## TECHNICAL MEMORANDUM

TO: Docket for Rulemaking, "Proposed Federal Implementation Plan Addressing Regional Ozone Transport for the 2015 Ozone National Ambient Air Quality Standards" (EPA-HQ-OAR-2021-0668)
DATE: February 28, 2022
SUBJECT: Screening Assessment of Potential Emissions Reductions, Air Quality Impacts, and Costs from Non-EGU Emissions Units for 2026

***Note: EPA originally posted this document on March 11, 2022. This document, posted on March 29, 2022, corrects inadvertent errors referencing a filename on page 9 and in Table 5 on page 16.***

### I. Introduction

The EPA developed an analytical framework to facilitate decisions about industries, emissions unit types, and cost thresholds for including emissions units in the non-electric generating unit "sector" (non-EGUs) in a federal implementation plan (FIP) proposal for the 2015 ozone national ambient air quality standards (NAAQS) transport obligations. Using this analytical framework, we prepared a screening assessment for the year 2026.

This memorandum presents the analytical framework and summarizes the screening assessment the EPA prepared to identify industries and emissions unit types to include in proposed rules to obtain NOx emissions reductions from non-EGUs. Sections VII.A.2. and VII.C. of the proposal preamble include discussions of the non-EGU NOx emissions limits, compliance timing, and other related-rule requirements for the industries and emissions unit types identified through the screening assessment.

The remainder of this memorandum includes the following sections:

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### II. Background on Analytical Framework

The number of different industries and emissions unit categories and types, as well as the total number of emissions units that comprise the non-EGU "sector"[1] makes it challenging to define a single method to identify impactful emissions reductions. We incorporated air quality information as a first step in the analytical framework to help determine potentially impactful industries to focus on for further assessing emission reduction potential, air quality improvements, and costs. Given the lengthy decision-making and analysis schedules for the FIP

[1] The non-EGU "sector" includes non-electric generating emissions units in various manufacturing industries and does not include municipal waste combustors (MWC), cogeneration units, or <25 MW EGUs. For a discussion of MWCs, cogeneration units, and EGUs <25 MW, see Section VI.B.3. of the proposed rule preamble.

proposal, we developed the analytical framework using inputs from the air quality modeling for the Revised CSAPR Update (RCU) for 2023[2], as well as the projected 2023 annual emissions inventory from the 2016v2 emissions platform that was used for the air quality modeling for the proposed rule.

Using the RCU modeling for 2023, we identified upwind states linked to downwind nonattainment or maintenance receptors using the 1% of the NAAQS threshold criterion, which is 0.7 ppb (1% of a 70 ppb NAAQS). In 2023 there were 27 linked states for the 2015 NAAQS: AL, AR, CA, DE, IA, IL, IN, KY, LA, MD, MI, MN, MO, MS, NJ, NY, NV, OH, OK, PA, TN, TX, UT, VA, WI, WV, and WY.

To analyze non-EGU emissions units, we aggregated the underlying projected 2023 emissions inventory data into industries defined by 4-digit NAICS.[3] Then for the linked states, we followed the 2-step process below:

1. **Step 1** -- We identified industries whose potentially controllable emissions are estimated, by applying the analytical framework, to have the greatest ppb impact on downwind air quality, [4] and
2. **Step 2** – We determined which of the most impactful industries and emissions units had the most emissions reductions that would make meaningful air quality improvements at the downwind receptors at a marginal cost threshold we determined using underlying control device efficiency and cost information.

Additional details on these steps are presented in the Section III below.

Finally, the EPA concluded, based on the most recent information available from the CSAPR Update Non-EGU TSD,[5] that controls on all of the non-EGU emissions units cannot be installed by the 2023 ozone season.[6] As such, we modified the analytical framework slightly and applied it for a screening assessment estimating potential emissions reductions, air quality improvements, and costs for the year 2026.

## III. The Analytical Framework

### Step 1 - Identifying Potentially Impactful Industries in 2023

The analytical framework starts with identifying industries whose potentially controllable emissions may contribute to downwind receptors. To identify industries that have large, meaningful air quality impacts from potentially controllable emissions, we estimated air quality contribution by 4-digit NAICS-based industry for 2023. To estimate the contributions by 4-digit NAICS at each downwind receptor, we used the 2023 state-receptor specific RCU ppb/ton values and the RCU calibration factors used in the air quality assessment tool (AQAT) for control analyses in 2023.[7]

[2] We used the RCU air quality modeling for this screening assessment because the air quality modeling for the proposed rule was not completed in time to support this assessment.
[3] North American Industry Classification System (https://www.census.gov/naics/).
[4] To identify industries, we reviewed emissions units with >= 100tpy emissions units in the 2023 inventory in those industries in the upwind states.
[5] Final Technical Support Document (TSD) for the Final Cross-State Air Pollution Rule for the 2008 Ozone NAAQS, Assessment of Non-EGU $NO_X$ Emissions Controls, Cost of Controls, and Time for Compliance Final TSD ("CSAPR Update Non-EGU TSD"), August 2016, available at *https://www.epa.gov/csapr/assessment-non-egu-NOx-emission-controls-cost-controls-and-time-compliance-final-tsd*.
[6] Note that information on control installation timing as detailed in the 2016 CSAPR Update Non-EGU TSD is not complete or sufficient to serve as a foundation for timing estimates for this proposed FIP.
[7] The calibration factors are receptor-specific factors. For the RCU, the calibration factors were generated using 2016 base case and 2023 base case air quality model runs. These receptor-level ppb/ton factors are discussed in the Ozone Transport

We focused on assessing emissions units that emit >100 tpy of NOx.[8] By limiting the focus to potentially controllable emissions, well-controlled sources that still emit > 100 tpy are excluded from consideration. Instead, the focus is on uncontrolled sources or sources that could be better controlled at a reasonable cost. As a result, reductions from any industry identified by this process are more likely to be achievable and to lead to air quality improvements.

Based on the industry contribution data, we prepared a summary of the estimated total, maximum, and average contributions from each industry and the number of receptors with contributions >= 0.01 ppb from each industry. We evaluated this information to identify breakpoints in the data, as described in detail in Appendix A. These breakpoints were then used to identify the most impactful industries to focus on for the next steps in the analysis.[9]

A review of the contribution data indicated that we should focus the assessment of NOx reduction potential and cost primarily on four industries. These industries each (1) have a maximum contribution to any one receptor of >0.10 ppb and (2) contribute >= 0.01 ppb to at least 10 receptors. We refer to these four industries identified below as comprising **"Tier 1"**.

- Pipeline Transportation of Natural Gas
- Cement and Concrete Product Manufacturing
- Iron and Steel Mills and Ferroalloy Manufacturing
- Glass and Glass Product Manufacturing

In addition, the contribution data suggests that we should include five additional industries as a second tier in the assessment. These industries each either have (1) a maximum contribution to any one receptor >=0.10 ppb but contribute >=0.01 ppb to fewer than 10 receptors, or (2) a maximum contribution <0.10 ppb but contribute >=0.01 ppb to at least 10 receptors. We refer to these five industries identified below as comprising **"Tier 2"**.

- Basic Chemical Manufacturing
- Petroleum and Coal Products Manufacturing
- Metal Ore Mining
- Lime and Gypsum Product Manufacturing
- Pulp, Paper, and Paperboard Mills

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Policy Analysis Final Rule TSD found here: https://www.epa.gov/sites/default/files/2021-03/documents/ozone_transport_policy_analysis_final_rule_tsd_0.pdf.

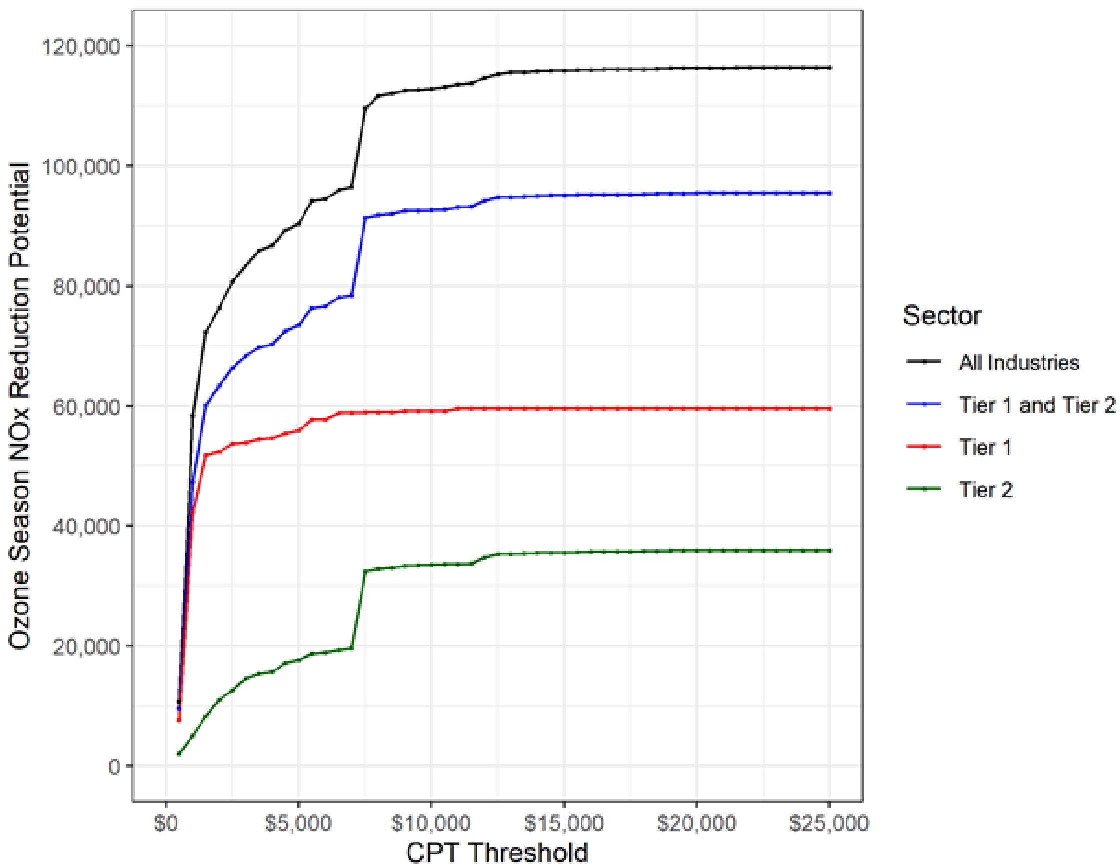
[8] In the non-EGU emission reduction assessment prepared for the Revised Cross State Air Pollution Rule Update (https://www.regulations.gov/document/EPA-HQ-OAR-2020-0272-0014), we reviewed emissions units with >150 tpy of NOx emissions. In this screening assessment, we broadened the scope to include emissions units with >=100 tpy of NOx emissions. We believe that emissions units that are smaller may already be controlled and reductions from these smaller units are likely to be more costly.

[9] The air quality contribution data and the R code that processed these data are available upon request.

**Step 2a - Identifying a Cost Threshold to Evaluate Emissions Reductions in Potentially Impactful Industries for 2023**

To identify an annual cost threshold for evaluating potential emissions reductions in the Tier 1 and Tier 2 industries, the EPA used the Control Strategy Tool (CoST)[10], the Control Measures Database (CMDB)[11], and the projected 2023 emissions inventory to prepare a listing of potential control measures, and costs, applied to non-EGU emissions units in the projected 2023 emissions inventory. Using this data, we plotted curves for Tier 1 industries, Tier 2 industries, Tier 1 and 2 industries, and all industries at $500 per ton increments. Figure 1 indicates there is a "knee in the curve" at approximately $7,500 per ton.[12] We used this marginal cost threshold to further assess estimated emissions reductions, air quality improvements, and costs from the potentially impactful industries. Note that controls and related emissions reductions are available at several estimated cost levels up to the $7,500 per ton threshold. The costs do not include monitoring, recordkeeping, reporting, or testing costs.

