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By Email and Certified U.S. Mail

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PETITION FOR RECONSIDERATION OF EPA'S FINAL RULE: NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS: COAL- AND OIL-FIRED ELECTRIC UTILITY STEAM GENERATING UNITS

Docket No. EPA-HQ-OAR-2018-0794

Pursuant to Section 307(d)(7)(B) of the Clean Air Act, 42 U.S.C. § 7607(d)(7)(B), Petitioners Air Alliance Houston, Alliance of Nurses for Healthy Environments, American

Academy of Pediatrics; American Lung Association; American Public Health Association; Chesapeake Climate Action Network, Citizens for Pennsylvania's Future, Clean Air Council, Clean Wisconsin, Conservation Law Foundation, Dakota Resource Council, Downwinders at Risk, Environmental Defense Fund, Environmental Integrity Project, Environmental Law and Policy Center, Kentucky Resources Council, Montana Environmental Information Center, Natural Resources Council of Maine, Natural Resources Defense Council, Physicians for Social Responsibility, and Sierra Club (collectively, "Petitioners") hereby petition the Administrator of the United States Environmental Protection Agency ("EPA" or "the Agency") for reconsideration of the final rule entitled "National Emission Standards for Hazardous Air Pollutants: Coal- and Oil-Fired Electric Utility Steam Generating Units: Final Rule," 91 Fed. Reg. 9,088 (Feb. 24, 2026) (the "Final Repeal").

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INTRODUCTION

The 2012 Mercury and Air Toxics Standards established emissions limits for mercury and other hazardous air pollutants from power plants. 77 Fed. Reg. 9304 (Feb. 16, 2012). In 2024, pursuant to Section 112(d)(6) of the Clean Air Act, EPA revised the standards to: (1) remove a loophole for lignite-burning coal plants allowing them to emit over three times as much mercury as non-lignite coal plants; (2) tighten emissions limits for other toxic metals, such as arsenic, chromium, and lead; and (3) require facilities to use continuous emissions monitoring systems (CEMS) for monitoring toxic metal emissions. *National Emission Standards for Hazardous Air Pollutants: Coal- and Oil-Fired Electric Utility Steam Generating Units Review of the Residual Risk and Technology* Review, 89 Fed. Reg. 38508 (May 7, 2024) (the "2024 Rule"). In the Final Repeal, EPA rescinded all three components of the 2024 Rule; as a consequence, the Final Repeal will significantly increase emissions of toxic air pollution even though the technologies to control that pollution are readily available. It will also result in significant increases in criteria air pollution.

Under Clean Air Act Section 307(b)(1), parties challenging EPA rules must petition for judicial review of a rule within 60 days of the rule's publication in the Federal Register. Because the Final Repeal is inconsistent with the requirements of the Clean Air Act and of reasoned decisionmaking, Petitioners have filed a petition for review of the Final Repeal. D.C. Cir. No. 26-1070 (consolidated with No. 26-1072).

Section 307(d)(7)(B) of the Clean Air Act also provides that if it was impracticable to raise an objection to an issue of central relevance to the outcome of a final rule, a party must seek administrative reconsideration before raising those issues in judicial review. As explained below, EPA's notice of proposed rulemaking in this proceeding, 90 Fed. Reg. 25,535 (June 17, 2025), failed to provide adequate notice as to the issues raised in this petition. Accordingly, it was impracticable for Petitioners to raise the objections presented herein during the public comment period. The objections presented in this reconsideration petition identify numerous and foundational flaws in EPA's rationales for the Final Repeal that, if corrected, would require a different outcome, and that are therefore centrally relevant to the outcome of the rule. As elaborated below, our petition presents the following objections:

First, EPA's calculations of the incremental costs resulting from the 2024 filterable PM ("fPM") standard erroneously included costs associated with fly ash removal that sources in fact already bear independent of the strengthened filterable PM standard, thereby skewing EPA's pivotal determination that the 2024 standard is not cost-effective.

Second, in the Final Repeal, EPA adopted a new position categorically rejecting industry-specific cost considerations, a position that lacks foundation in the statute or reasoned decisionmaking and that was likewise central to EPA's decision.

Third, in the Final Repeal EPA announced a new—and erroneous—legal position relying upon the one-in-one-million cancer risk test provided for in Clean Air Act Section 112(f)(2), 42 U.S.C. § 7412(f)(2), as part of EPA's analysis under Section 112(d)(6).

Fourth, in the Final Repeal, EPA arbitrarily limited its consideration of risk in its Section 112(d)(6) review by refusing to consider risk information outside its prior Section 112(f)(2) review.

Fifth, EPA's Final Repeal relied on the results of its 2020 Section 112(f)(2) residual risk review in a manner that conflicts with EPA's recently announced position that it lacks authority to revisit residual risk reviews.

Sixth, EPA's announcement in the Final Repeal that it would not quantify or monetize the health benefits associated with the 2024 Rule's reductions in NO_X and $PM_{2.5}$ was arbitrary and indefensible.

Pursuant to Clean Air Act Section 307(d)(7)(B), and for the reasons set forth below, Petitioners hereby petition EPA to reconsider these aspects of the Final Repeal. Under Section 307(d)(7)(B), the Administrator must convene a proceeding for reconsideration of a rule if a person demonstrates that "it was impracticable to raise such objection within [the] period for public comment" or that "the grounds for such objection arose after the period for public comment." 42 U.S.C. § 7607(d)(7)(B). The objection must also be "of central relevance to the outcome of the rule." *Id.* As demonstrated below, each ground for reconsideration raised herein satisfies these requirements: the objections either could not have been raised during the comment period because they are based on errors that were not apparent from the 2025 Proposal, 90 Fed. Reg. 25,535 (June 17, 2025), or are based on new rationales or positions that EPA adopted for the first time in the Final Repeal. And as we discuss below, each issue was of central relevance to the Rule. To promote efficient resolution of disputes over the Final Repeal, EPA should act swiftly on this petition and grant the requested reconsideration on the issues described herein.

We note that parties may have disputes over whether a particular objection was already exhausted or was subject to the reconsideration process outlined in Clean Air Act Section 307(d)(7)(B), and that definitive judicial resolution of that uncertainty may come after the time for submitting the objection to the agency has expired. Petitioners also note that Section 307(d)(7)(B)'s exhaustion requirement is not jurisdictional and can be waived by the agency. *See EPA v. EME Homer City Generation, L.P.*, 572 U.S. 489, 512 (2014). Accordingly, Petitioners reserve the right to press the objections presented herein in their pending judicial challenges. Although EPA's failure to provide the opportunity to comment on its new rationales and positions for the Final Repeal requires the agency to convene reconsideration proceedings, by filing this petition Petitioners do not concede that they failed to raise or exhaust any objections during the comment period.

STANDARD FOR RECONSIDERATION

Clean Air Act Section 307(d)(7)(B) provides:

> Only an objection to a rule or procedure which was raised with reasonable specificity during the period for public comment (including any public hearing) may be raised during judicial review. If the person raising an objection can demonstrate to the Administrator that it was impracticable to raise such objection within such time or if the grounds for such objection arose after the period for public comment (but within the time specified for judicial review) and if such objection is of central relevance to the outcome of the rule, the Administrator *shall* convene a proceeding for reconsideration of the rule and provide the same procedural rights as would have been afforded had the information been available at the time the rule was proposed.

42 U.S.C. § 7607(d)(7)(B) (emphasis added). Employing the mandatory "shall," the section *requires* EPA to convene a reconsideration proceeding upon the required demonstration. A fundamental purpose of the reconsideration process is to grant the public an opportunity to timely comment on important aspects of a final rule that were not properly noticed in a proposed rule, and to avoid such notice problems in the first place.

For rulemakings such as the Final Repeal, Section 307(d)(3) of the Clean Air Act requires EPA to provide notice of its proposed action that "shall be accompanied by a statement of its basis and purpose," including "the factual data on which the proposed rule is based; [] the methodology used in obtaining the data and in analyzing the data; and [] the major . . . policy considerations underlying the proposed rule." These notice requirements are designed (1) to ensure that agency regulations are tested via exposure to diverse public comment, (2) to ensure fairness to affected parties, and (3) to give affected parties an opportunity to develop evidence in the record to support their objections to the rule and thereby enhance the quality of review. *Envtl. Integrity Project v. EPA*, 425 F.3d 992, 996 (D.C. Cir. 2005). "[I]f the final rule deviates too sharply from the proposal, affected parties will be deprived of notice and opportunity to respond to the proposal." *Small Refiner Lead Phase-Down Task Force v. EPA* ("*Small Refiner*"), 705 F.2d 506, 547 (D.C. Cir. 1983). "[A]mbiguous comments and weak signals from the agency g[i]ve petitioners no . . . opportunity to anticipate and criticize the rules or to offer alternatives. Under these circumstances, the . . . rules exceed the limits of a logical outgrowth." *Int'l Union, UMW v. MSHA*, 407 F.3d 1250, 1261 (D.C. Cir. 2005) (internal citations omitted).

Therefore, considering the purposes of notice, a final rule that is not the logical outgrowth of a proposed rule does not provide the public with meaningful notice under

Section 307(d)(3). *See Envtl. Integrity Project*, 425 F.3d at 996. And critically for purposes of this petition, objections to aspects of a final rule that did not grow logically from the proposed rule are, necessarily, ones that were "impracticable to raise" or the grounds for which arose only after the public comment period. Even if EPA's conclusion could be considered a logical outgrowth of the proposal, the findings and analysis underlying the conclusion that were not disclosed at the proposal may be the proper subject of mandatory reconsideration. *Chesapeake Climate Action Network v. EPA*, 952 F.3d 310, 320 (D.C. Cir. 2020).

An objection is of central relevance if it "provides substantial support for the argument that the regulation should be revised." *Coal. for Responsible Regulation v. EPA*, 684 F.3d 102, 125 (D.C. Cir. 2012), *aff'd in part, rev'd in part on other grounds sub. nom. Util. Air Regulatory Grp. v. EPA*, 573 U.S. 302 (2014). An objection that "go[es] to the very legality" of the final rule satisfies this test, *Chesapeake Climate Action Network*, 952 F.3d at 322*,* even if EPA could conceivably claim alternative support for its action.

