Economic Impact Analysis for the Proposed National Emission Standards for Hazardous Air Pollutants: Chemical Manufacturing Area Sources

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Economic Impact Analysis for the Proposed National Emission Standards for Hazardous Air Pollutants: Chemical Manufacturing Area Sources

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1 INTRODUCTION

1.1 Background

The U.S. Environmental Protection Agency (EPA) is proposing amendments to the National Emission Standards for Hazardous Air Pollutants (NESHAP) for Chemical Manufacturing Area Sources (40 CFR Part 63, Subpart VVVVVV). The Chemical Manufacturing Area Sources (CMAS) categories are comprised of area sources in nine source categories in the chemical manufacturing sector: Agricultural Chemicals and Pesticides 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. The standards and associated requirements for the nine area source categories are combined in one subpart. Facilities currently subject to the CMAS NESHAP emit one or more of 15 urban air toxics.[1] This document presents the economic impact analysis (EIA) for this proposed rule.

Facilities in the CMAS categories manufacture a wide variety of specialty chemicals and products. The CMAS NESHAP was promulgated in 2009 and contained requirements for the 15 urban hazardous air pollutants (HAP) for: process vents, storage tanks, wastewater systems, heat exchange systems, transfer operations, and equipment leaks. This rule proposes to list an additional area source category alongside the nine currently regulated by the CMAS NESHAP, Chemical Manufacturing with Ethylene Oxide, and add ethylene oxide (Eto) to the list of pollutants regulated by the CMAS NESHAP. eto is emitted by area source chemical manufacturers and carries higher risks than previously understood at the time the CMAS NESHAP was originally promulgated in 2009. The EPA identified approximately 280 area source facilities that may be impacted by the proposed revisions to the CMAS NESHAP, 33 of which emit EtOH and may be affected by the proposed EtOH standards. Henceforth the 280 facilities are referred to as CMAS facilities.

[1] The 15 urban HAP regulated by the CMAS NESHAP are: 1,3-butadiene, 1,3-dichloropropene, acetaldehyde, chloroform, ethylene dichloride, hexachlorobenzene, methylene chloride, quinoline, hydrazine, arsenic compounds, cadmium compounds, chromium compounds, lead compounds, manganese compounds, and nickel compounds.

To meet the requirements of Clean Air Act (CAA) section 112(d)(6), the EPA must review, and revise standards promulgated under CAA section 112 no less often than every eight years. This review takes into account developments in practices, processes, and control technologies and determines which may be appropriate for the considered source category or source categories. This process is known as a 'technology review.'

This proposed rule adds new EtO-specific requirements to the CMAS NESHAP pursuant to CAA section 112(d)(5) for equipment leaks, heat exchange systems, process vents, storage tanks, pressure relief devices (PRDs), flares, and wastewater in EtO service. The EPA is also proposing a fenceline monitoring requirement for EtO. As part of the technology review, the EPA is proposing to add new leak detection and repair (LDAR) requirements to the CMAS NESHAP for equipment leaks and for heat exchange systems in organic HAP service. In addition, the EPA is proposing to add new generally available control technology (GACT) standards pursuant to CAA section 112(d)(5) for pressure vessels and PRDs in organic HAP service. The EPA is also proposing to require performance testing once every five years to demonstrate compliance with emission limits, in addition to changes to the recordkeeping and reporting requirements to require the use of electronic reporting of certain reports. More information on these proposed requirements can be found in the preamble for this proposal.

1.2 Economic Basis for this Rulemaking

Regulation can be used to address market failures, which otherwise lead to a suboptimal allocation of resources within a free market. Many environmental problems are classic examples of "negative externalities", which arise when private entities do not internalize the full opportunity cost of their production, and some of this opportunity cost is borne by members of society who are neither consumers nor producers of the goods produced (*i.e.*, they are "external"). For example, the smoke from a factory may adversely affect the health of nearby residents, and local soil quality and visibility. Public goods such as air quality are valued by individuals but suffer from a lack of property rights, so the value of good air quality tends to be unpriced in markets that generate air pollution. In such cases, markets fail to allocate resources efficiently and regulatory intervention is needed to address the problem.

While recognizing that the socially optimal level of pollution is often not zero, the emissions from CMAS facilities impose costs on society (*i.e.*, adverse human health and environmental impacts) that may not be reflected in the equilibrium market prices for the chemicals they produce. If emissions from CMAS facilities increase risks to human health and the environment, some social costs will be borne not by affected firms and their customers but rather imposed on communities near the facilities and other individuals exposed to their emissions. Consequently, absent a regulation limiting emissions from CMAS facilities and causing firms to internalize the external costs of their operations, emissions will likely exceed the socially optimal level.

1.3 Cost Impacts

The impacts of regulatory actions are evaluated relative to a baseline that represents the world without the regulatory action. Throughout this document, the EPA focuses the analysis on the requirements that result in quantifiable compliance costs or emissions changes compared to the baseline.

The cost impacts of this rule were estimated over a 15-year timeframe from 2027 to 2041. The EPA chose a 15-year analytical time horizon to be consistent with the equipment lifetime of some of the capital components that would be required to comply with the rule (lifetimes are not consistent across all capital equipment). The 15-year timeframe was also chosen to capture lasting regulatory impacts while avoiding uncertainties that would be introduced if a longer timeframe were used. The EPA assumes that impacts begin in 2027, the year that compliance is expected to be required for the proposed EtO standards (*i.e.*, two years after the presumed publication of the final rule). We note that affected sources have three years after publication to comply with the proposed amendments to the non-EtO standards.

The EPA identified approximately 280 area source facilities currently operating in the U.S. that may be impacted by the proposed revisions to the CMAS NESHAP, 33 of which emit EtO and may be affected by the proposed standards for EtO. All cost impacts were estimated in association with these 280 existing facilities, although new sources could become impacted by these proposed requirements in the future. Although the action contains requirements for new sources, the EPA is not aware of any new sources being constructed now or planned in the

future, and, consequently, did not estimate any cost or other impacts for new sources. Hence, the impacts estimated in this EIA solely reflect those for the 280 existing facilities.

The EPA estimates that the proposed requirements will allow owners of affected CMAS facilities to recover some sellable products. The EPA provides estimates of the costs including and excluding the value of recovered product. The total annual costs (annualized capital costs plus annual operating, maintenance, and testing costs) of the proposed rule are estimated to be about $38 million without product recovery and about $36.4 million including product recovery in 2022 dollars. Hence, product recovery accounts for about $1.6 million in annual cost savings, or about four percent of the total annual costs without product recovery.

The present value (PV) of the estimated costs of this proposed rule discounted at a two percent rate over the 15-year period from 2027 to 2041, excluding the value of product recovery, is $495 million in 2022 dollars. The equivalent annualized value[2] (EAV) of the costs excluding product recovery is $38.5 million at a two percent discount rate. The PV and EAV of the costs including product recovery are estimated to be $474 million and $37 million, respectively, using a two percent discount rate. Most of the estimated costs associated with this proposed rule are due to the new requirements for CMAS facilities that emit EtO.

The amendments to the CMAS NESHAP constitute a significant regulatory action. However, the proposal is not (3)(f)(1) significant, under Executive Order (EO) 14094 (which amended EO 12866), because it has an estimated annual effect on the economy that is less than $200 million and is not expected to adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or state, local, or tribal governments or communities.[3]

[2] The EAV is the value of the costs at time *t* if the stream of costs were equally distributed across periods in the time horizon. It is the amount that, if incurred each year over the time horizon, would generate the same present value as the actual (*i.e.*, time-varying) stream of expenditures. In other words, the sum of EAVs across years in present value terms yields the total present value of the costs.

[3] EO 14094 1(f)(1) specifies that impacts of $200 million or greater (costs, or benefits, in any single year) would indicate a rule is significant. EO 14094 can be found at: *https://www.federalregister.gov/documents/2023/04/11/2023-07760/modernizing-regulatory-review*.

1.4 Impacts on Small Entities

Based on the analysis of cost impacts on small entities, the EPA does not expect this proposed rule to have a Significant Impact on a Substantial Number of Small Entities (SISNOSE) under the Regulatory Flexibility Act as amended by the Small Business Regulatory Enforcement Fairness Act (SBREFA).

This proposed rule affects 58 small entities out of a total of 187 businesses that own affected CMAS facilities. Out of the 280 facilities expected to incur costs to comply with the proposed requirements, 64 facilities, or about 23 percent of facilities, are owned by the 58 ultimate parent companies that are classified as small entities based on the business size standards defined by the U.S. Small Business Administration (SBA).[4] The EPA estimated total annual costs per entity as a share of each entity's annual revenues to assess potential impacts on small entities. There are five small entities with an estimated cost-to-sales ratio of one percent or greater, which accounts for about nine percent of all affected small entities. There is one small entity with an estimated cost-to-sales ratio of three percent or greater, which accounts for about two percent of small entities. Thus, four small entities have estimated cost-to-sales ratios between one and three percent. Considering the low number and percentage of small entities with cost-to-sales ratios above one and three percent, the EPA does not anticipate that this action would result in a SISNOSE.

1.5 Emissions Impacts and Benefits

The EPA estimates that the proposed amendments will reduce HAP emissions (excluding EtO) from affected CMAS sources by approximately 158 tons per year (tpy) and reduce EtO emissions by approximately 4.6 tpy. Table 1-1 contains a summary of the estimated cost impacts and HAP emissions reductions for this proposed rule.

[4] U.S. Small Business Administration. (2023). Table of Small Business Size Standards. Found at https://www.sba.gov/document/support-table-size-standards.

Table 1-1. Estimated Costs and Emissions Impacts from 2027 to 2041 (Millions 2022$)

Total Capital Costs	$37.6
Total Annual Costs w/o product recovery	$38.0
Total Annual Costs w/ product recovery	$36.4
Present Value of Costs (2%) w/o product recovery	$495
Present Value of Costs (2%) w/ product recovery	$474
Equivalent Annualized Value (2%) w/o product recovery	$38.5
Equivalent Annualized Value (2%) w/ product recovery	$36.9
EtO Emissions Reductions (tpy)	4.6
HAP Emissions Reductions (tpy)	158

The total annual costs are the sum of the annualized capital costs and other annual costs. The capital costs were annualized over the lifetime of the equipment at an 8.5 percent interest rate.