**Figure 1. Ozone Season NOx Reductions and Costs per Ton (CPT) for Tier 1, Tier 2 Industries, and Other Industries**

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[10] Further information on CoST can be found at the following link: https://www.epa.gov/economic-and-cost-analysis-air-pollution-regulations/cost-analysis-modelstools-air-pollution.

[11] The CMDB is available at the following link: https://www.epa.gov/economic-and-cost-analysis-air-pollution-regulations/cost-analysis-modelstools-air-pollution.

[12] The CoST run results, the CMDB, and the R code that generated the curves are available upon request.

**Step 2b - Assessing Non-EGU Emission Reduction Potential and Estimated Air Quality Impacts in Potentially Impactful Industries in 2023**

Next, using the marginal cost threshold of $7,500 per ton, to estimate emissions reductions and costs the EPA processed the CoST run using the maximum emission reduction algorithm[13,14] with known controls.[15] We identified controls for non-EGU emissions units in the Tier 1 and Tier 2 industries that cost up to $7,500 per ton. Note that $7,500 per ton represents a marginal cost, and controls and related emissions reductions are available at several estimated costs up to the $7,500 per ton threshold. The costs do not include monitoring, recordkeeping, reporting, or testing costs.

We then calculated air quality impacts associated with the estimated reductions for the 27 linked states in 2023 following the steps below.

1. We binned the estimated reductions by 4-digit NAICS code into the Tier 1 and Tier 2 industries.
2. We used the 2023 state-receptor specific RCU ppb/ton values and the RCU calibration factors used in the AQAT for control analyses in 2023. We multiplied the estimated non-EGU reductions by the ppb/ton values and by the receptor-specific calibration factor to estimate the ppb impacts from these emissions reductions.[16]

*Note that we did not include the impact of reductions in the "home state" even if the "home state" was linked to receptor(s) in another state. That is, we only looked at the impact of NOx emissions reductions from upwind states. Furthermore, for each receptor we included impacts from states that are upwind to any receptor, not just those states that are upwind to that particular receptor.*

**Step 2c – Refining Tier 2 by Identifying Potentially Impactful Boilers in 2023**

In 2023 because boilers represent the majority emissions unit in the Tier 2 industries for which there were controls that cost up to $7,500 per ton (see Table 1 below), we targeted emissions reductions and air quality improvements in Tier 2 industries by identifying potentially impactful industrial, commercial, and institutional (ICI) boilers.

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[13] The maximum emission reduction algorithm assigns to each source the single measure (if a measure is available for the source) that provides the maximum reduction to the target pollutant. For more information, see the CoST User's Guide available at the following link: https://www.cmascenter.org/cost/documentation/3.7/CoST%20User's%20Guide/.
[14] The maximum emission reduction CoST run results and CMDB are available upon request.
[15] *Known controls* are well-demonstrated control devices and methods that are currently used in practice in many industries. *Known controls* do not include cutting edge or emerging pollution control technologies.
[16] The 2023 state-receptor specific RCU ppb/ton values, the RCU calibration factors used in AQAT for control analyses in 2023, the R code that processed the CoST run results using the maximum emission reduction algorithm, and the summaries of the air quality improvements are available upon request.

**Table 1. Number of Emissions Unit Types in Tier 2 Industries**

| | Number of Emissions Units by Type | | |
|---|---|---|---|
| Tier 2 Industries | Boiler | Internal Combustion Engine | Industrial Processes |
| Metal Ore Mining | -- | 1 | 15 |
| Pulp, Paper, and Paperboard Mills | 49 | 1 | -- |
| Petroleum and Coal Products Manufacturing | 37 | 4 | 48 |
| Basic Chemical Manufacturing | 46 | 8 | 13 |
| Lime and Gypsum Product Manufacturing | -- | -- | 1 |
| **Totals** | **132** | **14** | **77** |

To identify potentially impactful boilers, using the projected 2023 emissions inventory in the linked upwind states we identified a universe of boilers with >100 tpy NOx emissions that had <u>any</u> contributions at downwind receptors.[17,18] We refined the universe of boilers to a subset of impactful boilers by sequentially applying the three criteria below to each boiler. This approach is similar to the overall analytical framework and was tailored for application to individual boilers.[19,20]

- <u>Criterion 1</u> -- Estimated maximum air quality contribution at an individual receptor of >=0.0025 ppb ***or*** estimated total contribution across downwind receptors of >=0.01 ppb***.***
- <u>Criterion 2</u> -- Controls that cost up to $7,500 per ton.
- <u>Criterion 3</u> -- Estimated maximum air quality improvement at an individual receptor of >=0.001 ppb.

## <u>IV. Modifying the Analytical Framework for the Screening Assessment for 2026</u>

EPA concluded, based on the most recent information available from the CSAPR Update Non-EGU TSD, that controls on all of the non-EGU emissions units cannot be installed by the 2023 ozone season. As such, we prepared a screening assessment for the year 2026 by generally applying the analytical framework detailed above. Specifically, we

- Retained the impactful industries identified in Tier 1 and Tier 2, the $7,500 cost per ton threshold, and the methodology for identifying impactful boilers,
- Modified the framework to address challenges associated with using the projected 2023 emissions inventory by using the 2019 emissions inventory, and
- Updated the air quality modeling data by using data for 2026.

Using the projected 2023 emissions inventory introduced challenges associated with the application of new source performance standards (NSPS).[21] Some of the projected emissions inventory records reflected percent

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[17] We used the 2023fj non-EGU point source inventory files from the 2016v2 emissions platform.

[18] MD, MO, NV, and WY did not have boilers with >100 tpy NOx emissions.

[19] For the impactful boiler assessment, the estimated air quality contributions and improvements were not based on modeling of individual emissions units or emissions source sectors. The air quality estimates were derived by using the 2023 state/receptor specific RCU ppb/ton values and the RCU calibration factors used in AQAT. The results are intended to provide a general indication of the relative impact across sources.

[20] For the impactful boiler assessment, the 2023 state-receptor specific RCU ppb/ton values, the RCU calibration factors used in the AQAT for ozone for control analyses in 2023, and the R code that processed the CoST run results are available upon request.

[21] Using the projected inventory also introduced challenges associated with the growth of emissions at sources over time. EPA determined that the 2019 inventory was appropriate because it provided a more accurate prediction of potential near-

reductions associated with the application of current NSPS (e.g., Reciprocating Internal Combustion Engine, Natural Gas Turbines, Process Heaters NSPS). Applying NSPSs during the emissions projections process includes estimating the number of modifications/replacements that would trigger NSPS requirements. None of the existing sources, as they currently exist, would install a control because of a NSPS. But some of those sources might modify and become subject to the NSPS. Because we do not know which sources might become subject to an NSPS by modifying, across-the-board percent reductions from unknown control measures are applied to all of the sources.[22] As a result, CoST replaced some of the unknown control measures with a control measure that it concluded was more efficient. However, we do not know if a control would be applied to a particular source in response to the NSPS rules and if so, what that control would be. Therefore, we do not know if CoST is correctly replacing those unknown control measures. To address this challenge, we used a current, not projected, emissions inventory along with the latest air quality modeling information for 2026. Specifically, we used the 2019 inventory for information on emissions, emissions units, and estimated emissions reductions in concert with the emissions sector-specific (non-EGU-specific) ppb/ton factors for 2026 and 2026 AQAT calibration factors to estimate the impacts on future air quality from reductions at emissions units as those units currently exist.[23]

## V. Screening Assessment Results for 2026 -- Estimated Total Emissions Reductions, Air Quality Improvements, and Annual Total Costs for Emissions Units in Tier 1 Industries and Impactful Boilers in Tier 2 Industries

This screening assessment is not intended to be, nor take the place of, a unit-specific detailed engineering analysis that fully evaluates the feasibility of retrofits for the emissions units, potential controls, and related costs. We used CoST to identify emissions units, emissions reductions, and costs to include in a proposed FIP; however, CoST was designed to be used for illustrative control strategy analyses (e.g., NAAQS regulatory impact analyses) and not for unit-specific, detailed engineering analyses. The estimates from CoST identify proxies for (1) non-EGU emissions units that have emission reduction potential, (2) potential controls for and emissions reductions from these emissions units, and (3) control costs from the potential controls on these emissions units.

See Sections VII.A.2. and VII.C. of the proposal preamble for discussions of the NOx emissions limits, compliance timing, and other related rule requirements for the industries and emissions unit types identified through this screening assessment.

To prepare the screening assessment for 2026, we applied the analytical framework detailed in the sections above with the modifications discussed in the previous section. The assessment includes emissions units from the Tier 1 industries and impactful boilers from the Tier 2 industries. Using the latest air quality modeling for 2026, we identified upwind states linked to downwind nonattainment or maintenance receptors using the 1% of the NAAQS threshold criterion, or 0.7 ppb. In 2026 there are 23 linked states for the 2015 NAAQS: AR, CA, IL, IN, KY, LA, MD, MI, MN, MO, MS, NJ, NY, NV, OH, OK, PA, TX, UT, VA, WI, WV, and WY.
We re-ran CoST with known controls, the CMDB, and the 2019 emissions inventory. We specified CoST to allow replacing an existing control if a replacement control is estimated to be >10 percent more effective than the

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term emissions reductions. For additional discussion of the 2019 inventory, please see the *2019 National Emissions Inventory Technical Support Document: Point Data Category* available in the docket. In switching to the 2019 inventory, however, we did not account for any growth or decrease in emissions that might occur at individual units. Because the controls applied by CoST have efficiencies, or percent reductions, this means we could be over- or under-estimating the emission reductions and their ppb impacts.

[22] For additional information on the 2016v2 inventory and the projected 2023 emissions inventory, please see the September 2021 *Technical Support Document Preparation of Emissions Inventories for 2016v2 North American Emissions Modeling Platform* in the docket or available at the following link: https://www.epa.gov/system/files/documents/2021-09/2016v2_emismod_tsd_september2021.pdf.

[23] For this proposed FIP, the EPA used the ozone AQAT, which is described in detail in *Ozone Policy Analysis Proposed Rule TSD* in the docket. The receptor-state specific calibration factors for 2026 were derived using the following air quality modeling runs: 2026 base case and 2026 control case with 30 percent across-the-board NOx emissions cuts.

existing control. We did not replace an existing control if the 2019 emissions inventory indicated the presence of that control, even if the CMDB reflects a greater control efficiency for that control. Also, we removed six facilities from consideration because they are subject to an existing consent decree, are shut down, or will shut down by 2026. See Appendix B for a summary of the facilities removed.

For the emissions units in the Tier 1 industries and the impactful boilers in the Tier 2 industries, the estimated emissions reductions, air quality improvements, and costs are summarized below and in Tables 2 through 5 that follow. The cost estimates do not include monitoring, recordkeeping, reporting, or testing costs.[24] As shown in Table 2, the total estimated ozone season emissions reductions are 47,186 tons, the estimated total ppb improvement across all downwind receptors is 5.16 ppb, and the estimated total cost is $410.8 million annually. The estimated ozone season reductions, total ppb improvements, and total cost are representative of single year impacts and not cumulative impacts.