BACKGROUND ON PETITIONERS' OBJECTION TO EPA'S NEW STATUTORY INTERPRETATION OF THE RELATIONSHIP BETWEEN THE RESIDUAL RISK REVIEW AND TECHNOLOGY REVIEW

Among the objections Petitioners raise in this petition is an objection to EPA's new interpretation that it may consider the results of the Section 112(f)(2) risk review in its Section 112(d)(6) technology review. Here Petitioners provide the procedural history and context for EPA's adoption of this novel position in the Final Repeal.

In 2024, pursuant to Clean Air Act Section 112(d)(6), EPA determined there are developments in practices, processes, and control technologies that warranted revising the emissions standards for the coal- and oil-fired power plant source category. 89 Fed. Reg. 38,508 (May 7, 2024). As relevant to this petition, among other revisions, EPA tightened the fPM standard (a surrogate for non-mercury metals such as lead, nickel, arsenic, and chromium) for existing coal-fired electric generating units (EGUs) to 0.010 lb/MMBtu. The pollutants covered by this standard are associated with serious adverse health effects, including damage to the nervous system and kidneys, and cancer. 88 Fed. Reg. 24854, 24857 (April 24, 2023).

In EPA's proposal to repeal certain aspects of the 2024 Rule, EPA proposed to repeal the 2024 Rule's fPM standard for existing coal-fired EGUs of 0.010 lb/MMBtu "because the cost effectiveness of the revised standard is inconsistent with the EPA's prior technology review determinations." 90 Fed. Reg. at 25,541. EPA proposed to find that "despite developments recognized in the 2024 Final Action, the costs for the power sector to achieve the revised

standard are too high, such that the revised standard is not necessary under CAA section 112(d)(6)." *Id.*

EPA did not propose repealing the 2024 fPM standard on the basis of a health risk analysis. Instead, EPA solicited comment on "whether, when weighing the costs associated with developments under a CAA section 112(d)(6) technology review, the Agency should also consider whether there would be a meaningful risk reduction from lowering HAP emissions based on potential revisions to the emission standards resulting from those developments (Question #8)." 90 Fed. Reg. at 25,544.

In their comments, Petitioners addressed EPA's "Question #8" regarding whether EPA should consider risk reductions under its 112(d)(6) technology review. *See Comments of Public Health and Environmental Organizations on National Emission Standards for Hazardous Air Pollutants: Coal- and Oil-Fired Electric Utility Steam Generating Units, 90 Fed. Reg. 25,535 (Jun. 17, 2025)*, Docket ID No. EPA-HQ-OAR-2018-0794-7609 at 10-12, 76-107, (Aug. 11, 2025) (the "Comments"). As relevant here, Petitioners commented that the Clean Air Act does not permit EPA to repeal the revised standards based on a claim that revised standards produce "no meaningful risk reduction." *Id.* at 10. Petitioners commented that EPA had not provided any basis to change the agency's prior conclusion that the revised standards do provide meaningful health benefits, such as reductions in exposure to hazardous air pollutants by reducing emissions of mercury and other toxic pollutants like chromium, nickel, and arsenic. *Id.* at 11 (citing record support). Petitioners also commented that it would be unlawful and arbitrary for EPA to use or rely on the 2019 residual risk assessment and 2020 final rule in its final action because both were deeply flawed and did not account for up-to-date information about health risks from arsenic and other heavy metals. *Id.* at 76. Petitioners commented that EPA instead must consider scientific data that post-dated the residual risk review showing the health risks from coal plant emissions. Specifically, Petitioners provided information that a 2025 study found that people who are exposed to metals in their surrounding environments are at higher risk of heart failure. *Id*. at 105. Petitioners also pointed EPA to its own, 2025 health assessment of arsenic, which found that arsenic has higher risks of cancer and non-cancer health harms than previously understood, and further stated that EPA's 2020 risk determination significantly underestimated cancer risks from arsenic exposure from coal plants. *Id.* at 105-106.

In the Final Repeal, EPA provided for the first time a new rationale for repealing the 2024 fPM standard of 0.010 lb/MMBtu. EPA presented a novel statutory interpretation that "the results of the residual risk review may be considered when evaluating whether revisions to the emission standards are cost-reasonable and therefore 'necessary' under CAA section 112(d)(6)." 91 Fed. Reg. 9088, 9095. EPA contended that where a prior Section 112(f)(2) risk review found the maximum individual lifetime cancer risk to be below the one-in-one million figure found in Section 112(f)(2)(A), "a greater emphasis on cost is warranted in light of the low potential for further risk reduction, and that additional controls would generally only be 'necessary' when the costs are on the lower end of what has been found acceptable from a cost perspective in prior

CAA section 112 actions." *Id.* Based on this new statutory interpretation, EPA determined that the 2024 revision to the fPM standard was not "necessary." *Id.*

In its Response to Comments, with respect to comments regarding the extent of health risks and the scientific information about risks, EPA responded that EPA did not re-open the 2020 residual risk review and "any comments on the residual risk review or whether the 2012 MATS Rule provides an ample margin of safety under CAA section 112(f)(2) are outside the scope of this action and no response [is] required." EPA, *Summary of Public Comments and Responses on Proposed Rule, National Emission Standards for Hazardous Air Pollutants: Coal- and Oil-Fired Electric Utility Steam Generating Units: Final Repeal*, Docket ID No. EPA-HQ-OAR-2018-0794-8495 at 127 (Feb. 2026) ("RTC").

GROUNDS FOR RECONSIDERATION

I. EPA'S COST WORKBOOK CONTAINS A MATERIAL ERROR IN VARIABLE OPERATING AND MAINTENANCE COSTS FOR FABRIC FILTER INSTALLATIONS.

A. *EPA's Error Significantly Inflates EPA's Cost-Effectiveness Determination, Which Is the Basis for the fPM Standard's Repeal*.

The Final Repeal rests centrally on EPA's determination that the cost-effectiveness of the 2024 fPM standard—$11.1 million per ton of non-Hg HAP metals and $36,502 per ton of fPM—is "inconsistent" with the Agency's prior technology review determinations under CAA Section 112(d)(6). 91 Fed. Reg. at 9,096–97. The errors and new positions in the Final Repeal identified in this petition directly undermine that cost-effectiveness determination, *which provided the primary basis for EPA's decision*, and are therefore "of central relevance to the outcome of the rule." 42 U.S.C. § 7607(d)(7)(B).

Petitioners' expert, Dr. James Staudt of Andover Technology Partners, has identified a fundamental error in EPA's calculation of the compliance costs of the 0.010lb/MMBtu fPM standard. EPA incorrectly included in its calculation of incremental cost those costs associated with fly ash disposal that plants are already bearing. This error undermines EPA's determination—central to its decision to repeal the standard—that the standard is not cost-effective.

EPA's cost-effectiveness calculation for the fPM standard relied on a Microsoft Excel workbook to calculate the unit-by-unit incremental, annualized cost of fPM control upgrades, including fabric filter installations. 91 Fed. Reg. at 9,096. For those units that EPA projected would require a new fabric filter—including both units at the Colstrip Power Plant, which alone accounted for nearly half of the 2024 Rule's estimated compliance costs, *id.* at 9,100—EPA used a cost-estimating methodology developed by Sargent & Lundy for estimating variable operating

and maintenance ("VOM") costs. *See* EPA, 2025 Update to the 2024 Technology Review for the Coal- and Oil-Fired EGU Source Category ("2025 Technical Memo") (Nov. 2025), attach. 1 (Excel workbook), EPA-HQ-OAR-2018-0794-8480.

As detailed in the expert technical analysis of Dr. James Staudt—whose independent reconstruction of EPA's cost calculations first identified this error after the Final Repeal was issued—EPA's workbook failed to correctly apply the Sargent & Lundy cost-estimating methodology that the Agency itself selected for estimating fabric filter costs. *See* Memorandum from Jim Staudt, PhD, Andover Technology Partners, to Environmental Defense Fund, Re: EPA Repeal of 2024 MATS Update Rule, PM Cost Estimates at 1–5 (Apr. 21, 2026) ("Staudt Memo," attached as an exhibit to this petition). Specifically, EPA included the full cost of disposing of all fly ash generated by each coal unit in the incremental VOM for fabric filter installations. *Id.* at 1, 3-5. But this is a clear error in the application of the Sargent & Lundy methodology.

When a fabric filter replaces an existing PM control device such as an electrostatic precipitator ("ESP") or venturi scrubber, the composition and fate of the fly ash is unchanged—the fly ash was already being collected and either disposed of or sold for beneficial reuse prior to the fabric filter installation. The addition of a fabric filter does not alter the fly ash composition and therefore does not create any new disposal obligation. *See* Sargent & Lundy, IPM Model – Updates to Cost and Performance for APC Technologies, Particulate Control Cost Development Methodology, Final, Project 13527-001, Doc. ID No. EPA-HQ-OAR-2018-0794-5834 at 8, 10 (Apr. 2017); Staudt Memo at 1, 3-4. The Sargent & Lundy methodology was designed to estimate costs for fabric filters installed in conjunction with sorbent injection systems, where the chemical composition of the fly ash may change and render it unmarketable. *See id.* Where, as here, only a fabric filter is added without a sorbent injection system, the only legitimate incremental VOM components are bag replacement costs ("VOMB") and parasitic power costs ("VOMP").[1] *See* Staudt Memo at 4. EPA's misapplication of the methodology—treating a standalone fabric filter installation as if it were a combined sorbent injection and fabric filter system—resulted in the inclusion of fly ash disposal costs that the methodology itself recognizes should be excluded.[2] *Id.* at 3-5.

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[1] The abbreviations "VOMB," "VOMP," and "VOMW" (discussed below) correspond to cost components identified in the Sargent & Lundy Particulate Control Cost Development Methodology. *See* Sargent & Lundy, IPM Model - Updates to Cost and Performance for APC Technologies, Particulate Control Cost Development Methodology, Final, Project 13527-001, at 9 (Apr. 2017). EPA's workbook applies these components in its "FF Install Estimated Costs" sheet. *See* Staudt Memo at 5.