This EIA includes qualitative discussion of the human health risks associated with exposure to EtO and other HAP emissions. However, the EPA did not monetize the benefits from the estimated HAP emission reductions associated with this proposed action. The EPA is unable to monetize benefits associated with HAP risk reductions for this rulemaking. However, the EPA expects that the HAP emission reductions will lower the risk of adverse health effects, including cancer, for individuals in communities near CMAS facilities. Monetization of the benefits of reductions in HAP-related cancer incidences would require several important inputs, including central estimates of cancer risks, estimates of exposure to the urban HAP, and estimates of the value of avoided cases of cancer (fatal and non-fatal, and specific to the type of cancer).

The proposed requirements are also associated with secondary changes in emissions of several non-HAP pollutants. The EPA estimates that the proposed requirements would reduce volatile organic compound (VOC) emissions by about 1,560 tpy and methane (CH_4) emissions by about 250 tpy due to improved flaring efficiency. Due to supplemental fuel or additional electricity needed to comply with the proposed standards, the EPA estimates that emissions of several pollutants would increase, including an additional 36 tpy of carbon monoxide (CO), 57,000 tpy of carbon dioxide (CO_2), 43 tpy of nitrogen oxides (NO_x) (including 0.97 tpy of nitrous oxide (N_2O)), 3.3 tpy of fine particulate matter ($PM_{2.5}$), and 0.26 tpy of sulfur dioxide (SO_2).

This EIA provides monetized estimates of the impacts associated with the methane emissions reductions and the net increases in CO_2 and N_2O emissions using the EPA's social

cost of greenhouse gas (SC-GHG) estimates.[5] The EPA was not able to monetize the health and environmental impacts associated with the estimated changes in criteria air pollutant emissions for this proposed rule, which include increased $PM_{2.5}$ and $PM_{2.5}$ precursor emissions and changes in VOC and NO_x emissions, which impact the formation of ground-level ozone.

Table 1-2 shows the PV and EAV of the estimated benefits of the GHG emissions changes from 2027 to 2041 discounted to 2027 at rates of 1.5 percent, 2 percent, and 2.5 percent. For purposes of this EIA, we will focus on the SC-GHG using the two percent discount rate. The estimated climate benefits are negative on net. The PV of the climate benefits for the 15-year period from 2027 to 2041 is estimated to be negative $195 million in 2022 dollars discounted at a two percent rate, and the EAV is estimated to be negative $15 million.

Table 1-2. Present Value of GHG Emissions Impacts from 2027 to 2041 (millions 2022$)

Discount Rate	2.5%	2.0%	1.5%
Present Value in 2027	(117.7)	(194.5)	(335.2)
Equivalent Annualized Value	(9.5)	(15.1)	(25.1)

Monetized climate benefits are based on changes in methane, N_2O, and CO_2 emissions and are calculated using the respective estimates of the SC-GHG for the three pollutants using a 1.5 percent, 2 percent, and 2.5 percent near-term Ramsey discount rate.

1.6 Summary of Results

Table 1-3 summarizes the costs, benefits, and net benefits estimated for this proposed rule. The monetized net benefits are negative as they include the estimated costs and the impacts of the secondary GHG impacts, which are negative (i.e., climate damages). The EPA was unable to monetize the benefits associated with the estimated HAP reductions for this proposed rule, however these reductions are expected to reduce adverse health effects, including cancer, and would presumably increase the net benefits of this rule if monetized. The PV of the monetized net benefits of the proposed amendments to the CMAS NESHAP is estimated to be about negative $670 million for the 15-year period from 2027 to 2041 discounted at a two percent rate

[5] U.S. EPA. (2024). Report on the Social Cost of Greenhouse Gases: Estimates Incorporating Recent Scientific Advances. Found at *https://www.epa.gov/environmental-economics/scghg*.

in 2022 dollars. The EAV of the net benefits is estimated to be negative $52 million using a two percent discount rate.

Table 1-3. Summary of Benefits, Costs, and Net Benefits for the Proposed CMAS Amendments from 2027 to 2041 (Millions 2022$)

	2% Discount Rate	
	PV	**EAV**
Benefits	158 tpy of reduced non-EtO HAP and 4.6 tpy of reduced EtO	
Net Compliance Costs	$474	$37
Compliance Costs	*$495*	*$39*
Value of Product Recovery	*($21)*	*($1.6)*
Monetized Climate Benefits	($195)	($15)
Non-Monetized Benefits	• Reduced adverse health effects of reduced HAP exposure • Reduced VOC emissions of 1,560 tpy • Increased emissions of SO_2 (0.26 tpy), NO_x (43 tpy), $PM_{2.5}$ (3 tpy), and CO (36 tpy) • Health and environmental impacts associated with effects on $PM_{2.5}$ and ozone	
Net Benefits	*($670)*	*($52)*

Monetized climate benefits are based on changes in methane, N_2O, and CO_2 emissions and are calculated using the respective estimates of the SC-GHG for the three pollutants using a 2 percent near-term Ramsey discount rate. Values rounded to three significant figures. While we expect these emissions reductions to have beneficial effects on air quality and public health for populations exposed to emissions from CMAS facilities, we have determined that quantification of those benefits cannot be accomplished for this proposed rule. This is not to imply that there are no benefits of the amendments. Rather, it is a reflection of the difficulties in modeling the health effects and monetizing the benefits of reducing HAP and EtO emissions from this source category with the data currently available. EPA is not including monetized estimates of the criteria pollutant emissions impacts for this proposal in the net monetized impacts in this EIA.

The remainder of this document is organized as follows. Chapter 2 provides regulatory history for the source category and describes the proposed requirements and new standards. Chapter 3 presents the cost analysis for the proposed rule. Chapter 4 presents the estimated emissions impacts and the benefits. Chapter 5 contains the small entity analysis. Chapter 6 concludes with a presentation of net benefits.

2 REGULATORY BACKGROUND

2.1 Regulatory History

This section provides the regulatory history for the CMAS category and the baseline regulatory requirements for CMAS sources. CMAS facilities are primarily synthetic area source chemical manufacturing facilities that produce a wide variety of specialty chemicals and products.

Collectively, CAA sections 112(c)(3), (d)(5), and (k)(3) are the basis of the Area Source Program under the Urban Air Toxics Strategy, which provides the framework for regulation of area sources under CAA section 112. Section 112(k)(3)(B) of the CAA requires the EPA to identify at least 30 HAP that pose the greatest potential health threat in urban areas with a primary goal of achieving a 75 percent reduction in cancer incidence attributable to HAP emitted from stationary sources. The HAP identified by the EPA (see the Integrated Urban Air Toxics Strategy (64 FR 38706, 38715, July 19, 1999)) are commonly referred to as the "30 urban HAP." CAA section 112(c)(3), in turn, requires the EPA to list sufficient categories or subcategories of area sources to ensure that area sources representing 90 percent of the emissions of the 30 urban HAP are subject to regulation.

In October 2009, the EPA promulgated the final NESHAP for area sources in the chemical manufacturing industry. The CMAS NESHAP affected area sources in nine source categories, including: Agricultural Chemicals and Pesticides 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. The rule established GACT standards pursuant to CAA section 112(d)(5). Determining what constitutes GACT involves considering the control technologies and management practices that are generally available to and appropriate for area sources in the category. The EPA considers technical capabilities of affected sources, costs, and economic impacts in establishing and amending GACT standards.

The 2009 rule established GACT emission standards in the form of management practices for each chemical manufacturing process unit as well as emission limits for certain

subcategories of process vents and storage tanks. The rule also established management practices and other emission reduction requirements for subcategories of wastewater systems, heat exchange systems, transfer operations, and equipment leaks.

In terms of management practices, the 2009 rule required quarterly inspections for equipment leaks, required owners and operators to keep lids on process vessels and to keep them closed whenever they were in organic HAP or metal HAP service, required the use of certain emission control techniques when transferring liquid to tank trucks and railcars, and required the development and operation of an inspection plan to identify leaks from small heat exchange systems. In addition to these management practices, the 2009 rule included standards for certain process vents, storage tanks, heat exchange systems, and wastewater systems. Specifically, the rule required:

- Emission reductions of total organic HAP greater than or equal to 95 percent (85 percent during periods of startup and shutdown), to a concentration of 20 parts per million by volume (ppmv), or by routing emissions via closed vent system to a flare for certain continuous process vents;
- Emission reductions of total organic HAP greater than or equal to 85 percent, to a concentration of 20 ppmv, or by routing emissions via closed vent system to a flare for certain existing batch process vents (90 percent for new sources);
- Emission reductions of total organic HAP greater than or equal to 95 percent for certain vents emitting metal toxic air pollutants;
- Emission reductions of certain halogenated vent streams by greater than or equal to 95 percent, to less than or equal to 0.45 kilograms per hour, or to a concentration of less than or equal to 20 ppmv;
- Improved controls for storage tanks varying in stringency depending on capacity;
- Quarterly monitoring via water sampling for heat exchange systems with flow rates greater than 8,000 gallons per minute;
- Separation of the organic and water phases or hard piping of the wastewater stream to either onsite treatment or a transfer point for offsite treatment for certain wastewater streams.

CMAS facilities were also required to submit one-time notifications of applicability and compliance status, semiannual compliance reports under certain circumstances, and keep records to demonstrate compliance with the final rule.

In December of 2012, the EPA finalized a reconsideration of the CMAS NESHAP to address minor technical corrections; to remove startup, shutdown, and malfunction exemptions; and to add affirmative defense provisions.

2.2 Proposed Requirements

The amendments being proposed in this rule are the result of the statutory authority comes from CAA section 112(d)(6). Technology reviews assess developments in practices, processes, or control technologies and revise the standards as necessary, considering factors like cost and cost-effectiveness. The EPA is required to conduct a technology review every eight years after a NESHAP is promulgated. In addition to the technology review, this rule is proposing to list a new source category, Chemical Manufacturing with Ethylene Oxide, pursuant to CAA section 112(c)(5) and is proposing new GACT standards for EtO pursuant to CAA section 112(d)(5). Refer to the preamble of this action, available in the docket for this rulemaking, for additional details.

For categories of area sources subject to GACT standards, CAA sections 112(d)(5) and (f)(5) provide that the EPA is not required to conduct a residual risk review. However, in light of the revisions to the cancer risk value for EtO,[6] the EPA performed a risk assessment to determine if a category of area source chemical manufacturers emitting EtO is adversely affecting human health or the environment, pursuant to CAA section 112(c)(3) as referenced by CAA section 112(c)(5). The risk assessment, available in the docket for this rulemaking, estimated lifetime cancer risks and noncancer effects from both chronic and acute inhalation exposures. Based on the risk assessment, the EPA determined it was appropriate to propose a new source category for regulation as part of the CMAS NESHAP and to set standards for EtO emissions from CMAS sources.