Table 3 presents estimated ppb improvements at receptors grouped by region. For the coastal Connecticut/New York City nonattainment area receptors, total ppb improvements from Tier 1 and Tier 2 range from 0.247 to 0.356 ppb; for the receptors near Chicago, total ppb improvements range from 0.261 to 0.375 ppb; for the receptors along the western shoreline of Lake Michigan in Wisconsin, total ppb improvements range from 0.360 to 0.443 ppb; for the Houston receptors, total ppb improvements range from 0.284 to 0.472 ppb; and for the western receptors, ppb improvements range from <0.001 to 0.056 ppb. There are far fewer emissions reductions from western states because there are far fewer states and impacted emissions units in the west, and the resulting air quality improvements are noticeably lower.

For Tier 1 industries and the impactful boilers in the Tier 2 industries, Table 4 provides by state and by industry estimated emissions reductions and costs; Table 4a provides by state, estimated emissions reductions and costs. New Jersey and Nevada are not included in these tables because they did not have any estimated non-EGU reductions from the Tier 1 industries and boilers in Tier 2 industries that cost up to $7,500 per ton. In addition, Figure 2 shows the geographical distribution of ozone season reductions.

Table 5 provides by industry and east/west, the number and type of emissions units, total estimated emissions reductions, total ppb improvements, and costs. There are 489 emissions units contributing to the total estimated reductions of 47,186 ozone season tons and total estimated ppb improvements of 5.16 ppb.[25]

Table 6 includes by industry, the emissions source group, control technology, number of emissions units, ozone season emissions reductions, and annual total cost for the emissions units in the screening assessment. Lastly, Tables 7, 8, and 9 provide summaries of estimated ozone season emissions reductions, annual total cost, and average cost per ton by the control technologies CoST applied (i) across all non-EGU emissions units, (ii) across non-EGU emissions units grouped by the Tier 1 industries and impactful boilers in Tier 2 industries, and (iii) across non-EGU emissions units grouped by the seven individual Tier 1 and 2 industries.

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[24] EPA submitted an information collection request (ICR) to OMB associated with the proposed monitoring, calibrating, recordkeeping, reporting and testing activities required for non-EGU emissions units -- *ICR for the Proposed Rule, Federal Implementation Plan Addressing Regional Ozone Transport for the 2015 Primary Ozone National Ambient Air Quality Standard: Transport Obligations for non-Electric Generating Units*, EPA ICR No. 2705.01. The ICR is summarized in Section XI.B.2 of the proposed rule preamble. The ICR includes estimated monitoring, recordkeeping, reporting, and testing costs of approximately $11.45 million per year for the first three years. These costs are not reflected in the cost estimates presented in Tables 2 through 9.

[25] While the number of units listed in Table 5 sums to 491, the emissions inventory records for two of the units in Tier 1 industries include SCCs for both boilers and industrial processes. As a result, those units appear twice in the counts.

For the Excel workbooks with Tables 2 through 9, see *Transport Proposal – NonEGU Results – 03-16-2022.xlsx* and *Non-EGU Analysis Controls – 11-15-2021.xlsx* in the docket.[26]

[26] The R code that processed the CoST run results, the sector-specific (non-EGU-specific) ppb/ton values, and the 2026 AQAT calibration factors used to prepare these tables are available upon request.

***All costs are in 2016$ and do not include monitoring, recordkeeping, reporting, or testing costs.***

**Table 2. Estimated Emissions Reductions (ozone season tons), Maximum PPB Improvements, and Costs**

| **Option** | **Ozone Season Emissions Reductions (East/West)** | **Total PPB Improvement Across All Downwind Receptors** | **Max PPB Improvement Across All Downwind Receptors** | **Annual Total Cost (million $) (Avg Annual Cost per Ton)** | **Industries (# of emissions units > 100 tpy in identified industries)** |
|---|---|---|---|---|---|
| Tier 1 Industries with Known Controls that Cost up to $7,500/ton | 41,153 (37,972/3,181) | 4.352 | 0.392 | $356.6 ($3,610) | Cement and Concrete Product Manufacturing (47), Glass and Glass Product Manufacturing (44), Iron and Steel Mills and Ferroalloy Manufacturing (39), Pipeline Transportation of Natural Gas (307) |
| Tier 2 Industry Boilers with Known Controls that Cost up to $7,500/ton | 6,033 (5,965/68) | 0.809 | 0.169 | $54.2 ($3,744) | Basic Chemical Manufacturing (17), Petroleum and Coal Products Manufacturing (10), Pulp, Paper, and Paperboard Mills (25) |

*The estimated ozone season reductions, total ppb improvements, and total cost are representative of single year impacts and not cumulative impacts.*

**Table 3. Estimated PPB Improvements at Receptors Grouped by Region***

| Receptor ID | State | Receptor Name | Average/Max PPB Improvement Needed to Attain | Home State PPB Contribution | Tier 1 | Tier 2 | Total |
|---|---|---|---|---|---|---|---|
| 90010017 | CT | Greenwich | 0.6/1.3 | 9.3 | 0.231 | 0.016 | 0.247 |
| 90013007 | CT | Stratford | 1.9/2.8 | 4.1 | 0.332 | 0.024 | 0.356 |
| 90019003 | CT | Westport | 3.7/3.9 | 2.9 | 0.314 | 0.022 | 0.336 |
| 90099002 | CT | Madison | -/1.5 | 3.9 | 0.323 | 0.023 | 0.346 |
| 170310001 | IL | Chicago/Alsip | -/1.6 | 19.4 | 0.196 | 0.065 | 0.261 |
| 170310032 | IL | Chicago/South | -/0.8 | 16.6 | 0.299 | 0.076 | 0.375 |
| 170310076 | IL | Chicago/ComEd | -/0.4 | 18.7 | 0.229 | 0.060 | 0.289 |
| 170314201 | IL | Chicago/Northbrook | -/1.5 | 21.4 | 0.262 | 0.069 | 0.332 |
| 170317002 | IL | Chicago/Evanston | -/1.1 | 18.9 | 0.307 | 0.049 | 0.356 |
| 550590019 | WI | Kenosha/Water Tower | 0.8/1.7 | 5.8 | 0.325 | 0.035 | 0.360 |
| 550590025 | WI | Kenosha/Chiwaukee | -/0.2 | 2.6 | 0.392 | 0.051 | 0.443 |
| 551010020 | WI | Racine/Racine | -/1.2 | 10.8 | 0.353 | 0.044 | 0.397 |
| 480391004 | TX | Houston/Brazoria | -/0.3 | 29.3 | 0.302 | 0.169 | 0.472 |
| 482010024 | TX | Houston/Aldine | 3.3/4.8 | 29.7 | 0.186 | 0.098 | 0.284 |
| 40278011 | AZ | Yuma | -/0.9 | 2.8 | 0.027 | 0.001 | 0.028 |
| 60070007 | CA | Butte | -/-0.8 | 23.5 | 0.000 | 0.000 | 0.000 |
| 60170010 | CA | El Dorado #1 | 4.1/6.5 | 26.7 | 0.000 | 0.000 | 0.000 |
| 60170020 | CA | El Dorado #2 | 2.3/4.1 | 28.7 | 0.000 | 0.000 | 0.000 |
| 60190007 | CA | Fresno #1 | 8.6/10.4 | 29.1 | 0.001 | 0.000 | 0.001 |
| 60190011 | CA | Fresno #2 | 11/11.9 | 31.1 | 0.002 | 0.000 | 0.002 |
| 60195001 | CA | Fresno #3 | 11.8/14.5 | 30.2 | 0.002 | 0.000 | 0.002 |
| 60570005 | CA | Nevada | 6.3/9.6 | 25.4 | 0.000 | 0.000 | 0.000 |
| 60610003 | CA | Placer #1 | 5/7.7 | 29.8 | 0.000 | 0.000 | 0.000 |
| 60610004 | CA | Placer #2 | 0/5.1 | 24 | 0.000 | 0.000 | 0.000 |
| 60670012 | CA | Sacramento | 2.7/3.4 | 30.8 | 0.000 | 0.000 | 0.000 |
| 60990005 | CA | Stanislaus | 3.8/4.7 | 29.2 | 0.001 | 0.000 | 0.001 |
| 80350004 | CO | Denver/Chatfield | -/0.2 | 15.6 | 0.055 | 0.001 | 0.056 |
| 80590006 | CO | Rocky Flats | 0.8/1.4 | 17.3 | 0.042 | 0.000 | 0.042 |
| 80590011 | CO | Denver/NREL | 1.7/2.4 | 17.6 | 0.044 | 0.001 | 0.044 |
| 490110004 | UT | SLC/Bountiful | 0.8/3 | 8 | 0.037 | 0.002 | 0.038 |
| 490353006 | UT | SLC/Hawthorne | 1.6/3.2 | 8.3 | 0.036 | 0.002 | 0.038 |
| 490353013 | UT | SLC/Herriman | 2.6/3.1 | 8.9 | 0.018 | 0.001 | 0.019 |
| 490570002 | UT | SLC/Ogden | -/0.8 | 6.1 | 0.034 | 0.001 | 0.035 |

**Home state emission reductions are not assumed in this analysis.*

**Table 4. For Tier 1 Industries and Impactful Boilers in Tier 2 Industries, By State And By Industry, Estimated Emissions Reductions (ozone season tons*) and Costs**