[2] The Sargent & Lundy methodology specifies that the waste disposal VOM component ("VOMW") is designed to capture additional disposal costs attributable to sorbent-laden fly ash—i.e., fly ash whose composition has been altered by sorbent injection, potentially rendering it unsuitable for beneficial reuse. *See* Sargent & Lundy, IPM Model - Updates to Cost and Performance for APC Technologies, Particulate Control Cost Development Methodology, Final, Project 13527-001, at 8–10 (Apr. 2017) (specifying that VOMW captures waste disposal costs for the combined sorbent-and-fly-ash waste stream generated when sorbent is injected into a fabric filter, and providing that "the user can remove fly ash disposal volume from the waste disposal cost" where fly ash is captured separately; noting that fly ash captured with sodium sorbent "must be landfilled" because the sorbent alters its

The magnitude of this error is substantial. Of the total estimated VOM multiplier factor of approximately $2.50/MWh used in the Sargent & Lundy methodology, the waste disposal component ("VOMW") accounts for approximately $2.07/MWh—or roughly 83% of the total VOM. *Id.* at 4. The remaining VOM for bag replacement and parasitic power is only approximately $0.43/MWh (in 2016 dollars). *Id.* EPA's Excel workbook shows VOM cost factors for the affected fabric filter units ranging from $2.04/MWh to $3.40/MWh, confirming that EPA included the full fly ash disposal cost. *See* 2025 Technical Memo, attach. 1, tab "FF Install Estimated Costs," col. G.

The actual incremental fly ash requiring disposal is negligible. EPA's own workbook shows that at the 0.010 lb/MMBtu level, the total incremental fly ash collected for all units is only 2,567 tons per year. Staudt Memo at 5. Even if all of that tonnage were disposed of at $50/ton[3]—a conservatively high estimate, as fly ash is commonly *sold* into beneficial reuse markets rather than landfilled—the total disposal cost would be approximately $128,000—only about 0.14% of EPA's estimated total annualized cost of $93.7 million. Staudt Memo at 5. EPA correctly excluded incremental fly ash disposal costs for units that received ESP upgrades or existing fabric filter improvements; there is no rational basis for including such costs only for new fabric filter installations where the fly ash composition is equally unchanged.

Correcting this error alone—using EPA's own capital costs and fixed O&M assumptions, and substituting the correct VOM of approximately $0.48/MWh (escalated from 2016 dollars using the Chemical Engineering Plant Cost Index)—reduces the total annualized cost at the 0.010 lb/MMBtu level from $93.7 million to approximately $76.8 million, and improves the cost-effectiveness from $11.1 million per ton to approximately $9.1 million per ton of non-Hg HAP metals. *See* Staudt Memo at 6, 8, 10, 14 & tbl. 3. This represents a $2 million per ton error—approximately 18 percent of EPA's headline cost-effectiveness figure.

This VOM error is particularly significant because the cost-effectiveness of the fPM standard is the central—and dispositive—basis for the repeal of the fPM standard in the Final Repeal. EPA expressly stated that it is "finalizing the repeal of the more stringent fPM standard and corresponding total and individual HAP metal standards promulgated in the 2024 Final Rule because the cost effectiveness of the revised standard is inconsistent with that of the EPA's prior technology review determinations." 91 Fed. Reg. at 9,096. Correcting this error alone improves the cost-effectiveness from $11.1 million per ton to approximately $9.1 million per ton of non-

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composition); Staudt Memo at 3, 4. Where no sorbent injection system is installed, as with a standalone fabric filter, the fly ash composition remains unchanged from what was already being collected and disposed of under the prior control configuration, and VOMW should therefore be excluded from the incremental cost calculation. *See* Staudt Memo at 4.

[3] The $50/ton figure used here matches the default waste disposal cost in the Sargent & Lundy methodology that EPA employs in its calculation. *See* Sargent & Lundy at 10, Table 1 (variable "AA"); Staudt Memo at 5.

Hg HAP metals—below the $10 million per ton value that EPA rejected in the Petroleum Refinery Sector RTR, 80 Fed. Reg. 75,178, 75,201 (Dec. 1, 2015), which was one of two primary comparators EPA relied upon to justify the repeal. *See* 91 Fed. Reg. at 9,099. The other comparator was the Integrated Iron and Steel Manufacturing Facilities RTR, 85 Fed. Reg. 42,074, 42,088 (July 13, 2020), which rejected a cost-effectiveness value of $7 million per ton of non-Hg HAP metals. *See* 91 Fed. Reg. at 9,099. However, as Petitioners discussed in their comments on the proposal, the Iron and Steel RTR is a poor comparator: the $7 million value failed to include $140 million in capital costs, making it a gross underestimate; the cost-to-revenue ratio was nearly two-thirds greater than that of the 2024 Rule; the source category covered only 11 facilities with merely 3 tpy of HAP reductions versus 314 EGUs and 8.3 tpy under the 2024 Rule; and industry-specific factors—including concerns about technical feasibility and potential facility closures—independently counseled against adopting more stringent standards in that rulemaking. *See* 89 Fed. Reg. at 38,524; Comments at 20-21.

The VOM error is further compounded when considered alongside the Hg sorbent savings offset that Petitioners raised in their comments on the 2025 Proposal: because installation of a fabric filter at Colstrip would substantially reduce activated carbon injection costs for mercury control, EPA's failure to account for that offset further inflated the cost-effectiveness figure. *See* Comments at 26 (explaining that installation of a fabric filter at Colstrip "would likely reduce its costs of controlling Hg due to the improved efficacy of the baghouse at controlling Hg leading to less use of activated carbon" and that "[t]his upgrade could save about $15 million per year in Hg control costs, or about 41% of EPA's estimated annual cost of the baghouse retrofit"). When both the VOM error and the Hg sorbent savings offset are corrected, the total annualized cost drops to approximately $68.5 million—a 27% reduction from EPA's estimate—and the cost-effectiveness improves to approximately $8.1 million per ton of non-Hg HAP metals. *See* Comments at 26.

B. *This Objection Could Not Practicably Have Been Raised During the Comment Period.*

The VOM error could not practicably have been identified during the comment period for the 2025 Proposal. EPA's Excel workbook contained "numerical values in cells without including the underlying equations," making it impossible for commenters to assess the VOM calculations by examining the underlying formulas not present in the workbook. Staudt Memo at 1. Moreover, the error was masked in the 2024 Rule because EPA had also erroneously annualized the VOM using the capital charge rate, which made the VOM figure appear lower and thus obscured the fly ash disposal inclusion. In its Technical Memo accompanying the Final Repeal, EPA discussed how it discovered and corrected the annualization error that was present in the 2024 Rule, which, once corrected, increased the individual fabric filter install costs by roughly $9.6 to $9.8 million or 50 to 53% at the unit level. *See* 2025 Technical Memo at 6 ("[T]he EPA found the variable operation and maintenance (VOM) component of the FF [fabric filter] install

cost calculation was erroneously annualized, resulting in a lower incremental annual cost…This error has been corrected in this action."). *Compare id.* attachment 1, "FF Install Estimated Costs" sheet, "Incremental Annual Cost" column (showing incremental annual costs of $28.1 and $28.2 million for Colstrip units B4 and B3) *with* EPA, 2024 Update to the 2023 Proposed Technology Review for the Coal- and Oil-Fired EGU Source Category ("2024 Technical Memo"), attachment 1, "FF Install Estimated Costs" sheet, "Incremental Annual Cost" column (showing incremental annual costs of $18.5 million and $18.4 million for Colstrip units B4 and B3). Once EPA corrected the annualization error for the Final Repeal—properly treating VOM as an annual cost that should not be multiplied by the capital charge rate—the fly ash disposal error became visible because it was no longer offset by the countervailing annualization mistake. After EPA's correction of the annualization error presented numbers that, for the first time, appeared much too high, careful independent reconstruction of the VOM calculations using the Sargent & Lundy methodology, performed by Dr. Jim Staudt of Andover Technology Partners, identified the fly ash disposal error. *See* Staudt Memo at 1–5. The CAA Section 307(d)(7)(B) impracticability standard does not demand that commenters possess specialized technical expertise sufficient to independently reconstruct an agency's cost model from hard-coded numerical values—particularly where, as here, the agency's own workbook omitted the underlying formulas. *See, e.g., Am. Radio Relay League, Inc. v. FCC,* 524 F.3d 227, 236-37 (D.C. Cir. 2008) (quoting *Conn. Light & Power Co. v. Nuclear Regul. Comm'n,* 673 F.2d 525, 530-31 (D.C. Cir. 1982) (agency bears burden of presenting data and revealing "portions of the technical basis for a proposed rule" in a manner that allows meaningful public comment)).

C. *This Objection Is of Central Relevance to the Outcome of the Rule.*

EPA proposed repealing the fPM standard "based on a determination that the cost of the revision to the standard are [sic] unreasonable, and thus, not 'necessary' as required by CAA section 112(d)(6)." 91 Fed. Reg. at 9,095. In the Final Repeal, EPA confirmed that "the cost-effectiveness of the revised standards is not reasonable and compares unfavorably to prior Agency decisions on cost-reasonableness across other technology reviews and other section 112 actions where costs are considered." *Id.* EPA has explained the centrality of these cross-industry comparisons to its methodology: "The EPA also uses these metrics when determining whether additional controls are necessary under CAA section 112(d)(6) on the theory that if the costs of such controls are within the range of what had been found reasonable in one rule, then those same costs are potentially reasonable for other source categories. If additional controls cost more than the historical range, we generally conclude that such controls are unnecessary." *Id.* at 9,098. Moreover, EPA itself acknowledged that "in the 2024 Final Rule, the EPA established CAA section 112(d)(6) standards for emissions of fPM and corresponding standards for emissions of non-Hg HAP metals though the cost-effectiveness values of such controls were the highest (or among the highest) of any CAA section 112(d)(6) standard the Agency has established." *Id.* at

9,099. The $11.1 million per ton figure reported in Table 3 of the Final Repeal is thus the linchpin of the fPM standard repeal rationale. *Id.* at 9,096.

An error that reduces this figure by $2 million per ton—or by $3 million per ton when combined with the Hg sorbent savings offset that Petitioners raised in their comments—is plainly "of central relevance to the outcome" of the rule because it directly undermines this factual predicate. As noted above, the VOM error alone improves the cost-effectiveness to approximately $9.1 million per ton—below the $10 million per ton Petroleum Refinery comparator that EPA itself identified as a primary benchmark for unacceptable cost-effectiveness. *See* 91 Fed. Reg. at 9,099 (citing 80 Fed. Reg. at 75,201).