[6] EPA updated the Integrated Risk Information System (IRIS) value associated with EtO in 2016 and the unit risk estimate for EtO is nearly 60 times higher than it was prior to the 2016 IRIS update. An update in risk value of this magnitude is not typical for regulated HAPs. Additional information on the IRIS program is available here: https://www.epa.gov/iris.

In this proposed rule, the EPA is proposing new standards and management practices to the CMAS NESHAP for facilities that emit EtO, including requirements for:

- Heat exchange systems in EtO service, namely quarterly monitoring requirements using the Modified El Paso Method, a requirement to repair leaks more quickly, and removal of delay of repair;
- Equipment in EtO service, including monthly instrument monitoring requirements for valves, connectors, and pumps;
- Fenceline monitoring for EtO emissions;
- Process vents and storage tanks in EtO service, including new performance standards and testing requirements;
    - For process vents in EtO service, the EPA is proposing to require owners and operators to route emissions via closed vent system to a flare, reduce EtO emissions by greater than or equal to 99.9 percent, to a concentration less than 1 ppmv for each process vent, or to less than 5 pounds per year for all combined process vents.
    - For storage tanks containing greater than or equal to 0.1 percent EtO by weight, the EPA is proposing to require owners and operators to route emissions via closed vent system to a flare, reduce EtO emissions by greater than or equal to 99.9 percent, or to a concentration less than 1 ppmv for each storage tank.
- Flares in EtO service, including monitoring to ensure the flares are achieving control efficiencies greater than or equal to 98 percent.
- Wastewater in EtO service, proposing that any wastewater stream containing an annual average concentration of EtO greater than or equal to 1 ppmw to be treated and reduce EtO in the wastewater to less than 1 ppmw.
- Pressure relief devices in EtO service, proposing that PRDs be equipped with preventative measures and monitoring equipment and specifying that any EtO release to atmosphere from a PRD is a deviation. We expect all affected facilities

are already monitoring PRDs in EtO service, so there are no costs estimated for this practice.

- Transfer operations, proposing that owners and operators transferring liquids containing EtO to tank trucks or railcars comply with the same management practices that are already required for CMAS operations for non-EtO HAP. We expect all affected facilities are already complying with this requirement, so there are no costs estimated for this practice.

This proposed rule also updates several of the non-EtO standards in the CMAS NESHAP, including for:

- Pressure vessels, which will have updated leak detection and repair requirements.
- Pressure relief devices, proposing to require PRDs to be equipped with preventive measures and monitoring equipment and specify that PRDs may not release to the atmosphere more than twice over a rolling three year period.
- Equipment leaks, proposing to require instrument monitoring of valves, pumps, and connectors via EPA Method 21.
- Heat exchange systems with flow rates greater than 8,000 gallons per minute, proposing quarterly monitoring via the Modified El Paso Method.

The EPA is also proposing to require performance testing of non-flare control devices once every five years to demonstrate compliance with the emissions limits and amending the recordkeeping and reporting requirements to require the use of electronic reporting of certain reports. The EPA is proposing that affected sources must be in compliance with the proposed EtO requirements within two years of this rule being finalized and must be in compliance with the non-EtO requirements within three years of this rule being finalized. For fenceline monitoring, the EPA is proposing that facilities must start collecting data two years after the effective date of the final rulemaking and must begin root cause analysis and corrective action upon exceedance of the annual average concentration action level three years after the effective date of the final rulemaking.

The preamble contains a more thorough discussion of the analyses conducted to determine the amendments in this proposed rule, including the range of technologies, practices,

and other requirements considered and the EPA's reasoning for ultimately choosing the standards being proposed.

3 ENGINEERING COST ANALYSIS

3.1 Introduction

This section describes the EPA's estimates of the engineering costs associated with this proposed rule's requirements for affected CMAS operations. This EIA focuses on the requirements that result in quantifiable compliance cost or emissions changes compared to a regulatory baseline that represents the status quo without this rule. The EPA assumed each facility achieved emissions control sufficient to meet the baseline standards and estimated the emissions reductions and cost of fully complying with the proposed requirements relative to this baseline. The costs were estimated by multiplying facility and source counts by engineering cost estimates for the various requirements in the rule.

The technical memoranda in the docket describe the methodology, data, and assumptions used to estimate the costs (capital and annual costs) and the emission reductions for the proposed requirements for the CMAS NESHAP (40 CFR Part 63, Subpart VVVVVV). For greater detail on the methods for estimating the cost and emissions impacts associated with each emissions process group, see the documents titled *Clean Air Act Section 112(d)(5) GACT Standard Analysis for Equipment Leaks that Emit Ethylene Oxide and Section 112(d)(6) Technology Review for Equipment Leaks from Chemical Manufacturing Process Units at Area Sources Subject to the CMAS NESHAP, 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, Clean Air Act Section 112(d)(5) GACT Standard Analysis for Flares that Emit Ethylene Oxide and Section 112(d)(6) Technology Review for Flares Associated with Chemical Manufacturing Process Units at Area Sources Subject to the CMAS NESHAP, Clean Air Act Section 112(d)(5) GACT Standard Analysis for Heat Exchange Systems that Emit Ethylene Oxide and Section 112(d)(6) Technology Review for Heat Exchange Systems Associated with Chemical Manufacturing Process Units at Area Sources Subject to the CMAS NESHAP, Clean Air Act Section 112(d)(5) GACT Standard Analysis for Pressure Relief Devices Associated with Processes Subject to the CMAS NESHAP, Clean Air Act Section 112(d)(5) GACT Standard Analysis for Process Vents and Storage Tanks that Emit Ethylene Oxide and Section 112(d)(6)*

Technology Review for Process Vents and Storage Tanks Associated with Chemical Manufacturing Process Units at Area Sources Subject to the CMAS NESHAP, Clean Air Act Section 112(d)(5) GACT Standard Analysis for Pressure Vessels Associated with Processes Subject to the CMAS NESHAP, Clean Air Act Section 112(d)(5) GACT Standard Analysis for Wastewater Streams that Emit Ethylene Oxide and Clean Air Act Section 112(d)(6) Technology Review for Wastewater Systems Associated with Chemical Manufacturing Process Units at Area Sources Subject to the CMAS NESHAP, and the preamble, in the docket.

3.2 Affected Facilities

The EPA estimated costs for 280 CMAS facilities, including 33 facilities that emit EtO and will be affected by the EtO-specific requirements. It was assumed that these 280 facilities would continue to operate and be affected by the rule throughout the 15-year analytical timeframe from 2027 to 2041. The EPA did not estimate compliance costs for any new sources that may become affected by this rule in the future. Although the action contains requirements for new sources, the EPA is not aware of any new sources being constructed now or planned in the future, and, consequently, did not estimate any costs for new sources.

It should be noted that the EPA's rule, "Reclassification of Major Sources as Area Sources Under Section 112 of the Clean Air Act" (MM2A), that was finalized in September 2020, may offer some chemical manufacturing sources that are currently major HAP sources the opportunity to reclassify as area sources under certain conditions. In addition, the EPA finalized an amendment to the MM2A rule in 2024 to include a requirement that sources subject to certain major source NESHAP used to meet the Agency's obligations under CAA section 112(c)(6) for seven specific persistent and bioaccumulative pollutants must remain subject to those NESHAP even if those sources reclassify from major source status to area source status.[7] The EPA was not able to estimate how many major sources may reclassify that would then become affected by the CMAS NESHAP. While MM2A may result in a greater number of CMAS affected sources in the future, reclassification to area source status is generally expected to reduce costs for those sources relative to the costs that would be associated with the relevant major source standards, all

[7] Federal Register, "Review of Final Rule Reclassification of Major Sources as Area Sources under Section 112 of the Clean Air Act," 89 FR 73293. September 10, 2024.

other considerations being equal. Any major source considering reclassification will need to consider both the MM2A requirements and the requirements of the CMAS NESHAP.

3.3 Engineering Costs

The engineering costs estimated for the different proposed requirements are presented in Table 3-1. The 'total annual costs' are the sum of the annualized capital costs and other annual costs (*e.g.*, operating and maintenance costs, recordkeeping and reporting costs). Annualization of capital costs involves establishing an annual "payment" sufficient to finance the investment over the expected lifetime of the equipment or loan period. This payment is often referred to as the "capital recovery cost." To obtain annualized capital costs, a capital recovery factor is applied to the total capital cost estimate. The capital recovery factor is based on the lifetime of the capital equipment as well as the interest rate. To annualize the capital costs, the EPA assumed an 8.5 percent interest rate,[8] a 15-year lifetime for the pressure relief device equipment, a 5-year lifetime for the equipment leaks capital, a 5-year lifetime for the pressure vessel capital, a 5-year lifetime for the fenceline monitoring equipment, a 5-year lifetime for the EtO heat exchange system equipment, a 20-year lifetime for the EtO flare capital, a 20 year lifetime for process vent and storage vessel capital, and a 20-year lifetime for the capital associated with the EtO wastewater requirements. The other proposed requirements were not assumed to require capital expenditures.

The EPA estimated impacts for 15 years from 2027 to 2041. Capital costs are projected to be incurred in their entirety in 2027 (Year 1). For the purposes of this analysis, we assume all capital costs are incurred in 2027, rather than being spread out over the compliance period (which is two years for the EtO standards and three years for the non-EtO standards). While the affected firms may instead spread out these capital costs over the compliance timeframe, our methodological approach presents a worst-case scenario where all capital costs across the affected industry are incurred in one year.

In this EIA, the EPA also estimated the revenues that could be earned from selling the product that is estimated to be recoverable as a result of complying with the proposed requirements. The product recovery revenues are treated as an offset to the compliance costs

[8] The interest rate was obtained from https://fred.stlouisfed.org/series/PRIME on August 10, 2024.

(i.e., cost savings), though the revenues may also be considered as a benefit of the action. Regardless of whether the revenue from product recovery is considered a compliance cost offset or a benefit, the net benefits are equivalent. The cost estimates for this proposed rule are provided both including and excluding the value of product recovery.[9] When included, product recovery is embedded in the annual cost estimate. When the value of product recovery is included, the total annual cost estimate for the proposed rule is about four percent lower.

Table 3-1 presents the capital cost estimates and the total annual cost estimates (including and excluding product recovery) by requirement for the EtO-specific requirements and the other requirements.