| | | Tier 1 | | Tier 2 | |
|---|---|---|---|---|---|
| State | Industry | Ozone Season Emissions Reductions | Annual Total Cost (million $) (Avg Annual Cost per Ton) | Ozone Season Emissions Reductions | Annual Total Cost (million $) (Avg Annual Cost per Ton) |
| AR | Basic Chemical Manufacturing | - | - | 87 | $1.1 ($5,113) |
| AR | Glass and Glass Product Manufacturing | 47 | $0.2 ($2,046) | - | - |
| AR | Iron and Steel Mills and Ferroalloy Manufacturing | 6 | $0.0 ($631) | - | - |
| AR | Pipeline Transportation of Natural Gas | 868 | $10.1 ($4,852) | - | - |
| AR | Pulp, Paper, and Paperboard Mills | - | - | 646 | $6.1 ($3,967) |
| CA | Cement and Concrete Product Manufacturing | 1,162 | $3.6 ($1,279) | - | - |
| CA | Glass and Glass Product Manufacturing | 299 | $0.9 ($1,293) | - | - |
| CA | Petroleum and Coal Products Manufacturing | - | - | 68 | $0.4 ($2,349) |
| CA | Pipeline Transportation of Natural Gas | 137 | $1.5 ($4,718) | - | - |
| IL | Cement and Concrete Product Manufacturing | 234 | $0.7 ($1,279) | - | - |
| IL | Glass and Glass Product Manufacturing | 901 | $2.6 ($1,180) | - | - |
| IL | Pipeline Transportation of Natural Gas | 1,316 | $13.7 ($4,348) | - | - |
| IN | Cement and Concrete Product Manufacturing | 468 | $1.4 ($1,279) | - | - |
| IN | Glass and Glass Product Manufacturing | 338 | $1.7 ($2,046) | - | - |
| IN | Iron and Steel Mills and Ferroalloy Manufacturing | 1,829 | $16.0 ($3,653) | - | - |
| IN | Petroleum and Coal Products Manufacturing | - | - | 388 | $2.8 ($2,989) |
| IN | Pipeline Transportation of Natural Gas | 152 | $2.0 ($5,457) | - | - |
| KY | Pipeline Transportation of Natural Gas | 2,291 | $28.7 ($5,213) | - | - |
| LA | Basic Chemical Manufacturing | - | - | 1,611 | $15.2 ($3,939) |
| LA | Glass and Glass Product Manufacturing | 206 | $1.9 ($3,770) | - | - |
| LA | Petroleum and Coal Products Manufacturing | - | - | 477 | $4.0 ($3,498) |
| LA | Pipeline Transportation of Natural Gas | 3,915 | $44.3 ($4,720) | - | - |
| LA | Pulp, Paper, and Paperboard Mills | - | - | 561 | $5.2 ($3,830) |
| MD | Pipeline Transportation of Natural Gas | 45 | $0.3 ($3,042) | - | - |
| MI | Cement and Concrete Product Manufacturing | 371 | $1.1 ($1,279) | - | - |
| MI | Glass and Glass Product Manufacturing | 50 | $0.3 ($2,661) | - | - |
| MI | Iron and Steel Mills and Ferroalloy Manufacturing | 38 | $0.4 ($4,194) | - | - |
| MI | Pipeline Transportation of Natural Gas | 2,272 | $25.9 ($4,747) | - | - |
| MN | Glass and Glass Product Manufacturing | 115 | $0.6 ($2,288) | - | - |
| MN | Pipeline Transportation of Natural Gas | 558 | $7.3 ($5,452) | - | - |
| MO | Cement and Concrete Product Manufacturing | 1,296 | $4.0 ($1,279) | - | - |
| MO | Glass and Glass Product Manufacturing | 227 | $1.1 ($1,992) | - | - |
| MO | Pipeline Transportation of Natural Gas | 1,581 | $20.2 ($5,338) | - | - |
| MS | Pipeline Transportation of Natural Gas | 1,577 | $19.0 ($5,009) | - | - |
| MS | Pulp, Paper, and Paperboard Mills | - | - | 184 | $1.4 ($3,243) |
| NY | Cement and Concrete Product Manufacturing | 142 | $0.4 ($1,279) | - | - |
| NY | Glass and Glass Product Manufacturing | 141 | $0.5 ($1,572) | - | - |
| NY | Pipeline Transportation of Natural Gas | 106 | $1.2 ($4,697) | - | - |
| NY | Pulp, Paper, and Paperboard Mills | - | - | 111 | $1.2 ($4,486) |

| | | | | | |
|---|---|---|---|---|---|
| OH | Cement and Concrete Product Manufacturing | 116 | $0.4 ($1,279) | - | - |
| OH | Glass and Glass Product Manufacturing | 451 | $2.2 ($1,998) | - | - |
| OH | Iron and Steel Mills and Ferroalloy Manufacturing | 847 | $7.6 ($3,763) | - | - |
| OH | Pipeline Transportation of Natural Gas | 1,198 | $14.6 ($5,062) | - | - |
| OH | Pulp, Paper, and Paperboard Mills | - | - | 179 | $2.3 ($5,303) |
| OK | Cement and Concrete Product Manufacturing | 586 | $1.8 ($1,279) | - | - |
| OK | Glass and Glass Product Manufacturing | 190 | $1.2 ($2,550) | - | - |
| OK | Pipeline Transportation of Natural Gas | 2,799 | $34.1 ($5,083) | - | - |
| PA | Cement and Concrete Product Manufacturing | 888 | $2.8 ($1,336) | - | - |
| PA | Glass and Glass Product Manufacturing | 1,379 | $3.8 ($1,133) | - | - |
| PA | Iron and Steel Mills and Ferroalloy Manufacturing | 438 | $6.1 ($5,823) | - | - |
| PA | Petroleum and Coal Products Manufacturing | - | - | 98 | $0.6 ($2,349) |
| PA | Pipeline Transportation of Natural Gas | 427 | $4.1 ($3,994) | - | - |
| PA | Pulp, Paper, and Paperboard Mills | - | - | 54 | $0.9 ($7,019) |
| TX | Cement and Concrete Product Manufacturing | 1,234 | $7.8 ($2,624) | - | - |
| TX | Glass and Glass Product Manufacturing | 1,470 | $3.9 ($1,109) | - | - |
| TX | Pipeline Transportation of Natural Gas | 1,736 | $20.7 ($4,966) | - | - |
| UT | Cement and Concrete Product Manufacturing | 520 | $1.6 ($1,279) | - | - |
| UT | Pipeline Transportation of Natural Gas | 237 | $2.7 ($4,718) | - | - |
| VA | Cement and Concrete Product Manufacturing | 398 | $1.2 ($1,279) | - | - |
| VA | Glass and Glass Product Manufacturing | 174 | $0.9 ($2,154) | - | - |
| VA | Iron and Steel Mills and Ferroalloy Manufacturing | 92 | $1.0 ($4,357) | - | - |
| VA | Pipeline Transportation of Natural Gas | 801 | $10.5 ($5,457) | - | - |
| VA | Pulp, Paper, and Paperboard Mills | - | - | 98 | $1.4 ($5,903) |
| WI | Glass and Glass Product Manufacturing | 677 | $2.5 ($1,517) | - | - |
| WI | Pulp, Paper, and Paperboard Mills | - | - | 1,472 | $11.7 ($3,307) |
| WV | Cement and Concrete Product Manufacturing | 230 | $0.7 ($1,279) | - | - |
| WV | Pipeline Transportation of Natural Gas | 751 | $6.5 ($3,612) | - | - |
| WY | Cement and Concrete Product Manufacturing | 446 | $1.4 ($1,279) | - | - |
| WY | Pipeline Transportation of Natural Gas | 380 | $4.9 ($5,349) | - | - |
| | **Grand Total** | **41,153** | **$356.6 ($3,610)** | **6,033** | **$54.2 ($3,744)** |

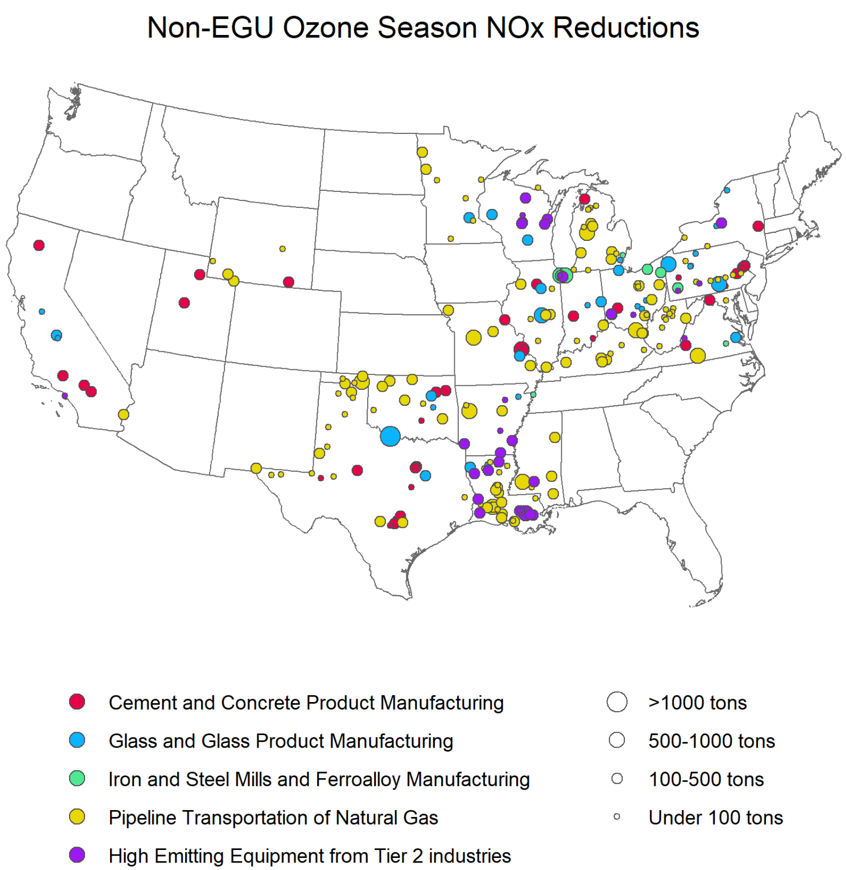
*Ozone season tons are calculated as tpy from the NEI multiplied by 5/12.

*Note that New Jersey and Nevada did not have any estimated non-EGU reductions that cost up to $7,500 per ton from the Tier 1 industries and boilers in Tier 2 industries.*

**Table 4a. For Tier 1 Industries and Impactful Boilers in Tier 2 Industries, By State, Estimated Emissions Reductions (ozone season tons) and Costs**

| | Tier 1 | | Tier 2 | |
|---|---|---|---|---|
| State | Ozone Season Emissions Reductions | Annual Total Cost (million $) (Avg Annual Cost per Ton) | Ozone Season Emissions Reductions | Annual Total Cost (million $) (Avg Annual Cost per Ton) |
| AR | 922 | $10.4 ($4,679) | 732 | $7.2 ($4,102) |
| CA | 1,598 | $6.0 ($1,576) | 68 | $0.4 ($2,349) |
| IL | 2,452 | $17.0 ($2,890) | - | - |
| IN | 2,787 | $21.1 ($3,157) | 388 | $2.8 ($2,989) |
| KY | 2,291 | $28.7 ($5,213) | - | - |
| LA | 4,121 | $46.2 ($4,673) | 2,649 | $24.4 ($3,837) |
| MD | 45 | $0.3 ($3,042) | - | - |
| MI | 2,731 | $27.7 ($4,230) | - | - |
| MN | 673 | $7.9 ($4,910) | - | - |
| MO | 3,103 | $25.3 ($3,399) | - | - |
| MS | 1,577 | $19.0 ($5,009) | 184 | $1.4 ($3,243) |
| NY | 389 | $2.2 ($2,316) | 111 | $1.2 ($4,486) |
| OH | 2,611 | $24.7 ($3,944) | 179 | $2.3 ($5,303) |
| OK | 3,575 | $37.1 ($4,325) | - | - |
| PA | 3,132 | $16.8 ($2,237) | 152 | $1.5 ($4,013) |
| TX | 4,440 | $32.4 ($3,038) | - | - |
| UT | 757 | $4.3 ($2,356) | - | - |
| VA | 1,465 | $13.6 ($3,861) | 98 | $1.4 ($5,903) |
| WI | 677 | $2.5 ($1,517) | 1,472 | $11.7 ($3,307) |
| WV | 982 | $7.2 ($3,065) | - | - |
| WY | 826 | $6.2 ($3,152) | - | - |