Moreover, EPA's cost-effectiveness analysis is further undermined by its selective choice of comparators. EPA relied on two prior rulemakings where it rejected cost-effectiveness values in the millions of dollars per ton of non-Hg HAP metals, while ignoring rules where it accepted far higher cost-effectiveness values for the same surrogate pollutant, fPM. For example, in the Ferroalloys Production rule, EPA accepted a cost-effectiveness value equivalent to $185,000 per ton of PM2.5, 80 Fed. Reg. 37,366, 37,381 (June 30, 2015), and in the Secondary Lead Smelting rule, EPA proposed a limit at $114,000 per ton of fPM, 76 Fed. Reg. 29,032, 29,060 (May 19, 2011). *See also* Comments at 21, nn. 7-8 (explaining adjustment of figures to 2019 dollars). These fPM-specific cost-effectiveness values are far greater than the $36,502 per ton of fPM in the 2024 Rule – demonstrating that the 2024 standard's fPM cost-effectiveness compares favorably with prior rules. EPA's selective reliance on the two least favorable comparators—while ignoring rules where it accepted far higher values for the same surrogate pollutant—is the hallmark of arbitrary decision-making. *See Motor Vehicle Mfrs. Ass'n v. State Farm Mut. Auto. Ins. Co.*, 463 U.S. 29, 43 (1983).

Petitioners further note that the VOM error identified herein is not the only flaw in EPA's cost-effectiveness calculation. In comments on the 2025 Proposal, the NGO coalition and Andover Technology Partners identified several additional errors that EPA failed to substantively address in the Final Repeal, including: (1) EPA's failure to adjust cost-effectiveness comparisons across rulemakings for differences in dollar-year values using the Chemical Engineering Plant Cost Index; (2) the distortive effect of the Colstrip facility—the sole remaining plant using venturi scrubber technology—on fleet-wide cost-effectiveness; (3) EPA's failure to account for the substantial mercury control cost savings that would result from fabric filter installation, which would offset a significant portion of the compliance costs EPA attributed to the fPM standard; (4) EPA's failure to address its own prior "allowable emissions" cost-effectiveness calculation of $197,000 per ton; (5) EPA's failure to evaluate intermediate fPM standards; and (6) EPA's systematic overestimation of ex ante compliance costs. *See* Comments at 14–27. The VOM error, when considered together with the errors addressed in comments, makes plain that EPA's cost-effectiveness rationale for the repeal is arbitrary and capricious.

II. EPA'S CATEGORICAL REJECTION OF INDUSTRY-SPECIFIC COST CONSIDERATIONS WAS NOT PROPOSED, VIOLATES THE ACT AND IS ARBITRARY AND CAPRICIOUS

A. *The Final Repeal Adopted a New Categorical Position That Was Not Proposed.*

In the Final Repeal, EPA presented a new legal position that the very act of considering industry-specific characteristics when evaluating cross-source-category cost-effectiveness comparisons is "inappropriate" under the statute—a position that was never proposed and never subjected to public comment. *See* 91 Fed. Reg. at 9,096–97.

In the 2025 Proposal, EPA described the multi-factor cost analysis it had employed in the 2024 Rule, acknowledging that it had "recognized differences between the power sector and the other industries regulated" in other prior technology reviews "and determined that despite the high cost-effectiveness ratio, the revised standards were still cost reasonable for the industry." 90 Fed. Reg. at 25,541. EPA then stated that it was "now reconsidering that judgment" and proposed to find that "the costs for the power sector to achieve the revised standard are too high, such that the revised standard is not necessary under CAA section 112(d)(6)." *Id.* In context, EPA's proposal was at most signaling a reconsideration of whether the bottom-line cost-effectiveness values warranted a different judgment. EPA did not, however, articulate or signal a wholesale rejection of the analytical framework that produced such cost-effectiveness values.

In the Final Repeal, EPA went dramatically further, declaring that "it was *inappropriate* to rely on the differences between the EGU sector and other sectors with respect to consideration of costs in the development of standards." 91 Fed. Reg. at 9,097 (emphasis added). EPA grounded this categorical rejection in a statutory interpretation: "[t]he EPA has consistently maintained that the statute treats the EGU source category the same as all other major source categories with respect to regulation under CAA section 112(d) once the Agency decides pursuant to CAA section 112(n)(1)(A) to add the EGU source category to the list of regulated major sources under CAA section 112(c)(1)." *Id.* (citing 42 U.S.C. § 7412(c)(1), (n)(1)(A); 88 Fed. Reg. 13,956, 13,960–61 (Mar. 6, 2023)). EPA then faulted its own prior analysis, stating that "[i]n the 2024 Final Rule, however, the Agency ignored" its position that EGUs must be treated the same as all other listed source categories "and used certain unique factors about the power sector in an attempt [to] justify otherwise unreasonable costs." *Id.*

In the preamble to the Final Repeal, EPA further elaborated on its categorical position, stating that "the Agency's statements about the power sector in the 2024 Final Rule are not appropriate reasons to accept higher cost-effectiveness values relative to other source categories" and that "[c]haracteristics of the power sector such as number of units and quantity of emissions

do not mean that metric is not reasonable, because the metric is already keyed to ton of HAP emissions reduced." 91 Fed. Reg. at 9,101. This was not a mere disagreement about whether the cost-effectiveness numbers are too high; it was a new legal position that the very act of considering industry-specific characteristics when evaluating cross-source-category cost-effectiveness comparisons is "inappropriate" under the statute—a position that was never proposed and never subjected to public comment. Although EPA does not explicitly state that its new interpretation governs technology reviews for all source categories, its reasoning necessarily implies as much: EPA declares that once a source category is listed under Section 112(c)(1), it must be treated "the same" as all other listed categories for cost-effectiveness purposes, and that sector characteristics like size and emission quantities are categorically irrelevant because the cost-effectiveness metric is "already keyed to ton of HAP emissions reduced." 91 Fed. Reg. at 9,097, 9,101. That reasoning is not limited to EGUs.

This position represents a significant departure from EPA's longstanding practice. EPA has routinely considered industry-specific characteristics—including sector size, number of affected facilities, total revenues, cost-to-revenue ratios, and the industry's ability to absorb compliance costs—when evaluating the reasonableness of cost-effectiveness values across different source categories. *See, e.g.,* 89 Fed. Reg. at 38,524–25 (2024 Final Rule relying on such factors). Notably, the Ferroalloys Production rule that EPA cites in the Final Repeal to support its cost-effectiveness framework actually undercuts EPA's new categorical position. In that very rule, EPA stated that "[i]t is important to note that there is no bright line for determining acceptable cost effectiveness for HAP metals. Each rulemaking is different, and various factors must be considered." 80 Fed. Reg. 37,366, 37,381 (June 30, 2015). In the 2026 Final Repeal, EPA also rejected a control option in the Ferroalloys Production rule based not solely on cost-effectiveness but also due to "concerns about technical feasibility and the significant economic impacts the option would create for the industry, including potential facility closures that would impact significant portions of industry production." 91 Fed. Reg. at 9,101 (citing 79 Fed. Reg. 60,238, 60,273 (Oct. 6, 2014)). The Final Repeal's categorical prohibition on considering industry-specific factors—treating a source category encompassing hundreds of coal-fired power plants generating billions in annual revenue as if it were indistinguishable from source categories covering as few as eleven facilities with a fraction of the emissions—is unprecedented and was not included in EPA's proposed rule. *Cf.* 89 Fed. Reg. at 38,524 (noting that the Integrated Iron and Steel source category covered only 11 facilities with 3 tpy of HAP and 120 tpy of PM reductions, compared to MATS, which affected 314 coal-fired EGUs with 8.3 tpy HAP and 2,537 tpy of fPM reductions).

In addition, EPA's application of this position is internally inconsistent. In the Final Repeal, EPA in fact asserted that the "unique character of the power sector and . . . increasing demand supports this repeal because any unnecessary downward pressure on the power industry at this time is not in the national interest or in the interest of consumers." 91 Fed. Reg. at 9,097.

It is arbitrary for EPA simultaneously to invoke the "unique character of the power sector" when it suits its deregulatory objective, while declaring at the same time that it is "inappropriate" to consider those same unique characteristics when they support stronger standards. EPA cannot have it both ways. To the extent that EPA did in fact consider industry-specific factors, it failed to provide a reasoned explanation for why those factors support repeal but cannot support retention of the 2024 standard. In its Response to Comments, for example, EPA stated that "[e]ven when the EPA considers the relative size of industry revenues or capital expenditures, the Agency finds that the emission reductions from these controls do not justify the industry-wide or facility specific costs." RTC at 49. This shows that EPA did, in fact, consider industry-specific revenue and capital expenditure data—the very factors it declared "inappropriate" to consider—but provided no reasoned basis for its changed assessment of those factors, as required by *FCC v. Fox Television Stations, Inc.*, 556 U.S. 502, 515 (2009).

EPA's new categorical position is also not the best reading of the statute. Nothing in Section 112(d)(6) prohibits EPA from considering the characteristics of the regulated source category when assessing compliance costs. To the contrary, the D.C. Circuit has confirmed that the parenthetical in Section 112(d)(6) elucidating "necessary" under Section 112(d)(6) "point[s] to a non-exhaustive list of considerations." *La. Env't Action Network v. EPA*, 955 F.3d 1088, 1097 (D.C. Cir. 2020). Assuming *arguendo* that the statute allows EPA to consider whether the cost of a rule is reasonable when it conducts reviews under Section 112(d)(6), it would be arbitrary to exclude consideration of the size, revenues, cost-to-revenue ratios, and regulatory structure of a source category in determining whether the costs of compliance are reasonable for that category. EPA has stated as much in prior rulemakings. The very technology review determinations that EPA now invokes as comparators themselves considered industry-specific factors: in the Ferroalloys Rule, EPA weighed "the significant economic impacts the option would create for the industry," 91 Fed. Reg. at 9,101; and in the Iron and Steel Rule, the rejection turned in part on the fact that the cost-to-revenue ratio was substantially higher for that industry. *See* Comments at 20-21. EPA cannot selectively invoke industry-specific factors from those prior rules to support repeal while simultaneously declaring it "inappropriate" to consider them for the power sector.