Table 3-1. Engineering Cost Estimates by Requirement or Cost Component (2022$)

		Capital costs	Total Annual Costs (w/o Product Recovery)	Total Annual Costs (w/ Product Recovery)
EtO-specific Requirements	Fenceline Monitoring	488,000	20,996,000	20,996,000
	Equipment Leaks	511,000	1,261,000	1,129,000
	Heat Exchange Systems	122,000	157,000	118,000
	Pressure Vessels/ Storage Vessels	1,395,000	2,126,000	2,126,000
	Wastewater	12,899,000	5,471,000	5,471,000
	Flares	3,770,000	960,000	960,000
	Total	19,185,000	30,971,000	30,800,000
Other Requirements	Equipment Leaks	2,500,000	2,221,000	862,000
	Pressure Relief Devices	15,878,000	4,743,000	4,743,000
	Heat Exchange Systems	0	57,100	16,900
	Pressure Vessels	3,800	3,300	3,300
	Total	18,382,000	7,024,000	5,625,000
All Requirements		37,567,000	37,995,000	36,425,000

Total annual costs include annualized capital costs, annual operating and maintenance costs, and one-time costs. All estimates are rounded to three significant figures.

[9] Product recovery revenues were estimated per ton of VOC recovered at an estimate of $900 per ton based on the estimates for SOCMI facilities (see https://www.epa.gov/stationary-sources-air-pollution/synthetic-organic-chemical-manufacturing-industry-organic-national).

Most of the estimated costs associated with this proposed rule are due to the new EtO-specific requirements and standards for CMAS facilities that emit EtO. The largest component of the total annual cost estimated for this proposed rule is the fenceline monitoring cost for affected facilities that emit EtO, which is estimated to be about $21 million in 2022 dollars. This requirement accounts for roughly 55 percent of the rule's total annual cost estimate without product recovery and 58 percent of the total annual cost with product recovery. For additional details on the cost analysis for fenceline monitoring, see the document titled *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*, available in the docket for this action. The updated requirements for pressure relief devices (not an EtO-specific standard) are associated with the highest estimated capital cost for any single requirement in Table 3-1 at about $16 million, which accounts for 42 percent of the total capital costs estimated for the proposed rule.

Table 3-2 contains a summary of the estimated costs of all the requirements in the proposed rule. The total capital cost of the proposed rule is estimated to be $37.6 million in 2022 dollars. The total annual cost without the value of product recovery is estimated to be $38 million, and with product recovery it is estimated to be $36.4 million.

Table 3-2. Engineering Cost Summary (millions 2022$)

Total Capital Costs	$37.6
Total Annual Costs w/o product recovery	$38.0
Total Annual Costs w/ product recovery	$36.4

3.4 Present Value of Costs

As part of fulfilling the analytical requirements of EO 12866, as amended by 14094, the EPA presents estimates of the present value (PV) of the costs over the period 2027 to 2041. Costs are in 2022 dollars and discounted to 2027 at a two percent discount rate per the recommendation in OMB Circular A-4. The EPA also presents the equivalent annualized value (EAV) at a two percent discount rate. The EAV takes the "lumpy" stream of costs *(i.e.*, different costs in different years) and converts them into a single value that, if paid each year from 2027 to 2041, would equal the original stream of values in present value terms. In other words, the sum

of uniform EAVs across years in the analytical timeframe in present value terms yields the total present value (*i.e.*, the total discounted stream of costs across years).

Table 3-3 shows the estimated capital costs, annual operating and maintenance costs, value of product recovery, and the total PV and EAV of the costs discounted at a two percent rate for the 15 years from 2027 to 2041 in 2022 dollars. The values in the columns for capital costs, annual costs, and product recovery are the undiscounted costs. Table 3-1 also shows the sum of those undiscounted values (with product recovery savings included). The PV of the costs without including the value of product recovery for the 15-year period from 2027 to 2041 is estimated to be $495 million using a two percent discount rate and the EAV is $38.5 million. The PV of the costs including the value of product recovery is estimated to be $474 million, discounted at a two percent rate, and the EAV is $36.9 million. The PV and EAV of the costs are about four percent lower when including the value of product recovery.

Table 3-3. Present Value of Costs and Undiscounted Costs of Proposed Rule (millions 2022$)

Year	Capital costs	Annual operating & maintenance costs	Value of product recovery	Total undiscounted costs (w/ product recovery)	Discounted stream of costs (2%) w/o product recovery	Discounted stream of costs (2%) w/ product recovery
2027	$37.6	$34.9	($1.6)	$70.9	$72.4	$70.9
2028		$34.9	($1.6)	$33.3	$34.2	$32.6
2029		$34.9	($1.6)	$33.3	$33.5	$32.0
2030		$34.9	($1.6)	$33.3	$32.9	$31.4
2031		$34.9	($1.6)	$33.3	$32.2	$30.8
2032		$34.9	($1.6)	$33.3	$31.6	$30.2
2033		$34.9	($1.6)	$33.3	$31.0	$29.6
2034		$34.9	($1.6)	$33.3	$30.4	$29.0
2035		$34.9	($1.6)	$33.3	$29.8	$28.4
2036		$34.9	($1.6)	$33.3	$29.2	$27.9
2037		$34.9	($1.6)	$33.3	$28.6	$27.3
2038		$34.9	($1.6)	$33.3	$28.0	$26.8
2039		$34.9	($1.6)	$33.3	$27.5	$26.3
2040		$34.9	($1.6)	$33.3	$27.0	$25.7
2041		$34.9	($1.6)	$33.3	$26.4	$25.2
				Present value	$495	$474
				Equivalent annualized value	$38.5	$36.9

3.5 Uncertainties

The cost estimates are subject to several sources of uncertainty. This analysis includes many data sources as inputs, including source counts, equipment and labor costs, and assumptions regarding the current state of the industry and how individual facilities carry out their operations, the future state of the industry, and the future state of the world (*e.g.*, regulations, technology, economic activity, and human behavior). There is also uncertainty about the specific components of the engineering costs, such as the costs of the equipment and labor required to comply with the rule and how the costs might change over time. Facilities may comply with the requirements through alternative methods that were not accounted for in the EPA's estimates. Each of the inputs and assumptions used are uncertain to some degree and generate uncertainty in the overall cost estimates. When the uncertainties from each stage of the analysis are compounded, even small uncertainties can have large effects on the total cost estimates.

This analysis assumes full compliance with the rule across affected sources. This analysis also assumes that compliance will start in 2027 and that all capital costs will be incurred that year, and this may not be the case. Companies have two years to comply with the requirements once the final rule is published (assuming finalization in 2025) but facilities may begin incurring compliance related costs in the years leading up to the compliance date. The cost impacts were estimated out to 2041 and more uncertainty is introduced when impacts are estimated farther into the future.

The total number of facilities subject to the action could change. The EPA estimated costs for existing facilities, but other new facilities may be constructed and become subject to the requirements. Facilities may modify or upgrade in ways that affect the counts of the various emissions sources impacted by this rule. Additionally, new control technology may become available in the future at lower cost, and the EPA is unable to predict exactly how industry will comply with the rule in the future. Some firms, such as small businesses, may not be able to obtain financing at the assumed interest rate (*i.e.*, the U.S. bank prime rate).

There may be an opportunity cost associated with the installation of environmental controls for purposes of mitigating emissions that is not reflected in the compliance cost estimates. If investment in environmental compliance displaces other productive investment, the

difference between the rate of return on the displaced investment and the mandatory compliance-related investment is a measure of the opportunity cost of the regulation. The opportunity cost is the value lost to society of any goods and services that will not be produced and consumed because some resources are reallocated towards pollution mitigation activities that yield lower returns to society. To the extent that any opportunity costs are not included in the control costs, the compliance costs for this action may be underestimated.

4 EMISSIONS IMPACTS AND BENEFITS ANALYSIS

4.1 Introduction

The EPA estimates that the proposed amendments will reduce HAP emissions (excluding EtO) from affected CMAS sources by approximately 158 tpy and reduce EtO emissions by approximately 4.6 tpy. The benefits of the HAP and EtO emissions reductions are not monetized in this EIA, but a description of the health effects associated with exposure to some of the HAP emissions, including EtO, is provided. The other HAP emissions reductions from this rulemaking may include, but are not limited to, acrolein and nickel.

The proposed rule will also have secondary emissions impacts on non-HAP pollutants. The secondary emissions impacts include net reductions in VOC and methane emissions, and increases in $PM_{2.5}$, SO_2, NO_x (including N_2O), CO_2, and CO emissions. This section presents secondary emissions impact estimates and the monetized impacts for the GHG changes (CH_4, N_2O, and CO_2) and using the EPA's SC-GHG estimates.[10] The EPA acknowledges that some of the secondary emissions changes may have health and environmental impacts associated with $PM_{2.5}$ and ozone changes, however, the EPA was not able to formally monetize these impacts for inclusion in this EIA. Changes in emissions of NO_x and VOCs affect ozone formation while changes in $PM_{2.5}$, SO_2, and NO_x affect $PM_{2.5}$ concentrations. For information on the health impacts associated with ozone and PM, see the Regulatory Impact Analysis (RIA) for the PM National Ambient Air Quality Standards[11] (NAAQS) and the Ozone NAAQS RIA.[12]

The EPA estimates that the proposed requirements would reduce VOC emissions by 1,560 tpy and methane emissions by about 250 tpy. Due to supplemental fuel or additional electricity needed to comply with the proposed standards, the EPA estimates that emissions of

[10] U.S. EPA. (2024). Report on the Social Cost of Greenhouse Gases: Estimates Incorporating Recent Scientific Advances. Found at https://www.epa.gov/environmental-economics/scghg. Or, see the Integrated Science Assessment found here: https://www.epa.gov/isa/integrated-science-assessment-isa-particulate-matter.

[11] U.S. EPA. (2024). Final Regulatory Impact Analysis for the Reconsideration of the National Ambient Air Quality Standards for Particulate Matter. Found at: https://www.epa.gov/system/files/documents/2024-02/naaqs_pm_reconsideration_ria_final.pdf. Or, see the Integrated Science Assessment found here: https://www.epa.gov/isa/integrated-science-assessment-isa-ozone-and-related-photochemical-oxidants.

[12] U.S. EPA. (2015). Regulatory Impact Analysis of the Final Revisions to the National Ambient Air Quality Standards for Ground-Level Ozone. Found at: https://www.epa.gov/sites/default/files/2016-02/documents/20151001ria.pdf.

several pollutants would increase, including an additional 36 tpy of CO, 57,000 tpy of CO_2, 43 tpy of NO_x (including 0.97 tpy of N_2O), 3 tpy of PM, and 0.26 tpy of SO_2.

In accordance with executive orders and Agency policy, the EPA has carefully considered the impacts of this action on communities with environmental justice concerns. This is summarized in Section V.F of the preamble for this proposed rule.