**Figure 2. Geographical Distribution of Ozone Season NOx Reductions and Summary of Reductions by Industry and by State**




| State | Cement and Concrete Product Manufacturing | Glass and Glass Product Manufacturing | Iron and Steel Mills and Ferroalloy Manufacturing | Pipeline Transportation of Natural Gas | High Emitting Equipment from Tier 2 industries | Total |
|---|---|---|---|---|---|---|
| LA | 0 | 206 | 0 | 3,915 | 2,649 | 6,769 |
| TX | 1,234 | 1,470 | 0 | 1,736 | 0 | 4,440 |
| OK | 586 | 190 | 0 | 2,799 | 0 | 3,575 |
| PA | 888 | 1,379 | 438 | 427 | 152 | 3,284 |
| IN | 468 | 338 | 1,829 | 152 | 388 | 3,175 |
| MO | 1,296 | 227 | 0 | 1,581 | 0 | 3,103 |
| OH | 116 | 451 | 847 | 1,198 | 179 | 2,790 |
| MI | 371 | 50 | 38 | 2,272 | 0 | 2,731 |
| IL | 234 | 901 | 0 | 1,316 | 0 | 2,452 |
| KY | 0 | 0 | 0 | 2,291 | 0 | 2,291 |
| WI | 0 | 677 | 0 | 0 | 1,472 | 2,150 |
| MS | 0 | 0 | 0 | 1,577 | 184 | 1,761 |
| CA | 1,162 | 299 | 0 | 137 | 68 | 1,666 |
| AR | 0 | 47 | 6 | 868 | 732 | 1,654 |
| VA | 398 | 174 | 92 | 801 | 98 | 1,563 |
| WV | 230 | 0 | 0 | 751 | 0 | 982 |
| WY | 446 | 0 | 0 | 380 | 0 | 826 |
| UT | 520 | 0 | 0 | 237 | 0 | 757 |
| MN | 0 | 115 | 0 | 558 | 0 | 673 |
| NY | 142 | 141 | 0 | 106 | 111 | 500 |
| MD | 0 | 0 | 0 | 45 | 0 | 45 |

**Table 5. By Industry, Number and Type of Emissions Units, Total Estimated Emissions Reductions (ozone season tons), Total PPB Improvements, and Costs**

| | | Number of Units by Type | | | Ozone Season Emissions Reductions (tons) by Type of Unit | | | Total PPB Improvement Across Downwind Receptors (Max Improvement At Receptor) | | Annual Total Cost (million $) (Avg Annual Cost per Ton) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Industry** | **Region** | **Boilers** | **Internal Combustion Engines** | **Industrial Processes** | **Boilers** | **Internal Combustion Engines** | **Industrial Processes** | **East** | **West** | |
| Glass and Glass Product Manufacturing | East | - | - | 41 | - | - | 6,367 | 0.6962 (0.0865) | 0.0015 (0.0004) | $23.2 ($1,520) |
| | **West** | **-** | **-** | **3** | **-** | **-** | **299** | **0.0009 (0.0001)** | **0.0332 (0.0066)** | **$0.9 ($1,293)** |
| Cement and Concrete Product Manufacturing | East | 1 | - | 39 | 16 | - | 5,948 | 0.6382 (0.0707) | 0.0018 (0.0006) | $22.4 ($1,566) |
| | **West** | **-** | **-** | **8** | **-** | **-** | **2,128** | **0.0151 (0.0019)** | **0.1996 (0.0332)** | **$6.5 ($1,279)** |
| Iron and Steel Mills and Ferroalloy Manufacturing | East | 25 | - | 15 | 2,044 | - | 1,207 | 1.1556 (0.1750) | 0.0000 (0.0000) | $31.2 ($3,995) |
| Pipeline Transportation of Natural Gas | East | - | 296 | - | - | 22,390 | - | 1.5373 (0.2815) | 0.0057 (0.0020) | $263.2 ($4,898) |
| | **West** | **-** | **11** | **-** | **-** | **754** | **-** | **0.0086 (0.0010)** | **0.0586 (0.0170)** | **$9.1 ($5,037)** |
| **Basic Chemical Manufacturing** | East | 17 | - | - | 1,698 | - | - | 0.1655 (0.0107) | 0.0002 (0.0000) | $16.3 ($3,999) |
| **Petroleum and Coal Products Manufacturing** | East | 9 | - | - | 962 | - | - | 0.2677 (0.0258) | 0.0000 (0.0000) | $7.3 ($3,176) |
| | **West** | **1** | **-** | **-** | **68** | **-** | **-** | **0.0002 (0.0000)** | **0.0075 (0.0015)** | **$0.4 ($2,349)** |
| **Pulp, Paper, and Paperboard Mills** | East | 25 | - | - | 3,305 | - | - | 0.3678 (0.0117) | 0.0002 (0.0000) | $30.2 ($3,807) |

***Blue highlights reflect western states information.***

***Orange highlights reflect Tier 2 industries with impactful boilers.***

## Table 6. By Industry, Emissions Source Group, Control Technology, Number of Units, Estimated Emissions Reductions (ozone season tons), and Annual Total Cost

| Industry | Emissions Source Group | Control Technology | Number of Units | Ozone Season Emissions Reductions | Annual Total Cost (million $) |
|---|---|---|---|---|---|
| Cement and Concrete Product Manufacturing | Boilers - < 10 Million BTU/hr; Industrial Processes - Kiln | Ultra Low NOx Burner; Selective Non-Catalytic Reduction | 1 | 117 | $0.5 |
| | Industrial Processes - Kiln | Selective Non-Catalytic Reduction | 24 | 3,123 | $9.7 |
| | Industrial Processes - Preheater Kiln | Selective Non-Catalytic Reduction | 3 | 342 | $1.2 |
| | Industrial Processes - Preheater/Precalciner Kiln | Selective Non-Catalytic Reduction | 19 | 4,510 | $17.5 |
| Glass and Glass Product Manufacturing | Industrial Processes - Container Glass: Melting Furnace | Selective Catalytic Reduction | 27 | 1,676 | $8.7 |
| | Industrial Processes - Flat Glass: Melting Furnace | Selective Catalytic Reduction | 13 | 4,674 | $12.7 |
| | Industrial Processes - Furnace: General | Oxygen Enriched Air Staging | 1 | 52 | $0.1 |
| | Industrial Processes - Pressed and Blown Glass: Melting Furnace | Selective Catalytic Reduction | 3 | 264 | $2.7 |
| Iron and Steel Mills and Ferroalloy Manufacturing | Boilers - > 100 Million BTU/hr | Ultra Low NOx Burner and Selective Catalytic Reduction | 3 | 383 | $4.2 |
| | Boilers - > 100 Million BTU/hr | Ultra Low NOx Burner | 6 | 282 | $2.2 |
| | Boilers - > 100 Million BTU/hr | Selective Catalytic Reduction | 2 | 106 | $1.2 |
| | Boilers - > 100 Million BTU/hr; Boilers - Blast Furnace Gas | Ultra Low NOx Burner | 1 | 166 | $1.0 |
| | Boilers - > 100 Million BTU/hr; Boilers - Coke Oven Gas | Ultra Low NOx Burner | 6 | 360 | $2.9 |
| | Boilers - > 100 Million BTU/hr; Boilers - Coke Oven Gas | Selective Catalytic Reduction; Ultra Low NOx Burner and Selective Catalytic Reduction | 1 | 114 | $1.7 |
| | Boilers - Blast Furnace Gas | Ultra Low NOx Burner | 1 | 65 | $0.4 |
| | Boilers - Blast Furnace Gas; Industrial Processes - Sintering: Windbox; Industrial Processes - Blast Furnace: Casting/Tapping: Local Evacuation; Industrial Processes - Process Gas: Process Heaters | Ultra Low NOx Burner; Selective Catalytic Reduction; Low NOx Burner and Flue Gas Recirculation | 1 | 440 | $4.4 |
| | Boilers - Coke Oven Gas | Ultra Low NOx Burner and Selective Catalytic Reduction | 3 | 394 | $3.7 |
| | Boilers - Coke Oven Gas; Boilers - > 100 Million BTU/hr | Ultra Low NOx Burner; Ultra Low NOx Burner and Selective Catalytic Reduction | 1 | 116 | $1.6 |
| | Industrial Processes - Basic Oxygen Furnace (BOF): Open Hood Stack | Selective Catalytic Reduction | 2 | 185 | $1.9 |
| | Industrial Processes - Basic Oxygen Furnace (BOF): Open Hood Stack; Industrial Processes - General | Selective Catalytic Reduction; Low NOx Burner | 1 | 172 | $1.7 |
| | Industrial Processes - Basic Oxygen Furnace (BOF): Top Blown Furnace: Primary | Selective Catalytic Reduction | 1 | 50 | $0.5 |
| | Industrial Processes - Blast Furnace: Casting/Tapping: Local Evacuation | Selective Catalytic Reduction | 1 | 38 | $0.4 |
| | Industrial Processes - General | Low NOx Burner | 5 | 191 | $1.7 |
| | Industrial Processes - General; Industrial Processes - Coke Oven or Blast Furnace | Low NOx Burner; Low NOx Burner and Flue Gas Recirculation | 1 | 84 | $1.0 |
| | Industrial Processes - Other Not Classified | Low NOx Burner and Flue Gas Recirculation | 2 | 43 | $0.1 |
| | Industrial Processes - Sintering: Windbox | Selective Catalytic Reduction | 1 | 60 | $0.6 |
| Pipeline Transportation of Natural Gas | Internal Combustion Engines - 2-cycle Clean Burn | Layered Combustion | 1 | 60 | $0.8 |
| | Internal Combustion Engines - 2-cycle Lean Burn | Layered Combustion | 136 | 12,645 | $165.6 |
| | Internal Combustion Engines - 4-cycle Lean Burn | Selective Catalytic Reduction | 41 | 2,656 | $21.6 |
| | Internal Combustion Engines - 4-cycle Rich Burn | Non-Selective Catalytic Reduction | 2 | 147 | $0.2 |
| | Internal Combustion Engines - Reciprocating | Non-Selective Catalytic Reduction or Layered Combustion | 94 | 6,329 | $72.0 |
| | Internal Combustion Engines - Reciprocating | Adjust Air to Fuel Ratio and Ignition Retard | 12 | 193 | $1.1 |
| | Internal Combustion Engines - Reciprocating | Non-Selective Catalytic Reduction or Layered Combustion; Adjust Air to Fuel Ratio and Ignition Retard | 1 | 49 | $0.4 |
| | Internal Combustion Engines - Turbine | Selective Catalytic Reduction and Steam Injection | 17 | 929 | $8.4 |
| | Internal Combustion Engines - Turbine | SCR + DLN Combustion | 3 | 136 | $2.1 |