The statutory provision EPA invokes to support its new position does not bear the weight EPA places on it. EPA argues that because Section 112(n)(1)(A) functions as a gateway that places EGUs "in the same position" as all other source categories listed under Section 112(c)(1), it was "inappropriate" to consider the power sector's unique characteristics when evaluating cost-effectiveness under Section 112(d)(6). 91 Fed. Reg. at 9,097 & n.64. But EPA conflates two different propositions. That EGUs, once listed, are subject to the same regulatory provisions as other listed source categories (including Sections 112(d) and (f)) does not mean that EPA must evaluate costs identically across source categories with vastly different economic profiles, scales, and regulatory structures. Section 112(n)(1)(A) addresses the threshold listing decision—that is,

whether to regulate EGUs under Section 112 at all—not how EPA should weigh costs once it conducts a technology review under Section 112(d)(6). If anything, Congress's decision to require an individualized "appropriate and necessary" finding for EGUs—including consideration of "the hazards to public health reasonably anticipated to occur," 42 U.S.C. § 7412(n)(1)(A)—reflects Congress's recognition that the EGU source category has distinctive characteristics warranting particularized analysis, not that those characteristics become irrelevant once the listing decision is made.

B. *This Objection Could Not Practicably Have Been Raised During the Comment Period.*

The 2025 Proposal gave no notice that EPA would adopt a categorical position that industry-specific characteristics are legally irrelevant to cross-source-category cost-reasonableness comparisons. The Proposal merely stated that EPA was "reconsidering" its prior judgment about whether the cost-effectiveness values were too high "despite" the differences between the power sector and other industries. 90 Fed. Reg. at 25,541. It did not invoke the statutory framework of Sections 112(c)(1) and 112(n)(1)(A) as a basis for treating EGUs identically to all other listed source categories for cost-effectiveness evaluation purposes. It did not state or suggest that considering sector-specific revenue, size, or cost-absorption capacity is "inappropriate." And the comment it solicited—Question #1—asked only whether "the cost effectiveness of the revised fPM standard is inconsistent with the EPA's prior CAA section 112(d)(6) technology review determinations." *Id.* at 25,544. This question was directed at the cost-effectiveness *value itself*—the bottom-line number—not at the broader question of whether the factors that inform the reasonableness of that value, including industry-specific characteristics, are categorically irrelevant to cross-source-category comparisons.

A commenter exercising reasonable diligence could not have anticipated that EPA would leap from "reconsidering" whether it viewed the cost-effectiveness values as too high to declaring that it is "inappropriate" as a matter of statutory interpretation to consider sector-specific characteristics, even though EPA has previously recognized them as relevant to cost-effectiveness evaluation under Section 112. Because EPA's categorical position first emerged in the Final Repeal, it was "impracticable to raise" an objection to it "within [the] period for public comment." 42 U.S.C. § 7607(d)(7)(B).

C. *This Objection Is of Central Relevance to the Outcome of the Rule.*

EPA's categorical rejection of industry-specific cost considerations is of central relevance to the Final Repeal because it displaces the analytical framework that the 2024 Final Rule used for assessing cost-effectiveness. In the 2024 Final Rule, EPA determined that, notwithstanding the higher cost-effectiveness ratio, the fPM standard was cost-reasonable for the power sector because of the sector's distinguishing characteristics: its large size, substantial revenues,

favorable cost-to-revenue ratios, and the fact that compliance costs would be borne by only a fraction of the fleet. 89 Fed. Reg. at 38,524–25, 38,534. By categorically declaring these considerations "inappropriate" for the first time in the Final Repeal, EPA invalidated the entire cost-reasonableness analysis that supported the 2024 standard without affording commenters an opportunity to defend those considerations, propose alternative analytical frameworks, or present evidence regarding the relevance of industry-specific factors to cost-effectiveness evaluation under Section 112(d)(6).

Moreover, this new position has ramifications beyond this rulemaking. If EPA's categorical statutory interpretation stands—that Section 112(n)(1)(A) listing forecloses any consideration of the EGU source category's unique characteristics when evaluating cost-effectiveness—it could fundamentally alter how costs are evaluated for the power sector in all future technology reviews under Section 112(d)(6). The D.C. Circuit has taken an "every tub on its own bottom" approach to reviewing EPA's technology review determinations, recognizing that the "adequacy of the underlying justification offered by the Agency is what matters in an arbitrary-and-capricious review—not what the Agency did on a different record concerning a different industry." *U.S. Sugar Corp. v. EPA*, 830 F.3d 579, 623 (D.C. Cir. 2016) (citing *Sierra Club v. EPA*, 353 F.3d 976, 986 (D.C. Cir. 2004)). And EPA itself has recognized that "[e]ach rulemaking is different, and various factors must be considered" in evaluating cost-effectiveness. 80 Fed. Reg. at 37,381 (EPA's own statement in Ferroalloys Production). EPA's new position abandons this flexible, context-sensitive approach—which was endorsed by both the Agency and the D.C. Circuit—in favor of a rigid, one-size-fits-all framework that was never proposed, never subjected to public comment, and is inconsistent with the process the statute contemplates. Reconsideration is therefore warranted.

III. EPA UNLAWFULLY AND WITHOUT NOTICE IMPORTED AND RELIED ON SECTION 112(f)'s ONE-IN-ONE-MILLION CANCER RISK TEST IN ITS SECTION 112(d)(6) TECHNOLOGY REVIEW.

A. *EPA Unlawfully Imported Section 112(f)(2)'s Cancer Risk Test Into the Agency's Section 112(d)(6) Review.*

EPA's Final Repeal asserts, for the first time, that where prior Section 112 standards have "lowered the maximum individual cancer risk" from a particular set of air toxics to "below one-in-one-million for every" source in a category, Section 112(d)(6) requires "a greater emphasis on cost" such that "additional controls would generally only be 'necessary' when the costs are on the lower end of what has been found acceptable" in prior actions under Section 112. 91 Fed. Reg. at 9,095. The Agency bases that new interpretation of Section 112(d)(6) on the appearance of that one-in-one-million figure in Section 112(f)(2), under which it serves as the cancer risk trigger at which EPA must promulgate health risk standards. 42 U.S.C. § 7412(f)(2) ("If standards promulgated pursuant to subsection (d) … do not reduce lifetime excess cancer risks to

the individual most exposed to emissions from a source in the category or subcategory to less than one in one million, the Administrator shall promulgate standards under this subsection for such source category.").

There is no lawful basis for EPA's importation of Section 112(f)(2)'s one-in-one-million cancer risk test into Section 112(d)(6) at all, much less as a way to nullify the rest of the Section 112(d)(6) factors. As petitioners have previously explained, Section 112(d)(6) does not permit *any* consideration of health risks; it confines EPA, through the term "necessary," to the standard-setting criteria contained in Section 112(d)(2). *See* Comments at 10-11. Because the statutory text and structure and D.C. Circuit precedent preclude all consideration of risk under section 112(d), consideration of the one-in-one million cancer risk test is also necessarily precluded. *Id.* For at least three additional reasons, Section 112(f)(2)'s one-in-one million figure does not create an exception to that prohibition.

First, Section 112(f)(2) uses the one-in-one-million figure for a particular and singular purpose: obligating EPA to promulgate standards based on health risk. 42 U.S.C. § 7412(f)(2). EPA cannot "import[ ] [that] consequential language into provisions containing nothing like it"—in this case, a provision that does not refer to health or cancer risk at all. *Badgerow v. Walters,* 596 U.S. 1, 11 (2022). *See Ass'n of Battery Recyclers v. EPA,* 716 F.3d 667, 672 (D.C. Cir. 2013) ("[N]othing" in Section 112(d)(6)'s "text suggests that EPA must consider" matters such as "risk reduction."); *Sierra Club v. EPA*, 353 F.3d 976, 990 (D.C. Cir. 2004) (collapsing the criteria in sections 112(d) and 112(f) would "collapse the technology-based/risk-based distinction at the heart of the Act"). Doing so violates the "ordinary principles of statutory construction," under which "[w]hen Congress includes particular language in one section of a statute but omits it in another section of the same Act," that choice should be understood to be "deliberate." *See Badgerow,* 596 U.S. at 11 (citation omitted). Because EPA's interpretation does not represent the best reading of either section 112(f)(2) or 112(d)(6), it must fail. *Loper Bright Enters. v. Raimondo*, 603 U.S. 369, 400 (2024).

That is especially so here, where EPA's use of the one-in-one million test is diametrically opposed to its statutory function. Section 112(f)(2) uses the one-in-one-million figure to make regulation *mandatory*. 42 U.S.C. § 7412(f)(2). EPA's Rule instead deploys the cancer risk test to *evade* regulatory obligations that would otherwise apply. 91 Fed. Reg. at 9,095. That functional inversion allows EPA to use purported low cancer-related risks to permit HAP emissions, even though those emissions create a variety of non-cancer-related harms. Comments at 61-67. But that Congress required regulation where cancer-related risks exceeded the one-in-one-million test does not mean that Congress relieved EPA of its duties to address other risks—just as a traffic law requiring drivers to stop at a red-light does not suggest that they are entitled to heedlessly speed through all other intersections. That Congress required EPA to "promulgate standards" addressing cancer risks over Section 112(f)(2)'s one-in-one-million cancer risk test does not

suggest that Congress reduced EPA's separate obligations to address other health harms, including serious non-cancer health effects. *See* 88 Fed. Reg. 24,854, 24,857 (describing adverse non-cancer health effects including damage to central nervous system and kidneys).

Indeed, EPA's choice to consider health risk only in reference to the one-in-one million cancer risk test, without any consideration of other material and relevant factors, is not only contrary to the statute, but also arbitrary and capricious. As the Agency has recognized, coal plants emit HAP with serious non-cancer health effects. *See id.*. And more stringent standards prevent facilities from backsliding and increasing their emissions over time, thereby preventing future health harms from occurring. By narrowly focusing on the one-in-one million cancer risk test, and setting aside all other considerations including any potentially significant non-cancer risk, EPA ignores an important aspect of the problem. *Motor Vehicle Mfrs. Ass'n v. State Farm Mut. Auto. Ins. Co.*, 463 U.S. 29, 43 (1983) (agency is arbitrary and capricious if it "entirely fail[s] to consider an important aspect of the problem").

Second, even if EPA could import Section 112(f)(2)'s cancer risk test into Section 112(d)(6) as a relevant factor, it cannot do so in the asymmetric fashion adopted by the Final Repeal. EPA claims that achievement of Section 112(f)(2)'s one-in-one-million test means that only low-cost controls are "necessary" under Section 112(d)(6). But EPA does not acknowledge the full consequences of that view: if that one-in-one million figure were relevant, the failure to achieve it must carry equivalent consequences. Where risks substantially exceed one-in-one million, Section 112(d)(6) would therefore make higher-cost controls "necessary." EPA's interpretation instead makes the one-in-one million figure relevant only where it weighs against more stringent standards; that cannot be the best reading of the statute. *See AFGE v. FLRA,* 850 F.2d 782, 787 (D.C. Cir. 1988) (requiring recognition of both "more beneficial" and "less advantageous" consequences of a statutory interpretation).