4.2 Health Effects from Exposure to HAP Reduced by this Rule

This section contains qualitative discussion of the human health risks associated with exposure to EtO and other HAP emissions. Due to methodology and data limitations, we did not attempt to monetize the health benefits of reductions in HAP in this analysis. Instead, we are providing a qualitative discussion of the health effects associated with HAP emitted from sources subject to control under the final action.

Estimating the economic value of HAP is made challenging by the wide array of HAPs and the many human health endpoints affected. For example, though EPA can quantify the number and economic value of HAP-attributable deaths resulting from cancer, it is difficult to monetize the value of reducing an individual's potential non-fatal cancer risk attributable to HAP exposure. An alternative approach of conducting willingness to pay studies specifically on risk reduction may be possible, but such studies have not yet been pursued. Furthermore, monetizing non-fatal health effects remains a challenge for a variety of noncancer endpoints. EPA solicits comments on data or methods that can be used to quantify and monetize non-fatal cancer and noncancer health effects.

This rule proposes several standards to specifically reduce EtO emissions. This section provides a qualitative discussion of the health risks associated with exposure to EtO and several other HAP that may be reduced due to the proposed rule. The other HAP emissions reductions from this rulemaking may include, but are not limited to, acrolein and nickel.

EtO

Ethylene oxide is used as a chemical intermediate in the manufacture of ethylene glycol (antifreeze), textiles, detergents, polyurethane foam, solvents, medicine, adhesives, and other products. EtO is also used to sterilize medical devices. The Department of Health and Human Services and the International Agency for Research on Cancer have classified EtO as a known

human carcinogen. The EPA has concluded that EtO is carcinogenic to humans by the inhalation route of exposure. Evidence in humans indicates that exposure to EtO increases the risk of lymphoid cancer (including non-Hodgkin lymphoma, myeloma, and lymphocytic leukemia) and, for females, breast cancer.[13] Noncancer health endpoints affected by chronic exposure to EtO include irritation of the eyes, skin, nose, throat, and lungs, and damage to the brain and nervous system. Health effects from acute (short-term) exposure consist mainly of central nervous system depression and irritation of the eyes and mucous membranes. There is also some evidence linking EtO exposure to reproductive,[14] developmental, and endocrine effects.[15] EtO is a mutagen, meaning it acts directly on DNA and causes chromosome damage. Children may be particularly susceptible to the harmful effects of mutagenic substances.[16]

Acrolein

Acrolein is primarily used as an intermediate in the synthesis of acrylic acid and as a biocide. It may be formed from the breakdown of certain pollutants in outdoor air or from the burning of organic matter including tobacco, or fuels such as gasoline or oil. It is toxic to humans following inhalation, oral or dermal exposures. Acute (short-term) inhalation exposure may result in upper respiratory tract irritation and congestion. The major effects from chronic (long-term) inhalation exposure to acrolein consist of general respiratory congestion and eye, nose, and throat irritation.[17]

Nickel

Nickel exists naturally in the environment.. Nickel dermatitis, consisting of itching of the fingers, hands, and forearms, is the most common effect in humans from chronic (long-term) skin contact with nickel. Respiratory effects have also been reported in humans from inhalation

[13] U.S. EPA. (2016). Evaluation of the Inhalation Carcinogenicity of Ethylene Oxide (CASRN 75-21-8) In Support of Summary Information on the Integrated Risk Information System (IRIS). National Center for Environmental Assessment, Office of Research and Development. Washington, DC. EPA/635/R-16/350Fa. Found at https://cfpub.epa.gov/ncea/iris/iris_documents/documents/toxreviews/1025tr.pdf.

[14] U.S. EPA. (2018). Ethylene Oxide. Health Effects Notebook for Hazardous Air Pollutants. Found at https://www.epa.gov/sites/default/files/2016-09/documents/ethylene-oxide.pdf.

[15] Agency for Toxic Substances and Disease Registry (ATSDR). (2022). Toxicological Profile for Ethylene Oxide. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

[16] U.S. EPA. (2005). Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens. Found at https://www.epa.gov/sites/default/files/2013-09/documents/childrens_supplement_final.pdf.

[17] U.S. EPA. (2009). Acrolein. Health Effects Notebook for Hazardous Air Pollutants. Found at https://www.epa.gov/sites/default/files/2016-08/documents/acrolein.pdf.

exposure to nickel. Human and animal studies have reported an increased risk of lung and nasal cancers from exposure to nickel refinery dusts and nickel subsulfide. Animal studies of soluble nickel compounds (i.e., nickel carbonyl) have reported lung tumors. The EPA has classified nickel refinery dust and nickel subsulfide as Group A, human carcinogens, and nickel carbonyl as a Group B2, probable human carcinogen.[18]

4.2.1 Summary of Risk Analysis for CMAS Category

The EPA's risk analysis for this proposed rule considered potential health impacts of all HAP emitted by current and proposed CMAS source categories, including noncancer health effects from chronic and acute exposure to HAP in addition to evaluating cancer risk.

Based on the assessment, seven CMAS facilities under the baseline were estimated to have maximum cancer risks greater than 100-in-1 million, all of which were driven primarily (>90 percent) by EtO emissions. The maximum individual lifetime [cancer] risk (MIR)[19] posed by the evaluated sources is 800-in-1 million under the baseline, driven by EtO emissions from process vents (97 percent). Under the baseline, 3,600 people within 10 km of the evaluated CMAS facilities are estimated to have cancer risks above 100-in-1 million due to emissions from the evaluated CMAS sources.

The chronic noncancer effects that were observed under the baseline are driven by emissions of nickel compounds from two facilities. The acute noncancer risks are driven by acrolein.

After the controls proposed in this action are implemented, the maximum individual cancer risk is estimated to be 100-in-1 million and no facilities are estimated to pose cancer risk greater than 100-in-1 million, thus zero people are projected to be exposed to CMAS-driven

[18] U.S. EPA. (2000). Nickel Compounds. Health Effects Notebook for Hazardous Air Pollutants. Found at https://www.epa.gov/sites/default/files/2016-09/documents/nickle-compounds.pdf.

[19] For each facility, the EPA calculates the Maximum Individual Risk (MIR) as the cancer risk associated with a continuous lifetime (24 hours per day, 7 days per week, 52 weeks per year, 70 years) exposure to the maximum concentration at the centroid of each census block. Individual cancer risk is calculated by multiplying the estimated lifetime exposure to the ambient concentration of each emitted HAP (in micrograms per cubic meter) by the corresponding unit risk estimate (URE) for each HAP. The URE is an upper-bound (*i.e.*, conservative) estimate of an individual's incremental risk of contracting cancer over a lifetime of exposure to a concentration of 1 microgram of the pollutant per cubic meter of air ($\mu g/m^3$). The MIR is the highest individual lifetime cancer risk estimated for any census block within 50 km of a facility.

cancer risk greater than 100-in-1 million post implementation of the proposed requirements. See section II.E of the preamble and the document titled *Risk Assessment for the CMAS Source Category in Support of the 2025 Technology Review Proposed Rule*, available in the docket for this rulemaking, for additional details.

4.3 Secondary Emissions Impacts

The proposed rule will have secondary emissions impacts on non-HAP pollutants. This NESHAP targets urban HAP, so impacts on other pollutants emitted by CMAS facilities that are due to compliance with the proposed requirements are considered secondary. The secondary emissions impacts include net reductions in VOC and methane emissions, and increases in emissions of $PM_{2.5}$, SO_2, NO_x (including N_2O), CO_2, and CO.

The EPA estimates that the proposed requirements would reduce VOC emissions by 1,560 tpy and methane emissions by about 250 tpy. Due to supplemental fuel or additional electricity needed to comply with the proposed standards, the EPA estimates that emissions of several pollutants would increase, including an additional 36 tpy of CO, 57,000 tpy of CO_2, 43 tpy of NO_x (including 0.97 tpy of N_2O), 3 tpy of PM, and 0.26 tpy of SO_2. The net GHG increase due to the proposed rule in CO_2 equivalent (CO_2e) is about 50,000 tpy. The secondary emissions impacts are summarized in Table 4-1. For details on the methods and assumptions used to estimate the secondary emissions impacts, see the memo titled *Secondary Impacts for Flares, Thermal Oxidizers, and Wastewater Controls for the CMAS NESHAP* in the docket.

Table 4-1. Secondary Emissions Impacts

Pollutant	Net Secondary Emissions Impacts (tpy)
VOC	(1,557)
PM	3.3
SO_2	0.26
NOx	43
CO	36
CO_2	57,000
N_2O	0.97
CH_4	(251)
Total CO_2e	49,700

The proposed flare requirements for EtO are estimated to result in GHG emission impacts including increased CO_2 emissions and a net reduction in CH_4 emissions due to improved combustion efficiency of steam-assisted flares, decreased steam demand, and increased need for supplemental natural gas. There is a very slight increase of N_2O emissions of in 0.1 tpy that results from the improvement in flare destruction efficiencies. While CO_2 emissions from flares will increase with higher flare destruction efficiencies, emissions of methane will decrease and there will be a net decrease in GHG emissions on a CO_2e basis associated with the flare requirements.

The proposed rule will also require some facilities to install thermal oxidizers as a result of the proposed standards requiring control of EtO emissions from certain process vents and storage vessels, which are estimated to decrease HAP and VOC emissions but increase GHG emissions and criteria air pollutant emissions. The secondary emissions impacts for the thermal oxidizers come from the combustion of pollutants and from the combustion of any auxiliary natural gas needed to operate the thermal oxidizer controls. The thermal oxidizers increase emissions of CO_2, N_2O, and CH_4, as well as several criteria air pollutants including PM, NOx, SO_2, and CO.

Finally, the wastewater requirements are estimated to increase electricity usage and water usage. As a result of the proposed standards requiring control of HAP emissions from certain wastewater streams, the EPA anticipates that some CMAS facilities will need to install steam strippers. The EPA estimates that the revised standards for controlling HAP from wastewater will lead to an increase in electricity usage of 0.38 million kWh per year and an increase in water usage of 290 million gallons per year.

The next section provides the monetized estimates of the GHG emissions changes for this proposed rule. The EPA acknowledges that some of the secondary emissions changes may have health and environmental impacts associated with $PM_{2.5}$ and ozone changes, however, the EPA was not able to monetize these impacts for inclusion in this EIA.