| | | | | | |
|---|---|---|---|---|---|
| Basic Chemical Manufacturing | Boilers - > 100 Million BTU/hr | Ultra Low NOx Burner and Selective Catalytic Reduction | 6 | 786 | $7.5 |
| | Boilers - > 100 Million BTU/hr | Selective Catalytic Reduction | 2 | 104 | $1.5 |
| | Boilers - 10-100 Million BTU/hr | Ultra Low NOx Burner and Selective Catalytic Reduction | 1 | 133 | $1.0 |
| | Boilers - 10-100 Million BTU/hr | Selective Catalytic Reduction | 1 | 43 | $0.1 |
| | Boilers - Cogeneration | Selective Catalytic Reduction | 1 | 68 | $0.9 |
| | Boilers - Distillate Oil - Grades 1 and 2: Boiler | Selective Catalytic Reduction | 1 | 47 | $0.6 |
| | Boilers - Petroleum Refinery Gas | Ultra Low NOx Burner and Selective Catalytic Reduction | 2 | 293 | $2.8 |
| | Boilers - Petroleum Refinery Gas | Ultra Low NOx Burner | 2 | 138 | $0.8 |
| | Boilers - Subbituminous Coal: Traveling Grate (Overfeed) Stoker | Selective Catalytic Reduction | 1 | 87 | $1.1 |
| Petroleum and Coal Products Manufacturing | Boilers - > 100 Million BTU/hr | Ultra Low NOx Burner | 1 | 41 | $0.2 |
| | Boilers - > 100 Million BTU/hr; Boilers - Blast Furnace Gas | Ultra Low NOx Burner | 1 | 38 | $0.4 |
| | Boilers - Boiler, >= 100 Million BTU/hr | Natural Gas Reburn | 1 | 284 | $1.8 |
| | Boilers - Coke Oven Gas | Ultra Low NOx Burner | 1 | 98 | $0.6 |
| | Boilers - Petroleum Refinery Gas | Ultra Low NOx Burner and Selective Catalytic Reduction | 3 | 433 | $3.8 |
| | Boilers - Petroleum Refinery Gas | Ultra Low NOx Burner | 3 | 137 | $0.9 |
| Pulp, Paper, and Paperboard Mills | Boilers - > 100 Million BTU/hr | Ultra Low NOx Burner and Selective Catalytic Reduction | 5 | 618 | $6.8 |
| | Boilers - > 100 Million BTU/hr | Ultra Low NOx Burner | 3 | 151 | $1.0 |
| | Boilers - > 100 Million BTU/hr | Selective Catalytic Reduction | 1 | 68 | $1.2 |
| | Boilers - 10-100 Million BTU/hr | Ultra Low NOx Burner | 2 | 106 | $0.5 |
| | Boilers - Bituminous Coal: Cyclone Furnace | Selective Catalytic Reduction | 2 | 662 | $3.4 |
| | Boilers - Bituminous Coal: Pulverized Coal: Dry Bottom | Ultra Low NOx Burner and Selective Catalytic Reduction | 1 | 111 | $1.1 |
| | Boilers - Bituminous Coal: Pulverized Coal: Dry Bottom; Boilers - > 100 Million BTU/hr | Low NOx Burner; Selective Catalytic Reduction | 1 | 98 | $1.4 |
| | Boilers - Bituminous Coal: Spreader Stoker | Selective Catalytic Reduction | 3 | 251 | $3.2 |
| | Boilers - Cogeneration | Ultra Low NOx Burner and Selective Catalytic Reduction | 2 | 338 | $2.9 |
| | Boilers - Fluid Catalytic Cracking Unit with CO Boiler: Natural Gas | Ultra Low NOx Burner and Selective Catalytic Reduction | 2 | 289 | $2.7 |
| | Boilers - Subbituminous Coal: Boiler, Spreader Stoker | Selective Catalytic Reduction | 2 | 348 | $3.7 |
| | Boilers - Subbituminous Coal: Spreader Stoker | Selective Catalytic Reduction | 1 | 266 | $2.3 |

**Table 7. Estimated Emissions Reductions (ozone season tons), Annual Total Cost, and Average Cost per Ton by Control Technology Across All Non-EGU Emissions Units**

| Control Technology | OS NOx Reductions | Annual Total Cost | Average Cost per Ton |
|---|---|---|---|
| Adjust Air to Fuel Ratio and Ignition Retard | 212 | $1,216,435 | $2,393 |
| Layered Combustion | 12,706 | $166,398,282 | $5,457 |
| Low NOx Burner | 231 | $2,092,579 | $3,773 |
| Low NOx Burner and Flue Gas Recirculation | 200 | $2,054,876 | $4,288 |
| Natural Gas Reburn | 284 | $1,843,948 | $2,703 |
| Non-Selective Catalytic Reduction | 147 | $205,808 | $585 |
| Non-Selective Catalytic Reduction or Layered Combustion | 6,359 | $72,383,222 | $4,743 |
| Oxygen Enriched Air Staging | 52 | $95,641 | $764 |
| SCR + DLN Combustion | 136 | $2,060,943 | $6,301 |
| Selective Catalytic Reduction | 12,239 | $74,692,132 | $2,543 |
| Selective Catalytic Reduction and Steam Injection | 929 | $8,439,921 | $3,787 |
| Selective Non-Catalytic Reduction | 8,076 | $28,782,335 | $1,485 |
| Ultra Low NOx Burner | 1,670 | $11,584,405 | $2,890 |
| Ultra Low NOx Burner and Selective Catalytic Reduction | 3,946 | $38,959,490 | $4,114 |

**Table 8. Estimated Emissions Reductions (ozone season tons), Annual Total Cost, and Average Cost per Ton by Control Technology Across Non-EGU Emissions Units Grouped by the Tier 1 Industries and Impactful Boilers in Tier 2 Industries**

| Tier | Control Technology | OS NOx Reductions | Annual Total Cost | Average Cost per Ton |
|---|---|---|---|---|
| Tier 1 | Adjust Air to Fuel Ratio and Ignition Retard | 212 | $1,216,435 | $2,393 |
| Tier 1 | Layered Combustion | 12,706 | $166,398,282 | $5,457 |
| Tier 1 | Low NOx Burner | 211 | $1,852,495 | $3,656 |
| Tier 1 | Low NOx Burner and Flue Gas Recirculation | 200 | $2,054,876 | $4,288 |
| Tier 1 | Non-Selective Catalytic Reduction | 147 | $205,808 | $585 |
| Tier 1 | Non-Selective Catalytic Reduction or Layered Combustion | 6,359 | $72,383,222 | $4,743 |
| Tier 1 | Oxygen Enriched Air Staging | 52 | $95,641 | $764 |
| Tier 1 | SCR + DLN Combustion | 136 | $2,060,943 | $6,301 |
| Tier 1 | Selective Catalytic Reduction | 10,219 | $55,575,188 | $2,266 |
| Tier 1 | Selective Catalytic Reduction and Steam Injection | 929 | $8,439,921 | $3,787 |
| Tier 1 | Selective Non-Catalytic Reduction | 8,076 | $28,782,335 | $1,485 |
| Tier 1 | Ultra Low NOx Burner | 962 | $7,172,778 | $3,107 |
| Tier 1 | Ultra Low NOx Burner and Selective Catalytic Reduction | 946 | $10,362,549 | $4,567 |
| Tier 2 | Low NOx Burner | 20 | $240,084 | $5,022 |
| Tier 2 | Natural Gas Reburn | 284 | $1,843,948 | $2,703 |
| Tier 2 | Selective Catalytic Reduction | 2,020 | $19,116,944 | $3,942 |
| Tier 2 | Ultra Low NOx Burner | 708 | $4,411,626 | $2,594 |
| Tier 2 | Ultra Low NOx Burner and Selective Catalytic Reduction | 3,000 | $28,596,941 | $3,972 |

**Table 9. Estimated Emissions Reductions (ozone season tons), Annual Total Cost, and Average Cost per Ton by Control Technology Across Non-EGU Emissions Units Grouped by the Seven Individual Tier 1 and Tier 2 Industries**

| Industry | Control Technology | OS NOx Reductions | Annual Total Cost | Average Cost per Ton |
|---|---|---|---|---|
| Cement and Concrete Product Manufacturing | Selective Non-Catalytic Reduction | 8,076 | $28,782,335 | $1,485 |
| Cement and Concrete Product Manufacturing | Ultra Low NOx Burner | 16 | $169,531 | $4,410 |
| Glass and Glass Product Manufacturing | Oxygen Enriched Air Staging | 52 | $95,641 | $764 |
| Glass and Glass Product Manufacturing | Selective Catalytic Reduction | 6,615 | $24,062,362 | $1,516 |
| Iron and Steel Mills and Ferroalloy Manufacturing | Low NOx Burner | 211 | $1,852,495 | $3,656 |
| Iron and Steel Mills and Ferroalloy Manufacturing | Low NOx Burner and Flue Gas Recirculation | 200 | $2,054,876 | $4,288 |
| Iron and Steel Mills and Ferroalloy Manufacturing | Selective Catalytic Reduction | 948 | $9,886,092 | $4,345 |
| Iron and Steel Mills and Ferroalloy Manufacturing | Ultra Low NOx Burner | 946 | $7,003,247 | $3,085 |
| Iron and Steel Mills and Ferroalloy Manufacturing | Ultra Low NOx Burner and Selective Catalytic Reduction | 946 | $10,362,549 | $4,567 |
| Pipeline Transportation of Natural Gas | Adjust Air to Fuel Ratio and Ignition Retard | 212 | $1,216,435 | $2,393 |
| Pipeline Transportation of Natural Gas | Layered Combustion | 12,706 | $166,398,282 | $5,457 |
| Pipeline Transportation of Natural Gas | Non-Selective Catalytic Reduction | 147 | $205,808 | $585 |
| Pipeline Transportation of Natural Gas | Non-Selective Catalytic Reduction or Layered Combustion | 6,359 | $72,383,222 | $4,743 |
| Pipeline Transportation of Natural Gas | SCR + DLN Combustion | 136 | $2,060,943 | $6,301 |
| Pipeline Transportation of Natural Gas | Selective Catalytic Reduction | 2,656 | $21,626,734 | $3,393 |
| Pipeline Transportation of Natural Gas | Selective Catalytic Reduction and Steam Injection | 929 | $8,439,921 | $3,787 |
| Basic Chemical Manufacturing | Selective Catalytic Reduction | 348 | $4,198,768 | $5,027 |
| Basic Chemical Manufacturing | Ultra Low NOx Burner | 138 | $769,564 | $2,317 |
| Basic Chemical Manufacturing | Ultra Low NOx Burner and Selective Catalytic Reduction | 1,211 | $11,326,715 | $3,896 |
| Petroleum and Coal Products Manufacturing | Natural Gas Reburn | 284 | $1,843,948 | $2,703 |
| Petroleum and Coal Products Manufacturing | Ultra Low NOx Burner | 313 | $2,110,773 | $2,808 |
| Petroleum and Coal Products Manufacturing | Ultra Low NOx Burner and Selective Catalytic Reduction | 433 | $3,762,867 | $3,624 |
| Pulp, Paper, and Paperboard Mills | Low NOx Burner | 20 | $240,084 | $5,022 |
| Pulp, Paper, and Paperboard Mills | Selective Catalytic Reduction | 1,672 | $14,918,176 | $3,717 |
| Pulp, Paper, and Paperboard Mills | Ultra Low NOx Burner | 257 | $1,531,289 | $2,484 |
| Pulp, Paper, and Paperboard Mills | Ultra Low NOx Burner and Selective Catalytic Reduction | 1,356 | $13,507,360 | $4,151 |

## VI. Request for Comment and Additional Information

In this screening assessment the EPA used CoST, the CMDB, and the 2019 emissions inventory to assess emission reduction potential from non-EGU emissions units in several industries. We identified emissions units that were uncontrolled or that could be better controlled and then applied control technologies to estimate emissions reductions and costs. As noted above, the cost estimates do not include monitoring, recordkeeping, reporting, or testing costs.

As discussed in Section VI.D.2.a of the proposal preamble, the EPA requests comment on the capital and annual costs of several potential control technologies, and in particular whether ultra-low $NO_X$ burners or low $NO_X$ burners are generally considered part of the process or add-on controls for ICI boilers (and how process changes or retrofits to accommodate controls would affect the cost estimates); the effectiveness of low emissions combustion in controlling $NO_X$ from reciprocating IC engines, compared to other potential $NO_X$ controls for these engines; and whether controls on ICI boilers and reciprocating IC engines are likely to be run all year or only during the ozone season.

The EPA also requests comment on the time needed to install the various control technologies across all of the emissions units in the Tier 1 and Tier 2 industries. In particular, the EPA solicits comment on the time needed to obtain permits, the availability of vendors and materials, and the earliest possible installation times for SCR on glass furnaces; SNCR on cement kilns; ultra-low $NO_X$ burners, low $NO_X$ burners, and SCR on ICI boilers (coal-fired, gas-fired, or oil-fired); low $NO_X$ burners on large non-EGU ICI boilers; and low emissions combustion, layered emissions combustion, NSCR, and SCR on reciprocating rich-burn or lean-burn IC engines.