Third, Section 112(d)(6) expressly lists which factors EPA can "tak[e] into account" when determining whether revisions are "necessary," including "developments in practices, processes, and control technologies." 42 U.S.C. § 7412(d)(6). Health risks calculated under Section 112(f)(2) are not mentioned in this specific list of factors, nor is the science of risk directly related to such factors. Under the principle of *noscitur a sociis*, "a word is known by the company it keeps." *Yates v. U.S.*, 574 U.S. 528, 543 (2015). In this case, the word "necessary" is followed immediately by a direction to consider "developments in practices, processes, and control technologies." Interpreting "necessary" to encompass the one-in-one million cancer risk test found in a separate provision, which bears little relationship to such developments, would divorce the word entirely from "the company it keeps."

EPA's reliance on the one-in-one million cancer risk test establishes, in effect, a *de minimis* exception to regulation under Section 112. In other words, EPA's approach treats cancer

risk under one-in-one million as too trivial to justify regulation under section 112(d)(6), unless costs are on the lower end of a historically acceptable range. This approach is contrary to the text of Section 112(d), which requires EPA to require the "maximum degree of reduction in emissions" that is "achievable," 42 U.S.C. § 7412(d)(2), and ensure that standards meet minimum stringency requirements, *id.* § 7412(d)(3), without any reference to a threshold under which regulation is presumptively unnecessary. Instead, Congress gave EPA limited authority to establish a health-based "threshold" under Section 112(d)(4) where certain specific conditions are met. Congress did not grant EPA "de minimis" exemption authority under Section 112(d)(6). The D.C. Circuit has recognized that Section 112 does not contain a *de minimis* exception. *Nat'l Lime Assn. v. EPA*, 233 F.3d 625, 640 (D.C. Cir. 2000) (upholding EPA's refusal to create a *de minimis* exception "on the ground that the statute 'does not provide for exceptions from emissions standards based on *de minimis* principles where a MACT floor exists'"); *Sierra Club v. EPA*, 884 F.3d 1185, 1196 (D.C. Cir. 2018) (holding EPA's refusal to control carbon monoxide, based on a justification that emissions were "extremely low," to be unlawful and arbitrary). Public health and environmental organizations have commented extensively on EPA's lack of authority to create a *de minimis* exception under Section 112. Comments of Public Health and Environmental Organizations, EPA-HQ-OAR-2025-0078-0114 at 94-106 (Dec. 8, 2025).

B. *The Objection Could Not Have Been Practicably Raised During the Comment Period.*

EPA's proposed rule did not even suggest, never mind seek comment on, the interpretation of Section 112(d)(6) as incorporating Section 112(f)(2)'s one-in-one-million cancer risk test as a thumb on the scales of its costs-consideration. Petitioners consequently could not raise the above-stated objection during the comment period.

C. *The Objection Is of Central Relevance to the Outcome of the Rule.*

EPA has made its interpretation of Section 112(d)(6) as incorporating Section 112(f)(2)'s one-in-one million cancer risk test an independent ground for its final rule, establishing its central relevance. 91 Fed. Reg. at 9,095.

IV. EPA UNLAWFULLY AND ARBITRARILY REFUSED TO CONSIDER RISK INFORMATION OUTSIDE OF ITS 2020 SECTION 112(f)(2) REVIEW.

A. *EPA's decision to confine its consideration of risk reduction to the results of its residual risk review was contrary to law and arbitrary and capricious.*

Although EPA solicited comment on whether it should consider "meaningful risk reduction from lowering HAP emissions," EPA for the first time in the Final Repeal confined itself to considering only "the conclusions of the section 112(f)(2) risk review " from 2020. 91 Fed. Reg. at 9095. Petitioners strongly disagree that the statute permits EPA to consider risk

reductions in a Section 112(d)(6) technology review at all. But even if EPA were permitted to do so, nothing in the text of section 112(d)(6) indicates EPA may disregard new information, and it is arbitrary and capricious for EPA to consider the agency's prior residual risk findings alone and ignore all other relevant information about risk reductions, including the best available science.

EPA fails to identify any statutory language that would limit its assessment of risk reduction to the conclusions of the section 112(f)(2) risk review, and Petitioners are aware of none. Section 112(d)(6) does not reference risk reductions at all. Nor does Section 112(d)(6) include the language about reducing lifetime cancer risks "to less than one in one million" that is found in Section 112(f)(2). *Compare* 42 U.S.C. § 7412(f)(2)(A) *with id.* at § 7412(d)(6); *see also Ass'n of Battery Recyclers,* 716 F.3d at 672. According to EPA, the word "necessary" in Section 112(d)(6) gives EPA the ability to rely on risk reductions as part of its evaluation of the cost of adopting technological advancements. *See, e.g.*, 91 Fed. Reg. at 9097. But if "necessary" were as broad as EPA claims, that term could not limit EPA to only consulting the residual risk findings and nothing else. Put another way, "necessary" cannot both be so broad as to allow consideration of risk and at the same time so narrow as to provide only for consideration of the risk conclusions from a stale residual risk review (when Section 112(d)(6) does not mention risk at all). Nothing in the definition of "necessary," or in the context in which it appears in Section 112(d)(6), supports EPA's apparent view. The "one in one million" language refers to cancer risks only, and for non-cancer risks, EPA does not identify any equivalent language in Section 112(f)(2).

In the Final Repeal, for the first time, EPA asserts that it is "consistent" with the Section 112(d)(6) term "necessary" and it is "reasonable" for the agency to consider residual risk review conclusions "because that information is part of the overall CAA Section 112 record for each source category." 91 Fed. Reg. at 9097. First, the relevant question is whether EPA's construction of "necessary" applies the best reading of Section 112(d)(6), not whether it is "consistent" with the statute or "reasonable." *See Loper Bright Enters. v. Raimondo*, 603 U.S. 369, 400 (2024). Second, the fact that a Section 112(f)(2) residual risk review creates a record does not distinguish it in any way from other information that becomes a part of the administrative record, including information submitted in comments to the agency. There is no support in the statutory text, and it would make no sense, for Section 112(d)(6) to forbid EPA from considering the most up-to-date scientific evidence about health risks that is submitted *into the record* for the section 112(d)(6) action the agency is undertaking, and at the same time permit EPA to consider risk information from the residual risk review it performed years ago.

Under EPA's approach, the understanding of risk would be frozen based on the science available to EPA when it first conducted the residual risk review. Given that EPA's own understanding of risk is constantly advancing, freezing health protections based on a snapshot of risk would undermine core purposes of the Act, including the goal of minimizing the number of people who face excessive cancer risk. In EPA's own words before the D.C. Circuit, "[t]he public is not condemned to inadequate protection based on obsolete science." EPA Br. at 31, *California*

Communities Against Toxics, et al. v. EPA, No. 24-1178, ECF No. #2093163 (D.C. Cir. filed Jan. 8, 2025).

Assuming arguendo that the statute allows EPA to consider information about risk reductions as part of a Section 112(d)(6) technology review, EPA must consider all relevant information—including the best available science—about such risks. Its failure to do so is arbitrary and capricious. *See, e.g.*, *Motor Vehicle Mfrs. Assn. of United States, Inc. v. State Farm Mut. Automobile Ins. Co.*, 463 U.S. 29, 43 (1983) (requiring an agency to "examine the relevant data"); 42 U.S.C. § 7607(d)(6)(B) ("The promulgated rule shall . . . be accompanied by a response to . . . new data submitted in written or oral presentation during the comment period."). If the agency is going to rely upon health risk information to determine what is "necessary" under Section 112(d)(6), it is arbitrary to rely solely upon health risk information the agency last reviewed in 2019, without giving any consideration to whether the understanding of risk has evolved or changed over time. As Petitioners explained in their comments on the Proposal, EPA's nearly 7-year-old residual risk findings do not reflect the best available science relating to health risks from coal plant emissions, including new studies linking exposure to heavy metals with increased risk of heart failure. Comments at 76, 105 & n.316; Attachments to Comments, Document ID No. EPA-HQ-OAR-2018-0794-6978 (attaching 2025 Journal of the American College of Cardiology study at vol. 22, attach. no. 124). In particular, EPA's own recent health assessment of arsenic reveals that arsenic poses far more cancer and non-cancer risk than previously understood. *Id.* at 76, 105-06 & n.317; Attachments to Comments, Document ID No. EPA-HQ-OAR-2018-0794-6978 (attaching EPA's 2025 IRIS Toxicological Review of Inorganic Arsenic at vol. 23, attach. No. 126, & vol. 31, attach. No. 156). EPA's updated Integrated Risk Information System (IRIS) assessment of arsenic, for example, adopted a new cancer slope factor 21.3x greater than the prior cancer slope factor, last updated in 1991. Comments at 105-106. Petitioners presented this new information in their comments and preserved their argument that any consideration of meaningful risk reductions must include this new, up-to-date information. *Id.* at 76, 105-06.

EPA's conclusion in the Final Repeal that risk of cancer below one-in-one million justifies a "greater emphasis on costs" rests on inaccurate and incomplete information that is contradicted by information in the record. 91 Fed. Reg. at 9098. EPA's residual risk conclusions about cancer risks from coal plant pollution are likely to be gross underestimates. They do not reflect the Agency's significantly revised cancer slope factor for arsenic. *See* 2019 Residual Risk Assessment, Document ID EPA-HQ-OAR-2018-0794 at 41, tbl. 3.2-1 (noting that arsenic compounds are a HAP driver of cancer risk). If EPA is going to consider risk reductions in its section 112(d)(6) determination—despite the statute not permitting it to do so—then EPA must take into account the effect on estimated cancer risks of the significant developments in the scientific understanding of the dangers to human health from arsenic.

B. *The Objection Could Not Have Been Practicably Raised During the Comment Period.*

EPA's proposed rule did not suggest, or take comment upon, the agency's reliance on "the conclusions of the section 112(f)(2) risk review" as the exclusive means of assessing and considering health risk reductions in a section 112(d)(6) technology review. *Compare* 90 Fed. Reg. 25535 *with* 91 Fed. Reg. at 9095. Petitioners consequently could not raise the above-stated objections in the public comments.