4.4 Climate Impact Valuation

The EPA estimates the climate impacts of GHG emissions changes expected from the proposed rule using estimates of the social cost of greenhouse gases (SC-GHG) that reflect recent advances in the scientific literature on climate change and its economic impacts. The SC-

GHG is the monetary value of the net harm to society associated with a marginal increase in GHG emissions in a given year, or the benefit of avoiding that increase. In principle, SC-GHG includes the value of all climate change impacts (both negative and positive), including (but not limited to) changes in net agricultural productivity, human health effects, property damage from increased flood risk and natural disasters, disruption of energy systems, risk of conflict, environmental migration, and the value of ecosystem services. The SC-GHG, therefore, reflects the societal value of reducing emissions of the gas in question by one metric ton and is the theoretically appropriate value to use in conducting benefit-cost analyses of policies that affect GHG emissions.

In practice, data and modeling limitations restrain the ability of SC-GHG estimates to include all physical, ecological, and economic impacts of climate change, implicitly assigning a value of zero to the omitted climate damages. The estimates are, therefore, a partial accounting of climate change impacts and likely underestimate the marginal impacts of abatement. A more detailed explanation of each input and the modeling process to estimate the SC-GHG, as well as characterizations of the various uncertainties associated with the SC-GHG estimates, are provided in the final technical report, EPA's Report on the Social Cost of Greenhouse Gases: Estimates Incorporating Recent Scientific Advances.[20]

This EIA provides monetized estimates of the benefits associated with the methane emissions reductions and the disbenefits associated with the net increases in CO_2 and N_2O emissions using the EPA's SC-GHG estimates. Monetized climate effects are presented using 1.5 percent, 2 percent, and 2.5 percent Ramsey discount rates. See Table 4-2 for the EPA's social cost estimates per metric ton of CO_2, CH_4, or N_2O in 2022 dollars for the years in the analytical timeframe used for this analysis. These values are multiplied by the annual emissions change estimates due to the proposed requirements and then discounted to 2027 to estimate the PV of the climate impacts of the proposal.

[20] U.S. EPA. (2023). Report on the Social Cost of Greenhouse Gases: Estimates Incorporating Recent Scientific Advances. Found at https://www.epa.gov/environmental-economics/scghg.

Table 4-2. Social Cost per Metric Ton of CO_2, CH_4, and N_2O (2022$)

	2% Near-term Ramsey Discount Rate		
Emission Year	**CO_2**	**CH_4**	**N_2O**
2027	245	2,436	70,212
2028	250	2,521	71,585
2029	253	2,605	72,956
2030	257	2,690	74,329
2031	262	2,788	75,728
2032	265	2,886	77,127
2033	270	2,985	78,527
2034	274	3,083	79,925
2035	278	3,182	81,324
2036	282	3,279	82,724
2037	287	3,378	84,123
2038	290	3,476	85,522
2039	294	3,575	86,922
2040	299	3,672	88,321
2041	303	3,778	89,900

Found at: https://www.epa.gov/environmental-economics/scghg

Table 4-3 shows the annual undiscounted monetized impacts of the changes in emissions of CO_2, CH_4, and N_2O while Table 4-4 shows these impacts discounted to 2027 over the 15-year period using discount rates of 2.5 percent, 2 percent, and 1.5 percent to estimate the PV. The estimated CO_2 benefits are the largest in absolute terms at an estimated PV of negative $203.5 million for the years 2027 to 2041 discounted at a two percent rate in 2022 dollars. The estimated methane benefits are about $10 million from 2027 to 2041 at a two percent discount rate.

Table 4-3. Undiscounted Values of CO_2, CH_4, and N_2O Emissions Impacts (millions of 2022$)

	CO_2			CH_4			N_2O		
	2.5%	2.0%	1.5%	2.5%	2.0%	1.5%	2.5%	2.0%	1.5%
2027	(8.7)	(14.0)	(23.6)	0.5	0.6	0.8	(0.0)	(0.1)	(0.1)
2028	(8.9)	(14.2)	(23.9)	0.5	0.6	0.8	(0.0)	(0.1)	(0.1)
2029	(9.0)	(14.4)	(24.2)	0.5	0.7	0.9	(0.0)	(0.1)	(0.1)
2030	(9.2)	(14.7)	(24.5)	0.5	0.7	0.9	(0.0)	(0.1)	(0.1)
2031	(9.4)	(14.9)	(24.8)	0.6	0.7	0.9	(0.0)	(0.1)	(0.1)
2032	(9.6)	(15.1)	(25.1)	0.6	0.7	0.9	(0.1)	(0.1)	(0.1)
2033	(9.8)	(15.4)	(25.4)	0.6	0.7	1.0	(0.1)	(0.1)	(0.1)
2034	(9.9)	(15.6)	(25.7)	0.6	0.8	1.0	(0.1)	(0.1)	(0.1)
2035	(10.1)	(15.8)	(26.0)	0.7	0.8	1.0	(0.1)	(0.1)	(0.1)
2036	(10.3)	(16.1)	(26.3)	0.7	0.8	1.1	(0.1)	(0.1)	(0.1)
2037	(10.5)	(16.3)	(26.6)	0.7	0.8	1.1	(0.1)	(0.1)	(0.1)
2038	(10.7)	(16.5)	(26.9)	0.7	0.9	1.1	(0.1)	(0.1)	(0.1)
2039	(10.8)	(16.8)	(27.2)	0.7	0.9	1.1	(0.1)	(0.1)	(0.1)
2040	(11.0)	(17.0)	(27.5)	0.8	0.9	1.2	(0.1)	(0.1)	(0.1)
2041	(11.2)	(17.3)	(27.8)	0.8	0.9	1.2	(0.1)	(0.1)	(0.1)

Note: Negative values imply climate disbenefits associated with GHG emissions increases (CO_2 and N_2O). Positive values imply positive benefits (reduced CH_4).

Table 4-4. Present Value of Emissions Impacts for CO_2, CH_4, and N_2O Discounted to 2027 (millions of 2022$)

	CO_2			CH_4			N_2O		
	2.5%	2.0%	1.5%	2.5%	2.0%	1.5%	2.5%	2.0%	1.5%
2027	(8.7)	(14.0)	(23.6)	0.5	0.6	0.8	(0.0)	(0.1)	(0.1)
2028	(8.7)	(14.0)	(23.6)	0.5	0.6	0.8	(0.0)	(0.1)	(0.1)
2029	(8.6)	(13.9)	(23.5)	0.5	0.6	0.8	(0.0)	(0.1)	(0.1)
2030	(8.5)	(13.8)	(23.4)	0.5	0.6	0.9	(0.0)	(0.1)	(0.1)
2031	(8.5)	(13.8)	(23.4)	0.5	0.6	0.9	(0.0)	(0.1)	(0.1)
2032	(8.5)	(13.7)	(23.3)	0.5	0.7	0.9	(0.0)	(0.1)	(0.1)
2033	(8.4)	(13.7)	(23.2)	0.5	0.7	0.9	(0.0)	(0.1)	(0.1)
2034	(8.3)	(13.6)	(23.2)	0.5	0.7	0.9	(0.0)	(0.1)	(0.1)
2035	(8.3)	(13.5)	(23.1)	0.5	0.7	0.9	(0.0)	(0.1)	(0.1)
2036	(8.2)	(13.5)	(23.0)	0.5	0.7	0.9	(0.0)	(0.1)	(0.1)
2037	(8.2)	(13.4)	(22.9)	0.5	0.7	0.9	(0.0)	(0.1)	(0.1)
2038	(8.1)	(13.3)	(22.9)	0.5	0.7	0.9	(0.0)	(0.1)	(0.1)
2039	(8.1)	(13.2)	(22.7)	0.5	0.7	1.0	(0.0)	(0.1)	(0.1)
2040	(8.0)	(13.2)	(22.7)	0.6	0.7	1.0	(0.0)	(0.1)	(0.1)
2041	(7.9)	(13.1)	(22.6)	0.6	0.7	1.0	(0.0)	(0.1)	(0.1)
Total	(124.9)	(203.5)	(347.1)	7.9	10.1	13.5	(0.7)	(1.0)	(1.6)

Note: Negative values imply climate disbenefits associated with GHG emissions increases (CO_2 and N_2O). Positive values imply positive benefits (reduced CH_4).

Table 4-5 shows the undiscounted values of the changes in all the GHGs combined, and Table 4-6 shows the impacts discounted to 2027 over the 15-year period using discount rates of 2.5 percent, 2 percent, and 1.5 percent to estimate the PV. The total monetized GHG benefits, which are negative on net, are estimated to be $194.5 million from 2027 to 2041 using a two percent discount rate. The corresponding EAV at a discount rate of two percent is about negative $15 million.

Table 4-5. Undiscounted Values of GHG Emissions Impacts (millions of 2022$)

	2.5%	2.0%	1.5%
2027	(8.2)	(13.4)	(22.9)
2028	(8.4)	(13.7)	(23.2)
2029	(8.5)	(13.8)	(23.5)
2030	(8.7)	(14.1)	(23.7)
2031	(8.9)	(14.3)	(24.0)
2032	(9.0)	(14.5)	(24.3)
2033	(9.2)	(14.7)	(24.5)
2034	(9.3)	(14.9)	(24.8)
2035	(9.5)	(15.1)	(25.1)
2036	(9.7)	(15.3)	(25.4)
2037	(9.8)	(15.6)	(25.6)
2038	(10.0)	(15.7)	(25.9)
2039	(10.2)	(16.0)	(26.2)
2040	(10.3)	(16.2)	(26.5)
2041	(10.5)	(16.4)	(26.7)

Table 4-6. Present Value of GHG Emissions Impacts Discounted to 2027 (millions of 2022$)

	2.5%	2.0%	1.5%
2027	(8.2)	(13.4)	(22.9)
2028	(8.2)	(13.4)	(22.9)
2029	(8.1)	(13.3)	(22.8)
2030	(8.1)	(13.3)	(22.7)
2031	(8.0)	(13.2)	(22.6)
2032	(8.0)	(13.1)	(22.6)
2033	(7.9)	(13.1)	(22.4)
2034	(7.8)	(13.0)	(22.4)
2035	(7.8)	(12.9)	(22.3)
2036	(7.7)	(12.8)	(22.2)
2037	(7.7)	(12.8)	(22.1)
2038	(7.6)	(12.7)	(22.0)
2039	(7.6)	(12.6)	(21.9)
2040	(7.5)	(12.5)	(21.8)
2041	(7.4)	(12.5)	(21.7)
Total PV	(117.7)	(194.5)	(335.2)
EAV	(9.5)	(15.1)	(25.1)

Note: Negative values imply climate disbenefits associated with GHG emissions impacts.