Finally, with respect to emissions monitoring requirements, the EPA requests comment on the costs of installing and operating CEMS at non-EGU sources without $NO_X$ emissions monitors; the time needed to program and install CEMS at non-EGU sources; whether monitoring techniques other than CEMS, such as predictive emissions monitoring systems (PEMS), may be sufficient for certain non-EGU facilities, and the types of non-EGU facilities for which such PEMS may be sufficient; and the costs of installing and operating monitoring techniques other than CEMS.

## APPENDIX A – Analysis of Industry Contribution Data

This appendix describes the analyses performed to help focus the non-EGU analytical framework and resulting screening assessment on the most impactful industries.

To inform this analysis, first using the procedure described in Section III, Step 1 above, we estimated contributions from each of 41 industries to each nonattainment and maintenance receptor in 2023 and used these data to calculate the 5 metrics identified in Table A-1.[27,28] A summary of the data for each metric for each industry is provided in Table A-3. These metrics were selected to provide air quality information to inform an evaluation of the magnitude and geographic scope of contributions from individual industries. Metrics 1, 2, and 3 provide information on the magnitude of the contribution. Metric 4 provides information on the geographic scope of the downwind impact, whereas Metric 5 provides information on the geographic scope of upwind state contributions. Of the three air quality metrics we chose to analyze the data for Metric 2, the maximum contribution to any downwind receptor, because this metric aligns with the air quality metric used in Step 2 of the four-step interstate transport framework to identify linked upwind states for further review in Step 3 of the interstate transport framework. To examine the geographic breadth of the industry contributions we chose Metric 4 because that metric provides information on the extent of impacts on downwind air quality problems.

**Table A-1. Contribution Metrics for Non-EGU Assessment**

| | |
|---|---|
| 1 | Total contribution to all downwind receptors |
| 2 | Maximum contribution to any downwind receptor |
| 3 | Average contribution across all receptors |
| 4 | Number of receptors with contributions >= 0.01 ppb |
| 5 | Number of linked upwind states with highest industry contribution >= 0.01 ppb |

Next, we evaluated the maximum downwind contributions to identify the most impactful industries for further analysis. This approach included a semi-quantitative examination of rank-ordered maximum contributions to identify breakpoints in the data that might serve as an initial screen to eliminate non-impactful industries from further analysis of the contribution data. The distribution of maximum contributions provided in Table A-3 indicate that there is a large range in the values across the 41 industries. Specifically, 5 industries individually contribute more than 0.10 ppb, 3 industries contribute between 0.05 ppb and 0.10 ppb, 11 industries contribute between 0.01 and 0.05 ppb, 8 industries contribution between 0.005 and 0.01 ppb, and 14 industries contribute less than 0.005 ppb.

The rank-ordered maximum downwind contributions from individual industries are shown in Figure A-1. In this figure each point represents the maximum contribution to a downwind receptor from a particular industry. Note that the values for the highest contributing industries are not show in the figure in order to provide greater resolution of the shape of the distribution at the lower end of the values. The declining curve in Figure A-1 exhibits a shape similar to a harmonic distribution. Initially, there is a fairly steep drop in contributions with a breakpoint between roughly 0.04 and 0.06 ppb followed by a steady decline to 0.01 ppb. Beyond 0.01 ppb the shape of the distribution is much flatter. The data suggest that perhaps 0.05 ppb or 0.01 ppb could serve as breakpoints in the data. Based on the distribution

[27] Receptors in California were not considered in evaluating the impacts of non-EGU sources because EPA's contributions from upwind states to these receptors at Step 2 of the four-step interstate transport framework finds that these monitoring sites are overwhelmingly impacted by in-state emissions to a degree not comparable with any other identified nonattainment or maintenance-only receptors in the country. In this regard, EPA is proposing a determination that California receptors are not sufficiently impacted by interstate transport of ozone to warrant proceeding with a Step 3 evaluation of emissions reduction opportunities.
[28] The methods for identifying receptors are described in the Air Quality Modeling TSD for this proposed rule.

of the data we determined that 0.01 ppb provides a meaningful conservative breakpoint for screening out non-impactful industries from the non-EGU contribution analysis. The specific industries with a maximum downwind contribution >= 0.01 ppb are identified in Table A-2.

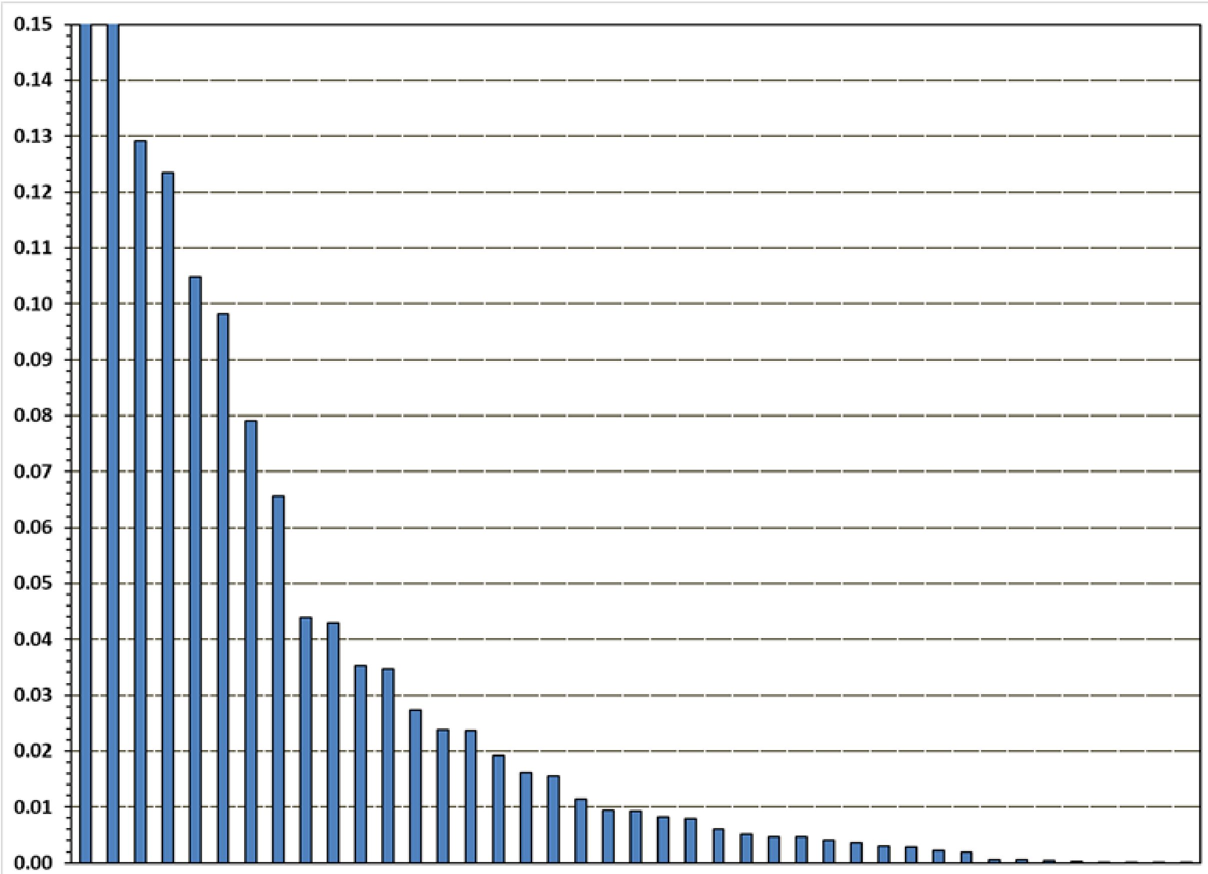


Figure A-1. Rank-ordered maximum downwind contributions from individual industries

We then examined the data for Metrics 2 and 4 for each industry that has a maximum contribution >= 0.01 ppb. The data for Metric 4, as shown in Figure A-2, suggests that there as a breakpoint between those industries that contribute to 10 or more receptors versus those industries that contribute to fewer than 10 receptors. Table A-2 provides the data for Metrics 2 and 4, ranked by the magnitude of Metric 4. The data show that 8 industries contribute >= 0.01 ppb to more than 10 receptors. Of these 8 industries, 5 have a maximum contributions of > 0.10 ppb to one of these receptors. In addition, one industry, Basic Chemical Manufacturing, contributes to only 9 receptors, but the maximum contribution to one of these receptors is >0.10 ppb. Using this information, we grouped the 9 industries into one of 2 tiers based on considering both the magnitude of the contribution and the downwind extent of affected receptors. Tier 1 includes the 4 industries that each have (1) a maximum contribution to any one receptor of >0.10 ppb and (2) a contribution >= 0.01 ppb to at least 10 receptors. Tier 2 includes the 5 industries that each have (1) a maximum contribution to any one receptor >=0.10 ppb but contribute >=0.01 ppb to fewer than 10 receptors, or (2) a maximum contribution <0.10 ppb but contribute >=0.01 ppb to at least 10 receptors.

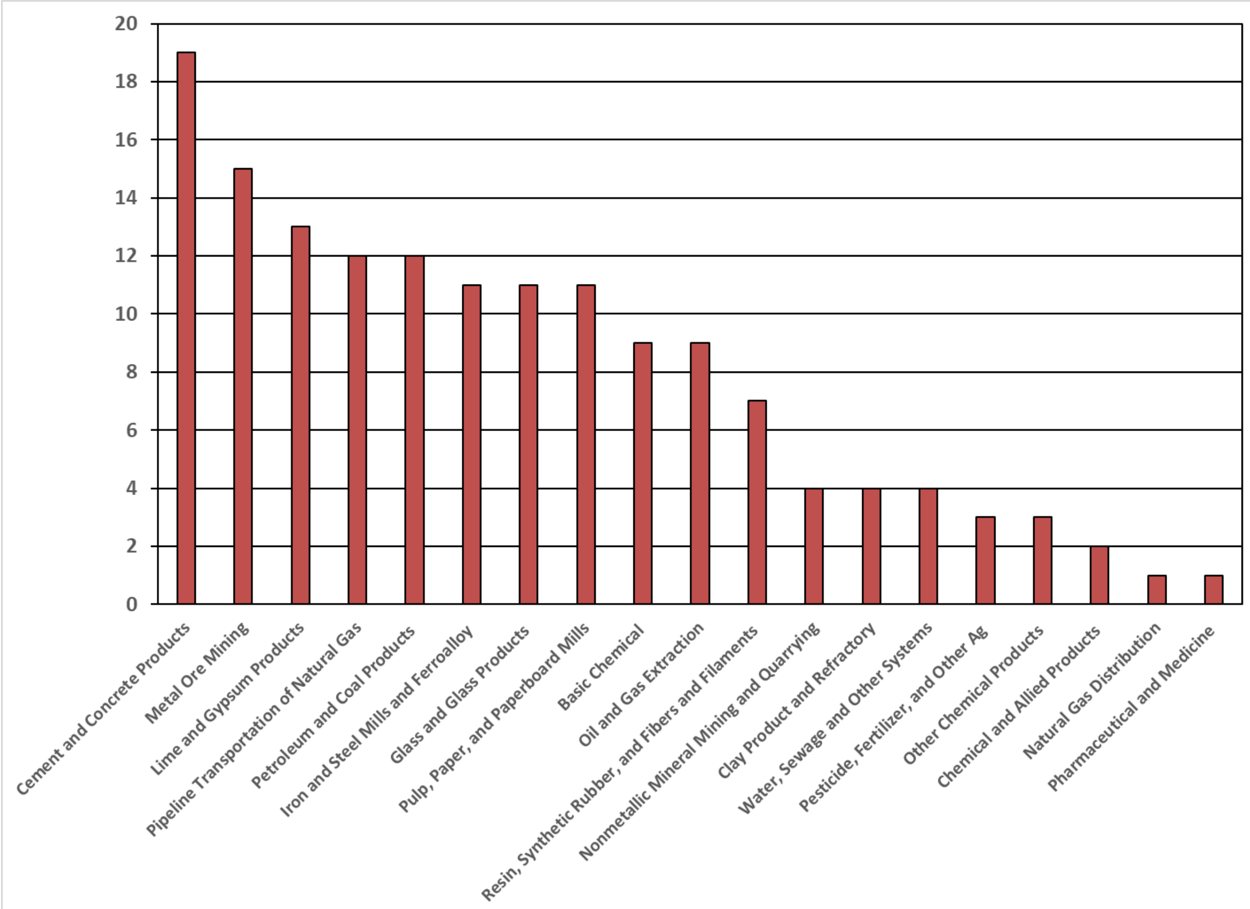



Figure A-2. Number of downwind receptors with contributions >= 0.10 ppb for each industry with a maximum downwind contribution >= 0.01 ppb

