for Lab, $
1	VOC Sample Analysis[3,4]	730[5]	$599	$437,505
2	Field Blank and Spike Samples[6]	6[7]	$599	$3,596
Total Cost for Analysis				**$441,101**
Total Cost for Analysis + 30% Full Data Package				**$573,431**
3	**Flow Controllers**[8]	108[9]	$50	$5,352
Total Cost for Analysis per Year				**$578,784**

[1] Lab costs provided in this table are based on outsourcing analysis to contractor and monitoring for one year as follows: one sample taken every 5 days at 8 locations around one facility's fenceline according to 40 CFR 63.184(b)(2) and (3).
[2] Quote provided in 2021$ from ERG laboratory services (https://www.erg.com/service/laboratory-services) updated to 2022$ using the Chemical Engineering Plant Cost Index (CEPCI). Costs were then doubled for enhanced cleaning that will be required for cannisters in method.
[3] VOC Sample Analysis based on Compendium Method TO-15 for EtO.
[4] VOC sample analysis includes (1) canister cleaning and handling, (2) toxics sample analysis using TO-15 with a GC/MS, (3) Monthly data validation and reporting, (4) AQS entry within 90 days of the end of each calendar quarter (if needed)

[5] 730 Samples = (8 sites + 1 method blank + 1 duplicate) x 73 sampling days per year
[6] Field Blank Samples Based on Compendium TO-15. Costs include (1) canister cleaning and handling, (2) toxics sample analysis using TO-15 with a GC/MS, (3) Monthly data validation and reporting.
[7] 6 Samples = 3 Field Blanks and 3 Trip Blanks per year
[8] Flow Controller costs includer (1) Site Coordination, (2) Shipment and Training SOP, (3) Sampler Blank Certification
[9] 108 Samples = 9 Flow Controllers x 12 Months per year

Table 3 (below) details the total annual cost for facility sampling collection. Since the number of samples taken per facility is rigidly defined in the proposed rule, the costs associated with conducting EPA Method 327 is the same for each facility. The labor rates were retrieved from the May 2022 labor rates presented from the Bureau of Labor and Statistics, for the North American Industry Classification System (NAICS) code 325000.

Table 3. Total Annual Cost for Facility Sampling Collection (in 2022$) for Fenceline Monitoring under EPA Method 327

Capital Costs	Labor Rate[1], ($/hr)	Hours[2]	Cost, $
Technical Support	$102	182.5	$18,615
Management Support	$160.13	182.5	$29,223
Clerical Support	$44.06	182.5	$8,041
Total Facility Sampling Collection Costs:			$55,878

[1] Costs per labor hour based on May 2022 labor rates from Bureau of Labor and Statistics, (BLS), for NAICS 325000 available at: https://www.bls.gov/oes/2022/may/naics3_325000.htm#11-0000.
[2] Assumes 0.25 hours to collect and replace each canister.

Lastly, a total capital investment cost evaluation was conducted for EPA Method 327 (Table 4). We used the document titled *Fenceline Monitoring Impact Estimates for Final Rule* (EPA, 2015) as a benchmark for the cost data, which was updated for 2022 dollars.

Table 4. Total Capital Investment Costs (in 2022$) for Fenceline Monitoring EPA Method 327[1]

Meteorological Station Equipment	Capital Costs, $
System Mounting Arm	$764
Data Logger	$4,476
Pressure Sensor and Enclosure	$1,100
Temperature Sensor and Enclosure	$689
Radiation Shield	$217
Ultrasonic Anemometer Wind Speed/Direction	$3,837
Tower	$3,704
Total Capital Investment Costs:	**$14,787**

[1] Costs reflect rates provided in R.M. Young Company, and presented in refinery memo: EPA-HQ-OAR-2018-0074-0020 but adjusted for 2022$ using CEPCI.

Table 5 presents the nationwide cost estimates for implementing the same EtO fenceline monitoring work practice standard that is in the HON for the CMAS NESHAP. The EPA anticipates 33 facilities identified as part of the facility list will be impacted by the proposed management practice as all use, produce, store, or emit EtO from CMPUs that would become subject to the CMAS NESHAP if EtO were to be added to Table 1 of 40 CFR part 63, subpart VVVVVV, as confirmed by the emissions inventories.

Table 5. Nationwide Cost Impacts of Fenceline Monitoring for the CMAS NESHAP

# CMAS Facilities Impacted	Total Capital Investment ($)	Total Annualized Cost ($/yr)[1]
33	488,000	20,990,000

[1] Includes capital recovery of the meteorological station equipment ($1,237 per facility) calculated using a 8.5% interest rate in addition to the total annual cost for facility sampling collection.

6.0 References

EPA, 2023. Clean Air Act Section 112(d)(6) Technology Review for Fenceline Monitoring located in the SOCMI Source Category that are Associated with Processes Subject to HON and for Fenceline Monitoring that are Associated with Processes Subject to Group I Polymers and Resins NESHAP. EPA Docket Item No. EPA-HQ-OAR-2022-0730-0091.

ERG, 2025. List of Facilities Subject to the CMAS NESHAP. January 2025. EPA Docket No. EPA-HQ-OAR-2024-0303.

EPA, 2015. Fenceline Monitoring Impact Estimates for Final Rule. To EPA Docket No. EPA-HQ-OAR-2010-0682. EPA Docket Item No. EPA-HQ-OAR-2010-0682-0749.

EPA, 2023. Representative Detection Limit (RDL) for Ethylene Oxide Using a Modified Version of Method TO-15A. February 2023. See Attachment 6, "Representative Detection Limit for Ethylene Oxide" as part of EPA Docket Item No. EPA-HQ-OAR-2022-0730-0091.

EPA, 2025. Risk Assessment for the Chemical Manufacturing Area Source (CMAS) Source Categories in Support of the 2025 Risk and Technology Review for the Proposed Rule. January 2025. EPA Docket No. EPA-HQ-OAR-2024-0303.