4.5 $PM_{2.5}$ and Ozone-related Health Impacts

This proposed rule is expected to increase annual emissions of direct $PM_{2.5}$, NO_X, and SO_2 as a secondary impact. Because NO_X and SO_2 are also precursors to secondary formation of ambient $PM_{2.5}$, increasing these emissions would increase human exposure to ambient $PM_{2.5}$ throughout the year and would increase the incidence of $PM_{2.5}$-attributable health effects. This rule is also expected to reduce ozone season VOC emissions and increase ozone season NO_X emissions. In the presence of sunlight, NO_X and VOCs undergo chemical reactions in the atmosphere resulting in ozone formation. Reducing VOC emissions (and increasing NO_X emissions) could impact formation of ground-level ozone and the incidence of ozone-related health effects, though ozone response to changes in these emissions depends on local conditions. To summarize, changes in emissions of NO_x and VOCs affect ozone formation while changes in $PM_{2.5}$, SO_2, and NO_x affect $PM_{2.5}$ concentrations. For information on the health impacts

associated with ozone and $PM_{2.5}$, see the Regulatory Impact Analysis (RIA) for the PM National Ambient Air Quality Standards[21] (NAAQS) and the Ozone NAAQS RIA.[22]

4.6 Uncertainties

Uncertainty is inherent in estimating baseline emissions from the source category, the emission reduction estimates for the assumed compliance methods, how the industry will comply and thus how emissions will be affected, the future of the industry and future source counts, the assumptions regarding the GHG and criteria pollutant impacts associated with increased electricity use to power the controls, as well as the SC-GHGs used to monetize the climate impacts. In practice, data and modeling limitations restrain the ability of SC-GHG estimates to include all physical, ecological, and economic impacts of climate change, implicitly assigning a value of zero to the omitted climate damages. The estimates are, therefore, a partial accounting of climate change impacts and likely underestimate the marginal impacts of abatement. A more detailed explanation of each input and the modeling process to estimate the SC-GHG, as well as characterizations of the various uncertainties associated with the SC-GHG estimates, are provided in the final technical report, EPA's Report on the Social Cost of Greenhouse Gases: Estimates Incorporating Recent Scientific Advances.[23] For risk assessments, including the one performed for this rule, there are uncertainties in the emissions datasets, dispersion modeling, inhalation exposure estimates, and dose-response relationships.

[21] U.S. EPA. (2024). Final Regulatory Impact Analysis for the Reconsideration of the National Ambient Air Quality Standards for Particulate Matter. Found at: https://www.epa.gov/system/files/documents/2024-02/naaqs_pm_reconsideration_ria_final.pdf. Or, see the Integrated Science Assessment found here: https://www.epa.gov/isa/integrated-science-assessment-isa-particulate-matter.

[22] U.S. EPA. (2015). Regulatory Impact Analysis of the Final Revisions to the National Ambient Air Quality Standards for Ground-Level Ozone. Found at: https://www.epa.gov/sites/default/files/2016-02/documents/20151001ria.pdf. Or, see the Integrated Science Assessment found here: https://www.epa.gov/isa/integrated-science-assessment-isa-ozone-and-related-photochemical-oxidants.

[23] U.S. EPA. (2023). Report on the Social Cost of Greenhouse Gases: Estimates Incorporating Recent Scientific Advances. Found at https://www.epa.gov/environmental-economics/scghg.

5 SMALL ENTITY IMPACT ANALYSIS

5.1 Introduction

This proposed rule is a significant regulatory action. The presentation of the compliance cost estimates in chapter 3 does not speak directly to potential economic and distributional impacts of the rule, which may be important consequences to consider. This chapter contains a discussion of the small entity analysis conducted for this rule and a qualitative discussion of potential market and employment impacts.

5.2 Small Entity Screening Analysis

This section describes the methods used to perform the small entity screening analysis, as well as the results of the screening analysis for this proposed rule. A small entity screening analysis is used to determine whether a regulatory action may have a SISNOSE. Guidelines for what constitutes 'significant' for economic impacts and 'substantial' for the number of small entities are outlined in guidance prepared for the Regulatory Flexibility Act (RFA) as amended by SBREFA.

The small entity impact analysis determined that this proposed rule will not have significant cost impacts on a substantial number of small entities, thus EPA made a 'no SISNOSE' determination for this proposed rule.

5.2.1 Description and Estimate of Affected Small Entities

The RFA describes small entities as "small businesses," "small governments," and "small organizations" (5 USC 601). The amendments being finalized by the EPA in this action are expected to affect a variety of businesses, including small businesses, but would not affect any small governments or small organizations. The "business" is defined as the parent owner rather than the facility. The EPA evaluates affected entities at the highest level of business ownership, or the 'ultimate parent company' level. The analysis uses the annual revenues of the ultimate parent company to determine the resources it has available to comply with the rule.

To conduct a small entity screening, the EPA first identifies the ultimate parent companies that own affected facilities, and obtains those companies' most recent annual

revenues, number of employees, and North American Industrial Classification System (NAICS) code using the Dun & Bradstreet Hoover's online database.[24] The annual revenues for each entity should correspond to the year 2022 in most cases. U.S. Small Business Administration (SBA) size standards are defined for each NAICS code based on either annual revenues or number of employees. To determine whether an entity is small, the EPA identifies the size standard corresponding to the NAICS code of the ultimate parent company and compares the company's annual revenues (or number of employees) to the size standards. To assess potential impacts on small entities, the EPA calculates cost-to-sales ratios, which compare facility-level total annual compliance cost estimates aggregated to the ultimate parent company level (in case one company owns multiple affected facilities) to the annual sales revenues of the ultimate parent company. This metric for evaluating impacts is known as the "sales test" and is consistent with guidance published by SBA's Office of Advocacy.[25]

The sales test is an impact methodology the EPA employs in analyzing entity impacts as opposed to a "profits test," in which annualized compliance costs are calculated as a share of profits. The sales test is frequently used because revenues or sales data are commonly available for entities impacted by EPA regulations, and profits data normally made available are often not the true profit earned by firms because of accounting and tax considerations.

Table 5-1 shows some of the most common NAICS codes for the ultimate parent companies that own facilities affected by this proposed rule. The table shows a wide variety of industries, although the most common code of the companies affected (21 out of 187, or 11 percent) is NAICS 551112: 'Offices of Other Holding Companies.' The second most common is NAICS 325412: 'Pharmaceutical Preparation Manufacturing,' with 14 affected companies.

[24] Dun & Bradstreet, Inc. (2024). D&B Hoovers. Retrieved from https://app.dnbhoovers.com/.

[25] U.S. SBA, Office of Advocacy. (2017). A Guide for Government Agencies: How to Comply with the Regulatory Flexibility Act. Retrieved from https://advocacy.sba.gov/2017/08/31/a-guide-for-government-agencies-how-to-comply-with-the-regulatory-flexibility-act/.

Table 5-1. Affected NAICS Codes

2022 NAICS	NAICS Description	Parent Companies Affected	Facilities Affected
551112	Offices of Other Holding Companies	21	33
325412	Pharmaceutical Preparation Manufacturing	14	23
325211	Plastics Material and Resin Manufacturing	10	21
325180	Other Basic Inorganic Chemical Manufacturing	10	18
325998	All Other Miscellaneous Chemical Product and Preparation Manufacturing	7	17
325199	All Other Basic Organic Chemical Manufacturing	13	17
424690	Other Chemical and Allied Products Merchant Wholesalers	11	11
325120	Industrial Gas Manufacturing	3	8
334516	Analytical Laboratory Instrument Manufacturing	4	7
523150	Investment Banking and Securities Intermediation	1	6
325320	Pesticide and Other Agricultural Chemical Manufacturing	6	6
325510	Paint and Coating Manufacturing	4	5
325612	Polish and Other Sanitation Good Manufacturing	3	5

See Table 5-2 for the number of entities and facilities by entity size. The EPA identified 280 CMAS facilities currently operating in the U.S. that will be impacted by this rule and incur costs, 64 of which are owned by small entities. This rule is expected to impact a total of 187 businesses, 58 of which are small entities based on the business size standards defined by the SBA.[26] Thus, approximately 31 percent of businesses affected by this proposed rule are small entities and they own about 23 percent of the affected CMAS facilities.

Table 5-2. Number of Percent of Entities and Facilities by Entity Size

Entity Size	Number of Affected Entities	Percent of Affected Entities	Number of Affected Facilities	Percent of Affected Facilities
Small	58	31%	64	23%
Large	129	69%	216	77%
All	187		280	

5.2.2 Compliance Cost Impact Estimates

The EPA calculated cost-to-sales ratios by first estimating the total annual compliance cost for each affected entity by summing annualized capital costs with other annual costs such as

[26] U.S. Small Business Administration. (2024). Table of Small Business Size Standards. Found at https://www.sba.gov/document/support-table-size-standards.

operating and maintenance costs. The EPA summed the annual compliance costs across facilities owned by an affected entity (when an entity owns more than one affected facility) and divided the company level total annual cost estimate by the company's annual sales to obtain the cost-to-sales ratio. Small entities incurring total annual costs less than one percent of annual sales are generally not expected to experience significant economic impacts due to the rule. Small entities with costs greater than three percent of their annual revenues may potentially experience significant economic impacts. The EPA also examines how many entities have cost-to-sales ratios of one percent or greater. The EPA believes the one and three percent ratio thresholds, which are from EPA guidance, are appropriate for analyzing impacts of this rule.

Table 5-3 shows by business size the average annual sales, employees, capital cost, total annual cost (with and without product recovery), cost-to-sales ratio, and the max cost-to-sales ratio. The table also shows the number and percent of businesses above the one and three percent cost-to-sales ratio thresholds by business size. The average total annual cost (not including the value of product recovery) per entity of the proposed requirements is about $66,000 for small entities and about $265,000 for large entities. When including the value of product recovery, the average total annual cost for small entities is about $59,000 and for large entities it is $256,000. Average annual sales for the 58 small entities is $230 million while the 129 affected large businesses have average annual sales of about $18 billion.

On average, small entities are estimated to experience a 0.3 percent cost-to-sales ratio not including the value of product recovery to comply with the proposed rule, compared to an average of 0.01 percent for large entities and about 0.1 percent for all entities. The highest cost-sales-ratio estimated is 5.5 percent and is experienced by a small entity. It is important to note that the small entities that own facilities affected by the proposed EtO standards have relatively higher estimated cost-to-sales ratios, with an average cost-to-sales ratio of 3 percent for the three EtO facilities that are owned by small entities. The small entity with the maximum cost-to-sales ratio of 5.5 percent owns a facility affected by the proposed EtO standards. These three small entities also have smaller average annual revenues compared to the whole population of small entities, averaging $47 million in annual revenues compared to $230 million for all small entities.