C. *The Objection Is of Central Relevance to the Outcome of the Rule.*

As the Final Repeal makes explicit, EPA's consideration of the residual risk review conclusions constituted an independent ground for its final repeal of the fPM standard, establishing its central relevance. 91 Fed. Reg. at 9095.

IV. EPA'S CONSIDERATION OF THE RESULTS OF ITS RESIDUAL RISK REVIEW CONFLICTS WITH ITS OWN POSITION ON ITS AUTHORITY TO REVISIT RESIDUAL RISK REVIEWS AND IS ARBITRARY.

EPA's position that it can consider the results of "the" residual risk review for a source category under CAA Section 112(f)(2) in assessing whether revising standards is "necessary" under CAA Section 112(d)(6) is arbitrary because it conflicts with EPA's own recent announcement of a new interpretation of its residual risk review authority in its proposed reconsideration of the 2024 Ethylene Oxide Emissions Standards for Sterilization Facilities, 91 Fed. Reg. 12,700, 12,703 (Mar. 17. 2026).

In that proposed reconsideration, EPA proposes to find that CAA Section 112(f)(2) authorizes only "a single residual risk review of the MACT standards within eight years, coupled with an express authority to review and revise the standards 'as necessary' through a technology review at least every eight years under CAA section 112(d)(6)." 91 Fed. Reg. at 12,703. Because EPA concludes that it lacks authority "to revisit residual risk reviews on an ad hoc, category-by-category basis," the Agency proposes to rescind health risk standards for ethylene oxide commercial sterilizers issued after its 2023 risk review revealed substantial residual cancer risks even after the application of section112(d) standards. *Id*. That interpretation is unlawful and arbitrary, and some petitioners here are challenging that interpretation in comments filed in that docket.

In the Final Repeal, EPA found that "it is appropriate to consider the conclusions of the section 112(f)(2) risk review in all subsequent section 112(d)(6) reviews," to "inform the potential for meaningful risk reduction when evaluating cost." 91 Fed. Reg. at 9,095. In other words, EPA asserts that it can consider the results of the (f)(2) residual risk review in determining whether there is sufficient public health benefit to make revising technology-based standards "necessary," but it may only conduct *one* (f)(2) residual risk review—and may not "revisit" its

residual risk reviews to respond to developments in our understanding of hazardous air emissions' public health risks. So "all subsequent section 112(d)(6) reviews," *id.* at 9,095, can consider the residual risk review, but *only* the residual risk review that will grow increasingly outdated as the years pass.

EPA cannot square that arbitrary and capricious circle. On the one hand, if EPA cannot update its risk reviews to assess whether existing Section 112 standards for a source category continue to "provide an ample margin of safety to protect public health," 42 U.S.C. § 7412(f)(2)(A), but it *can* consider the (f)(2) review under (d)(6), then the Agency yokes itself to an outdated risk assessment for "all subsequent section 112(d)(6) reviews" in which it considers health risk. 91 Fed. Reg. at 9,095. Indeed, in the Final Repeal, EPA stated that comments that attempted to bring EPA's attention to errors in the 2020 MATS risk review—on which EPA's alternative basis for rescinding the fPM standards is based—were "outside the scope of this action" and thus that "no response if [sic] required." RTC at 127. So, EPA constructs a framework for Section 112 reviews that leaves the Agency without critical, relevant information: it will neither conduct a review of residual risk under (f)(2), nor will it consider risk information raised by public commenters. This is contrary to the statutory scheme and arbitrary and capricious.

If risk information were relevant to EPA's Section 112(d)(6) analysis (which it is not), the agency would have to be open to information that shows that its prior Section 112(f)(2) risk analysis does not adequately characterize or quantify public health risks. The proposed reconsideration of the ethylene oxide standards for commercial sterilizers is a potent example of the arbitrary effect of EPA's interpretation. After the first Section 112(f)(2) review for the source category in 2006 concluded that the 1994 MACT standards "adequately protected public health with an ample margin of safety," 91 Fed. Reg. at 12,703, EPA updated its IRIS cancer risk value for ethylene oxide to reflect a growing body of evidence that ethylene oxide was significantly more carcinogenic than had been previously understood. *See* 89 Fed. Reg. 24,090, 24,091 (Apr. 5, 2024). EPA therefore updated its risk assessment for ethylene oxide commercial sterilizers and concluded that commercial sterilization facilities' emissions were associated with cancer risks as high as 6,000-in-1 million. *See id*. at 24,095. Under EPA's proposed re-interpretation of Section 112, EPA would have to ignore the new information about those risks, relying in perpetuity on the obsolete and demonstrably false assessment that the original MACT standards provide an ample margin of safety. Taken to its logical conclusion, EPA's approach forecloses the consideration of new risk information no matter how clear or dire it may be, including if updated information showed that exposed individuals were facing an immediate and imminent threat to their health.

EPA's proposed rule did not suggest, or take comment upon, the agency's reliance on "the conclusions of the section 112(f)(2) risk review," 91 Fed. Reg. at 9,095, as the exclusive means

of assessing and considering health risk reductions in a section 112(d)(6) technology review. The proposed rule also did not reflect EPA's new position on its authority to revisit section 112(f)(2) residual risk reviews. EPA only announced that position when it issued its proposal for the sterilizers source category on March 17, 2026. Petitioners consequently could not have raised the above-stated objections during the public comment period. EPA's consideration of the residual risk review conclusions constitutes an independent ground for its final repeal of the fPM standard, establishing its central relevance. 91 Fed. Reg. at 9095.

VI. EPA'S UNNOTICED REFUSAL TO QUANTIFY AND CONSIDER HEALTH BENEFITS WARRANTS RECONSIDERATION.

EPA's Final Repeal also failed to comport with foundational notice requirements or reasoned decisionmaking as to EPA's unjustified refusal to quantify the health benefits of the 2024 standards EPA sought to undo.

In the 2025 proposal, EPA quantified and monetized the health benefits of the 2024 standards the agency proposed for repeal. For example, the Regulatory Impact Analysis ("RIA") for the proposed rule included estimates (in millions) of the combined $PM_{2.5}$ and ozone health benefits that would be lost as a result of the repeal for 2028 as: "-$47 (-$6.4 to -$120) and -$99 (-$11 to -$260)" (at a 3% discount rate) and "-$41 (-$5.1 to -$110) and -$89 (-$9.2 to -$230)" (at a 7% discount rate). *See Regulatory Impact Analysis for the Proposed Repeal of Amendments to National Emission Standards for Hazardous Air Pollutants: Coal- and Oil-Fired Electric Utility Steam Generating Units* at 3-4 (June 2025) ("Proposed Repeal RIA"); *see also* 90 Fed. Reg. at 25545 (referencing the proposed rule RIA). In the Final Repeal, however, EPA abruptly abandoned without reasoned explanation its longstanding practice of reporting the quantified health benefits projected to result from Clean Air Act emission standards. In declining to project or consider the forgone health benefits resulting from the weakening of standards in the Final Repeal, EPA disregarded decades of guidance from experts, its own formal economic analysis guidelines, and a large body of empirical evidence documenting a strong relationship between pollution exposure, mortality and morbidity. EPA made that decision without any advance notice or solicitation of public comment. In the preamble to the Final Repeal, EPA explained:

> The EPA is obligated to present the agency's best scientific understanding and the implications of that science when developing policies and regulations. However, the EPA's analytical practices may not have presented the full range of uncertainties and associated confidence level regarding the potential benefit estimates from reduction in exposure from fine particulate matter ($PM_{2.5}$) and ozone. In addition, the science regarding the exposure, health effects from exposure and valuation of reduction in health effect are evolving with better data and methods, especially at low concentrations of PM and ozone. The EPA's use of benefit per ton (BPT) monetized values introduces additional uncertainty. Although developed as a screening tool when full-form photochemical modeling was not feasible, the BPT approach reduces complex spatial and atmospheric relationships and may be more suited to model emissions that are geographically more uniform and species better mixing,

> thereby adding uncertainty associated with those estimates. Some of the sources of uncertainties include the set of assumptions used in projecting the health impact of reducing particulate matter. These projections are based on a series of models that take into account emissions changes, resulting distributions of changes in ambient air quality, the estimated reductions in health effects from changes in exposure, and the composition of the population that will benefit from the reduced exposure. Each component includes assumptions, each with varying degrees of uncertainty.

91 Fed. Reg. at 9,112. In the Regulatory Impact Analysis for the Final Repeal, EPA cited "unique uncertainties" associated with estimating $PM_{2.5}$ and ozone benefits, and "even small uncertainties can have large effects on the total quantified benefits." *Regulatory Impact Analysis for the Final Repeal of Amendments to National Emission Standards for Hazardous Air Pollutants: Coal- and Oil-Fired Electric Utility Steam Generating Units* at 3-8 (February 2026) ("Final Repeal RIA"). EPA concluded that given "the significant impacts of environmental regulations on the U.S. economy," these uncertainties did not justify "utilizing these estimates in a regulatory context." *id.* at 3-10. *See also id.* at 3-12 (announcing EPA's interest in "reevaluating the validity of the approach for estimating the benefits of air quality improvements relative to the National Ambient Air Quality Standards (NAAQS) for $PM_{2.5}$ and ozone" and in "characterizing and communicating underlying uncertainty to the public"); *id.* at RIA 3-14 ("The human health effects of changes in emissions of directly emitted $PM_{2.5}$, as well as NO_X and SO_2 (which are both precursors to ambient $PM_{2.5}$), and ground-level ozone resulting from NO_X and VOC emissions, were not quantified for this rule.").

EPA's refusal to quantify and monetize PM- and ozone-related benefits in the final rule warrants reconsideration. EPA's decision to abandon its established practice of quantifying human health benefits was not noticed in the proposal, is arbitrary, and runs afoul of substantive and procedural Clean Air Act requirements. Assuming arguendo that health risks are relevant considerations under section 112(d)(6), Petitioners' objections on this point are "of central relevance to the outcome of the rule" and warrant reconsideration. 42 U.S.C. § 7607(d)(7)(B).