Table A-2. Maximum downwind contribution and number of receptors with contributions >= 0.01 ppb

| Industry | Max Downwind Contribution | # Receptors with Contributions >= 0.01 ppb |
|---|---|---|
| Cement and Concrete Products | **0.231** | **19** |
| Metal Ore Mining | 0.079 | **15** |
| Lime and Gypsum Products | 0.066 | **13** |
| Pipeline Transportation of Natural Gas | **0.287** | **12** |
| Petroleum and Coal Products | 0.098 | **12** |
| Iron and Steel Mills and Ferroalloy | **0.129** | **11** |
| Glass and Glass Products | **0.105** | **11** |
| Pulp, Paper, and Paperboard Mills | 0.043 | **11** |
| Basic Chemical | **0.123** | 9 |
| Oil and Gas Extraction | 0.035 | 9 |
| Resin, Synthetic Rubber, and Fibers and Filaments | 0.027 | 7 |
| Nonmetallic Mineral Mining and Quarrying | 0.035 | 4 |
| Clay Product and Refractory | 0.024 | 4 |
| Water, Sewage and Other Systems | 0.016 | 4 |
| Pesticide, Fertilizer, and Other Ag | 0.044 | 3 |
| Other Chemical Products | 0.024 | 3 |
| Chemical and Allied Products | 0.019 | 2 |
| Natural Gas Distribution | 0.016 | 1 |
| Pharmaceutical and Medicine | 0.011 | 1 |

## Table A-3. Estimated Total, Maximum, and Average Contributions from Each Industry, and Number of Receptors with Contributions >= 0.01 ppb for 2023

| Industry | # Facilities with Units > 100tpy | # Units > 100 tpy | Ozone Season Emissions | Total Contribution | Max Contribution | Average Contribution | # Receptors with Contributions >= 0.01 ppb | # States with Highest Contribution >= 0.01 ppb |
|---|---|---|---|---|---|---|---|---|
| **Pipeline Transportation of Natural Gas** | 144 | 399 | 34,343 | **1.679** | **0.287** | **0.084** | **12** | **12** |
| **Cement and Concrete Product Manufacturing** | 61 | 84 | 36,244 | **1.871** | **0.231** | **0.094** | **19** | **13** |
| **Iron and Steel Mills and Ferroalloy Manufacturing** | 14 | 43 | 4,622 | **0.577** | **0.129** | **0.029** | **11** | 1 |
| **Basic Chemical Manufacturing** | 38 | 78 | 9,612 | **0.293** | **0.123** | **0.015** | **9** | **2** |
| **Glass and Glass Product Manufacturing** | 38 | 53 | 12,059 | **0.695** | **0.105** | **0.035** | **11** | **7** |
| **Petroleum and Coal Products Manufacturing** | 47 | 94 | 8,163 | **0.733** | **0.098** | **0.037** | **12** | **6** |
| **Metal Ore Mining** | 9 | 21 | 17,778 | **0.687** | **0.079** | **0.034** | **15** | **3** |
| **Lime and Gypsum Product Manufacturing** | 31 | 60 | 8,856 | **0.531** | **0.066** | **0.027** | **13** | **3** |
| Pesticide, Fertilizer, and Other Agricultural Chemical Manufacturing | 16 | 27 | 3,680 | **0.162** | **0.044** | 0.008 | **3** | 1 |
| **Pulp, Paper, and Paperboard Mills** | 46 | 73 | 6,773 | **0.306** | **0.043** | **0.015** | **11** | **3** |
| Oil and Gas Extraction | 59 | 139 | 9,150 | **0.207** | **0.035** | **0.010** | **9** | **2** |
| Nonmetallic Mineral Mining and Quarrying | 8 | 18 | 3,808 | **0.167** | **0.035** | 0.008 | **4** | 1 |
| Resin, Synthetic Rubber, and Artificial and Synthetic Fibers and Filaments Manufacturing | 10 | 16 | 1,779 | **0.152** | **0.027** | 0.008 | **7** | **2** |
| Other Chemical Product and Preparation Manufacturing | 7 | 8 | 683 | **0.074** | **0.024** | 0.004 | **3** | 1 |
| Clay Product and Refractory Manufacturing | 1 | 2 | 1,098 | **0.088** | **0.024** | 0.004 | **4** | 1 |
| Chemical and Allied Products Merchant Wholesalers | 1 | 4 | 573 | **0.032** | **0.019** | 0.002 | **2** | 1 |
| Natural Gas Distribution | 6 | 17 | 1,027 | **0.058** | **0.016** | 0.003 | 1 | 1 |
| Water, Sewage and Other Systems | 6 | 6 | 375 | **0.069** | **0.016** | 0.003 | **4** | 1 |
| Pharmaceutical and Medicine Manufacturing | 2 | 2 | 300 | **0.057** | **0.011** | 0.003 | 1 | 1 |
| Grain and Oilseed Milling | 4 | 4 | 376 | **0.042** | 0.009 | 0.002 | 0 | 0 |
| Lessors of Real Estate | 2 | 2 | 138 | **0.037** | 0.009 | 0.002 | 0 | 0 |
| Nonferrous Metal (except Aluminum) Production and Processing | 1 | 4 | 408 | **0.025** | 0.008 | 0.001 | 0 | 0 |
| Sugar and Confectionery Product Manufacturing | 5 | 10 | 1,068 | **0.043** | 0.008 | 0.002 | 0 | 0 |
| Electric Power Generation, Transmission and Distribution | 4 | 4 | 296 | **0.039** | 0.006 | 0.002 | 0 | 0 |
| Engine, Turbine, and Power Transmission Equipment Manufacturing | 2 | 2 | 112 | **0.020** | 0.005 | 0.001 | 0 | 0 |
| Agriculture, Construction, and Mining Machinery Manufacturing | 1 | 1 | 73 | **0.012** | 0.005 | 0.001 | 0 | 0 |
| Colleges, Universities, and Professional Schools | 4 | 4 | 263 | **0.030** | 0.005 | 0.002 | 0 | 0 |
| Coal Mining | 5 | 5 | 283 | **0.015** | 0.004 | 0.001 | 0 | 0 |
| Plastics Product Manufacturing | 2 | 2 | 126 | **0.012** | 0.004 | 0.001 | 0 | 0 |
| Architectural, Engineering, and Related Services | 2 | 2 | 117 | **0.013** | 0.003 | 0.001 | 0 | 0 |
| Motor Vehicle Parts Manufacturing | 1 | 1 | 62 | **0.011** | 0.003 | 0.001 | 0 | 0 |
| Advertising, Public Relations, and Related Services | 1 | 1 | 51 | 0.009 | | | | |
| Waste Treatment and Disposal | 5 | 5 | 376 | 0.010 | | | | |
| National Security and International Affairs | 1 | 1 | 42 | 0.002 | | | | |
| Support Activities for Mining | 1 | 1 | 56 | 0.003 | | | | |
| Beverage Manufacturing | 1 | 1 | 45 | 0.002 | | | | |
| Veneer, Plywood, and Engineered Wood Product Manufacturing | 1 | 1 | 9 | 0.001 | | | | |
| Scientific Research and Development Services | 1 | 1 | 78 | 0.001 | | | | |
| Alumina and Aluminum Production and Processing | 1 | 1 | 13 | 0.000 | | | | |
| Other Food Manufacturing | 1 | 1 | 45 | 0.000 | | | | |
| Office Administrative Services | 1 | 1 | 5 | 0.000 | | | | |
| | | | | | | | | |
| **Total** | 591 | 1,199 | 164,962 | 8.77 | | | | |
| **Tier 1 Industries** | 257 | 579 | 87,267 | 4.82 | | | | |
| **Tier 2 Industries** | 171 | 326 | 51,182 | 2.55 | | | | |
| **Tier 1 Industries (% of Total)** | 43% | 48% | 53% | 55% | | | | |
| **Tier 2 Industries (% of Total)** | 29% | 27% | 31% | 29% | | | | |

**Legend**

| | Maximum Contribution | # Receptors with Contributions >=0.01 ppb | Total Contribution | # States with Highest Contribution >= 0.01 |
|---|---|---|---|---|
| **Break Points** | 0.01 to 0.04 | > 1 to 9 | 0.1 to 0.4 | > 1 to 9 |
| | >= 0.05 | >= 10 | >= 0.5 | >= 10 |

**1st Tier of Industries for Further Analysis Based on AQ Contributions**

*These industries (1) have a maximum contribution to any one receptor of >0.10 ppb AND (2) contribute >= 0.01 ppb to at least 10 receptors.*

**2nd Tier of Industries for Further Analysis Based on AQ Contributions**

*These industries either have:*

*(1) a maximum contribution to any one receptor >=0.10 ppb but contribute >=0.01 ppb to fewer than 10 receptors, or*

*(2) a maximum contribution <0.10 ppb but contribute >=0.01 ppb to at least 10 receptors*

# APPENDIX B – SUMMARY OF FACILITIES REMOVED in the SCREENING ASSESSMENT for 2026

| REGION_CD | FACILITY_ID | Reason for Removal | state | county | site_name | naics_code | naics_description | city |
|---|---|---|---|---|---|---|---|---|
| 24001 | 7763811 | Closure | MD | Allegany | Luke Paper Company | 322121 | Paper (except Newsprint) Mills | Luke |
| 06029 | 4789011 | Subject to Consent Decree | CA | Kern | LEHIGH SOUTHWEST CEMENT CO. | 327310 | Cement Manufacturing | MONOLITH |
| 06029 | 4789311 | Subject to Consent Decree | CA | Kern | CALIFORNIA PORTLAND CEMENT CO. | 327310 | Cement Manufacturing | MOJAVE |
| 06071 | 4841311 | Subject to Consent Decree | CA | San Bernardino | CEMEX - BLACK MOUNTAIN QUARRY PLANT | 327310 | Cement Manufacturing | APPLE VALLEY |
| 18093 | 8225311 | Units to be replaced by new kiln by 2023 | IN | Lawrence | LEHIGH CEMENT COMPANY LLC | 32731 | Cement Manufacturing | Mitchell |
| 26007 | 8127411 | Subject to Consent Decree | MI | Alpena | Holcim (US) Inc. DBA Lafarge Alpena Plant | 327310 | Cement Manufacturing | ALPENA |