Table 5-3. Average Costs per Entity and Cost-to-Sales Ratios by Entity Size

	All Businesses	Large Businesses	Small Businesses
Average Annual Revenues (millions)	$12,500	$18,100	$230
Average Employees	32,300	46,800	250
Average Capital Cost	$200,900	$255,100	$80,300
Average Total Annual Cost	$203,200	$265,100	$65,500
Average Total Annual Cost w/ Product Recovery	$194,800	$255,700	$59,300
Average Cost-to-Sales Ratio	0.11%	0.01%	0.32%
Average Cost-to-Sales Ratio w/ Product Recovery	0.10%	0.01%	0.29%
Maximum Cost to Sales Ratio	5.48%	0.40%	5.48%
Number and Percent of Businesses with Cost-to-Sales ratio greater than or equal to 1%	5 (3%)	0 (0%)	5 (9%)
Number and Percent of Businesses with Cost-to-Sales ratio greater than or equal to 3%	1 (1%)	0 (0%)	1 (2%)
Number of Businesses	187	129	58
Number of Facilities	280	216	64

Table 5-4 shows the total capital costs, total annual costs, product recovery value, and annual operating and maintenance costs by business size. Out of a total capital cost estimate for the rule of about $37.6 million, small entities are expected to incur about $4.7 million, or about 12 percent of the total capital costs. Additionally, out of a total annual cost estimate for the proposed rule of about $38 million, small entities are expected to incur about $3.8 million, or about 10 percent of the total annual costs. Large entities incur most of the total costs estimated for the rule and they incur higher total annual costs per entity on average than small entities.

Table 5-4. Total Costs of Proposed Requirements by Entity Size (millions of 2022$)

	All Businesses	Large Businesses	Small Businesses
Capital Costs	$37.6	$32.9	$4.7
Total Annual Costs	$38	$34.2	$3.8
Value of Product Recovery	$1.6	$1.2	$0.36
Total Annual Costs w/ Product Recovery	$36.4	$33	$3.4
Operating and Maintenance Costs	$34.9	$31.3	$3.5
Number of Businesses	187	129	58
Number of Facilities	280	216	64

Table 5-5 shows the number of small and large entities with cost-to-sales ratios above one percent and three percent. These cost-to-sales ratios were estimated using the total annual costs without the cost savings from product recovery to be conservative. There are five small entities, which account for about nine percent of the 58 affected small entities, with estimated cost-to-sales ratios greater than or equal to one percent. There is one small entity, which accounts for about two percent of all 58 small entities, with an estimated cost-to-sales ratio greater than or equal to three percent. This small entity has an estimated cost-to-sales ratio of about 5.5 percent (this entity has comparatively low annual revenues). Thus, four small entities have estimated cost-to-sales ratios between one and three percent. No large entities have a cost-to-sales ratio estimated to exceed one percent.

Table 5-5. Small Entity Screening Summary

	Capital Cost (Million 2022$)	Total Annual Cost (w/o recovery credits)	Entities with 1% or greater Cost-to-Sales	Entities with 3% or greater Cost-to-Sales
All Entities	$37.6	$38	5	1
Small Entities	$4.7	$3.8	5	1
Large Entities	$32.9	$34.2	0	0

Total annual costs do not include the value of product recovery.

The results of this small entity screening analysis do not indicate that a substantial share of the small entities affected by this rule would incur potentially high costs relative to their revenues. EPA guidance on RFA implementation suggests that when less than 20 percent of small entities are estimated to experience annual compliance costs greater than or equal to one percent of their annual revenues, it may be appropriate to determine that the rule would not have a significant impact on small entities.[27] The EPA believes the example thresholds provided in the guidance are appropriate for the small entity analysis of this rule. Since a low percentage of small entities that own CMAS facilities have estimated cost-to-sales ratios that exceed the example thresholds in the guidance, the EPA does not expect this proposed rule to have significant economic impacts on a substantial number of small entities, therefore the EPA has certified a no SISNOSE determination for the proposed rule.

[27] US EPA. (2006). Final Guidance for EPA Rulewriters: Regulatory Flexibility Act as amended by the Small Business Regulatory Enforcement Fairness Act. Found at: https://www.epa.gov/sites/default/files/2015-06/documents/guidance-regflexact.pdf.

5.2.3 Uncertainties

The cost-to-sales ratios estimated in this analysis may be overstated or understated depending on the accuracy of the information in the underlying data on parent company ownership and parent company revenues in addition to the accuracy of the facility-level cost estimates. The uncertainties associated with the cost estimates are discussed in chapter 3.

Regulatory costs can disproportionately impact small entities for several reasons, even when larger firms incur higher absolute costs. In addition to potentially holding more market power, larger companies may be better positioned financially than small businesses to invest in proven compliance mechanisms, obtain financing for upgrades, raise prices to recoup regulatory costs, or conduct research and development needed to innovate and identify more efficient compliance methods. Small firms have fewer units of production to spread compliance costs over. In some situations, larger firms may also have the advantage of being closer to meeting a more stringent new standard under baseline conditions. This analysis assumes that small and large entities both obtain financing for capital expenses at the same interest rates (8.5 percent). It is possible that small businesses have less opportunities to obtain financing or receive higher interest rates than larger businesses.

While a "sales test" can provide some insight as to the economic impact of an action such as this one, it assumes that the impacts of a regulation are solely incident on a directly affected firm (therefore, no impact to consumers of the affected product), or solely incident on consumers of output directly affected by this action (therefore, no impact to companies that are producers of the affected product). Thus, an analysis such as this one is best viewed as providing insight on a polar example of economic impacts: maximum impact to directly affected companies. A "sales test" analysis does not consider shifts in supply and demand curves to reflect intermediate economic outcomes. EPA solicits comment on data, methods, or models that can be used to reduce uncertainties in all aspects of the small entity impact analysis.

5.3 Economic and Employment Impacts

The EPA does not expect this proposed rule to affect market prices or the supply of the products manufactured by affected CMAS facilities, regardless of whether costs are passed on to consumers or absorbed by affected firms, and thus the EPA does not expect this rule to have

market impacts. The costs of this rule are estimated to be low relative to the earnings of the companies that ultimately own impacted CMAS facilities. The average cost-to-sales ratio for the affected ultimate parent owners of CMAS facilities is 0.1 percent. Even if CMAS firms have market power and/or demand is inelastic and affected firms are able to raise prices for their chemical products in response to increased regulatory costs, it is reasonable to infer that the impact on consumers from this rule is likely to be minor given the low cost-to-sales ratios. Given the relatively low costs of the rule and the limited impacts on affected firms, the EPA also does not expect this rule to impact employment.[28] Any other economic impacts, such as changes in firm concentration within the affected industry or movement of CMAS facilities outside of the U.S., are also expected to be minor.

[28] The employment analysis in this EIA is part of EPA's ongoing effort to "conduct continuing evaluations of potential loss or shifts of employment which may result from the administration or enforcement of [the Act]" pursuant to CAA section 321(a).

6 NET BENEFITS

The costs, benefits, and net benefits of the proposed amendments to the NESHAP for CMAS operations are shown in Table 6-1. The monetized net benefits are negative as they include the estimated costs and the impacts of the secondary GHG impacts, which are negative (i.e., climate damages). The EPA was unable to monetize the benefits associated with the estimated HAP reductions for this proposed rule, however these reductions are expected to reduce adverse health effects, including cancer, and would presumably increase the net benefits of this rule if monetized. The PV of the monetized net benefits of the proposed amendments is estimated to be about negative $670 million for the 15-year period from 2027 to 2041 discounted at a two percent rate in 2022 dollars. The EAV is estimated to be negative $52 million using a two percent discount rate.

Table 6-1. Summary of Benefits, Costs, and Net Benefits for the Proposed CMAS Amendments from 2027 to 2041 (Millions 2022$)

	2% Discount Rate	
	PV	**EAV**
Benefits	158 tpy of reduced non-EtO HAP and 4.6 tpy of reduced EtO	
Net Compliance Costs	$474	$37
Compliance Costs	*$495*	*$39*
Value of Product Recovery	*($21)*	*($1.6)*
Monetized Climate Benefits	($195)	($15)
Non-Monetized Benefits	• Reduced adverse health effects of reduced HAP exposure • Reduced VOC emissions of 1,560 tpy • Increased emissions of SO_2 (0.26 tpy), NO_x (43 tpy), $PM_{2.5}$ (3 tpy), and CO (36 tpy) • Health and environmental impacts associated with effects on $PM_{2.5}$ and ozone	
Net Benefits	*($670)*	*($52)*

Monetized climate benefits are based on changes in methane, N_2O, and CO_2 emissions and are calculated using the respective estimates of the SC-GHG for the three pollutants using a 2 percent near-term Ramsey discount rate.

As noted in the table, the primary benefits of the rulemaking, the HAP reductions associated with the proposed standards, are not monetized. However, as indicated by the risk assessment and the magnitude of anticipated risk reductions, we expect health benefits from reducing exposure to HAP.

6.1 Uncertainties

The results of this analysis are subject to many sources of uncertainty. This analysis includes many data sources as inputs, including source counts, equipment and labor costs, and assumptions regarding the current state of the chemical manufacturing industry and how individual facilities carry out their operations, the future state of the industry, and the future state of the world (*e.g.*, regulations, technology, economic activity, and human behavior). There is also uncertainty about the specific components of the engineering costs, such as the costs of the equipment and labor required to comply with the rule and how the costs might change over time, as well as the interest rate firms may be able to obtain when financing capital expenditures.

The EPA estimated costs for existing CMAS facilities, but other new facilities may be constructed in the future and become subject to the requirements. Facilities may modify or upgrade in ways that affect the number of the various emissions points impacted by this rule. Additionally, new control technology may become available in the future at lower cost.

For the small entity analysis, the cost-to-sales ratios for individual firms estimated and presented in Chapter 5 are based on the best information the EPA had available, but because the cost estimates are subject to the uncertainty described above, the cost-to-sales ratios may overestimate or underestimate the true impact for affected firms.

There is also uncertainty in the baseline emissions dataset and the modeling conducted to estimate the emissions reductions due to the rule. Finally, there is uncertainty regarding the benefits of the rule due to methodology and data limitations related to the association between HAP pollutant exposure and the reductions in cancer and non-cancer endpoints, as well as the monetary value of avoiding those health impacts. There is also uncertainty inherent to the GHG impact estimates due to the many limitations associated with estimating SC-GHG values.

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