A. *EPA's Failure to Quantify and Monetize Health Benefits Was Unlawful and Arbitrary.*

1. Background on EPA's Methodology.

For decades, EPA has built and refined the scientific infrastructure to answer a fundamental question: what is the cost, in human lives and suffering, of industrial pollution in the air we breathe? Over the years, EPA, working in close collaboration with outside experts, has developed and improved a rigorous suite of peer-reviewed and robust methodologies to quantify and monetize the public health benefits of air pollution reductions. These methodologies have been used to aid policymakers and the public in understanding the health impacts of EPA's regulatory actions in countless rulemakings across administrations of both parties.

Since 1993, EPA has maintained a practice of quantifying public health benefits as fully as possible in regulatory impact analyses. That practice has been required by Executive Order

12,866, which directs that agencies "assess all costs and benefits of available regulatory alternatives" with such costs and benefits to include both "quantifiable measures (to the fullest extent that these can be usefully estimated)," as well as "qualitative measures . . . that are difficult to quantify, but nevertheless essential to consider." Exec. Order No. 12,866, 58 Fed. Reg. 51,735, 51,735 (Oct. 4, 1993).

To meet the requirements of Executive Order 12,866, EPA has formally memorialized benefits quantification methodologies through its Guidelines for Preparing Economic Analyses. U.S. EPA., *Guidelines for Preparing Economic Analyses* (2024) [hereinafter Guidelines]. EPA most recently revised and published in 2024 a third edition of the Guidelines. The Guidelines as revised "establish a sound scientific framework for performing economic analyses of environmental regulations and policies." EPA, Landing Page for *Guidelines for Preparing Economic Analyses, 3rd Edition*, *available at* https://www.epa.gov/environmental-economics/guidelines-preparing-economic-analyses-3rd-edition (last updated Dec. 1, 2025). They describe the very "best practices for economic analysis grounded in the economics literature." Guidelines at 1-1. And they ensure "high-quality analyses and consistency" in how "economic analyses are prepared, performed and reported." *Id.* Among other things, the Guidelines include detailed guidance regarding how to prepare mortality risk valuation estimates (*see* Guidance Appendix B). The Guidelines also contain detailed guidance for how to address and account for analytic uncertainty, which is inherent in all benefit cost analyses. *See* Guidelines at 5-29 to 5-34. The Guidelines, for example, explain that in assessing and presenting uncertainty, analysis should generally present outcomes or conclusions based on the most plausible values and perform sensitivity analysis on key assumptions. *Id.* at 5-29. The Guidelines also address how to communicate uncertainty in the analysis. *Id.* at 11-13 to 11-14.

The Guidelines as most recently revised underwent extensive external peer review prior to finalization. All chapters of the Guidelines underwent external peer review either through EPA's Science Advisory Board or through independent review by external experts. *See* US EPA, Landing Page for *Guidelines for Preparing Economic Analyses, 3rd Edition*, *available at* https://www.epa.gov/environmental-economics/guidelines-preparing-economic-analyses-3rd-edition (last updated Dec. 1, 2025).

Consistent with its Guidelines and its long-standing practice in Clean Air Act rulemakings, EPA released with its proposed rule a regulatory impact analysis that assessed the monetized benefits related to avoided premature mortality and morbidity associated with reduced exposure to NOx as a precursor to ozone and $PM_{2.5}$. *See* Proposed Rule RIA at 3-2 to 3-4. EPA referenced the 2024 MATS RTR RIA and its quantification of the ozone and $PM_{2.5}$-related premature mortality and illnesses associated with the rule. *See* Proposed Rule RIA 3-3 (citing Section 4.3.9 of the 2024 MATS RTR RIA). EPA generally calculated health benefits by estimating counts of air pollution-attributable cases of adverse health outcomes and assigning dollar values to those counts. *Id.*

EPA's approach in the proposed rule relied on well-established resources and methods that EPA has repeatedly used in Clean Air Act rulemakings across administrations, that utilize transparent and rigorous means for identifying and accounting for uncertainties, and that have

undergone rigorous review by the Science Advisory Board and the Clean Air Scientific Advisory Committee ("CASAC"). In identifying specific health-related impacts associated with $PM_{2.5}$ and ozone, for example, EPA expressly relied upon the most recent Integrated Science Assessments ("ISAs") prepared for review of the National Ambient Air Quality Standards ("NAAQS"), each of which underwent external review by the CASAC and subsequent EPA revision and improvement. Likewise, EPA's approach to quantifying and monetizing the health impacts associated with changing concentrations of these pollutants is grounded in its 2023 Technical Support Document ("TSD"), *Estimating PM2.5- and Ozone-Attributable Health Benefits*, which was updated for the 2023 proposed reconsideration of the PM2.5 NAAQS. Proposed Rule RIA 27-31 (citing *Technical Support Document for the 2022 PM NAAQS Reconsideration Proposal RIA: Estimating PM2.5-and Ozone-Attributable Health Benefits* (2023), *available at* https://www.regulations.gov/document/EPA-HQ-OAR-2019-0587-0063. This TSD was further revised and improved in June 2024, just months before the Proposed Rule, in response to an SAB review that concluded the TSD's approaches are "scientifically robust and appropriate for regulatory analyses." EPA Science Advisory Board, Review of BenMAP and Benefits Methods, EPA-SAB-24-003, Transmittal Letter (Jan. 17, 2024), *available at* https://www.regulations.gov/document/EPA-HQ-OW-2009-0819-10571.

Notably, this TSD includes an entire chapter exhaustively discussing the various sources of uncertainty associated with quantifying and valuing $PM_{2.5}$ and ozone-related health impacts, as well as the multiple techniques the Agency has incorporated into its analysis to assess and characterize those uncertainties. EPA, *Estimating PM2.5- and Ozone-Attributable Health Benefits: 2024 Update* 103 (2024), https://www.epa.gov/system/files/documents/2024-06/estimating-pm2.5-and-ozone-attributable-health-benefits-tsd-2024.pdf. [hereinafter 2024 TSD]. For example, for $PM_{2.5}$ risks, the 2024 TSD discusses EPA's use of Monte Carlo methods to quantitatively assess statistical uncertainties with respect to health risks and economic valuation of health harms; statistical techniques and use of sensitivities to assess confounding factors and other sources of uncertainty in the key health studies used to evaluate mortality risk; and consideration of a variety of studies featuring alternative risk estimates for non-mortality health impacts. *Id.* at 103-118. The 2024 TSD contains a similar discussion of multiple methods used to characterize uncertainty for ozone-related health impacts, *id.* at 119-127, as well as an explanation of how EPA has used sensitivity analysis and other techniques to evaluate uncertainties associated with cross-cutting factors such as the baseline incidence of health conditions that are exacerbated by $PM_{2.5}$ and ozone, the "lag" between air pollution exposure and health effects, and other sources of uncertainty, *id.* at 128-147.

In the Proposed Rule RIA, EPA explained that:

> The health benefits analysis presented in this section applies methods consistent with those employed most recently in the final PM National Ambient Air Quality Standards (NAAQS) RIA (U.S. EPA, 2024a). The 2024 MATS RTR was estimated to reduce emissions of $PM_{2.5}$, SO_2, and NOx by 5,400 tons, 770 tons, and 220 tons, respectively. The EPA's approach for selecting $PM_{2.5}$ and ozone-related health endpoints to quantify and monetize is summarized below. For a full description of the methods, please see *Estimating $PM_{2.5}$- and Ozone-Attributable Health Benefits: 2024 Update* (Health Benefits

> TSD) (U.S. EPA, 2024b). The EPA's methods for estimating health benefits due to changes in $PM_{2.5}$ and ground-level ozone concentrations were reviewed by an EPA Science Advisory Board (SAB) in 2023 (U.S. EPA Science Advisory Board, 2024). This SAB panel concluded that EPA's methods are "scientifically robust and appropriate for regulatory analyses." The panel made several recommendations for improvements, including valuing changes in nonfatal health risks with willingness-to-pay measures or broader measures of the cost of illness, using scenario-based demographic projections, and updating inputs to the calculation of the value of a statistical life.

Proposed Rule RIA at 3-2. EPA noted that the 2024 Rule itself had relied upon the EPA's Guidelines for Preparing Economic Analyses in order to convert "each air pollution-attributable health impact … to a monetary value. *Id.* at 3-2 to 3-3 (citing Section 4.3.9 and Tables 4-2 and 4-3 of the 2024 MATS RTR RIA).

The analysis of ozone and $PM_{2.5}$-related health impacts presented in the Proposed Rule RIA was consistent with EPA's well-established methodologies and agency-wide guidelines for regulatory analyses, rested on a vast body of public health science and EPA technical resources that have undergone peer review and/or review by EPA's external advisory boards, and thoroughly explained both the assumptions and approaches used as well as the nature and extent of relevant uncertainties.

2. <u>EPA's abrupt choice, without notice, to abandon its longstanding policy regarding calculation of benefits is arbitrary.</u>

EPA's decision in the Final Repeal to abruptly abandon this well-established and scientifically robust approach to evaluating health impacts is arbitrary. Where benefits are practicable to quantify through scientific methods, but difficult to quantify with precision, the appropriate response is to assign a value and disclose the nature of the uncertainty, as EPA did at the proposal stage. In the Final Rule, however, EPA, by continuing to quantify compliance costs in precise dollar terms while omitting any quantification of health benefits, has produced a systematically skewed regulatory impact analysis that overstates net costs and precludes fair comparison of regulatory alternatives. *Cf. Ctr. for Biological Diversity v. NHTSA*, 538 F.3d 1172, 1198 (9th Cir. 2008) (where an agency uses a cost-benefit analysis, it "cannot put a thumb on the scale by undervaluing the benefits and overvaluing the costs of more stringent standards").

EPA's abrupt reversal on benefits quantification also flouts established administrative law principles. When an agency reverses a longstanding policy, it must acknowledge it is changing course and, in some cases, provide a more "detailed" and reasoned justification than when it is operating on a blank slate. *FCC v. Fox Television Stations, Inc*., 556 U.S. 502, 515-16 (2009). Here, EPA's stated justification for declining to report and consider hundreds of millions of dollars in potential quantified health benefits falls far short of that standard.

EPA failed in the Final Repeal to acknowledge the extent to which it is changing course and the nature of the scientific foundation and support for its prior approach. In the brief passage that EPA devotes to the announced policy change, EPA did not discuss or even reference its peer-

reviewed, twelve-chapter, four-hundred-plus page Guidelines for Economic Analyses or begin to explain why its numerous departures from the specific recommendations therein are justified (even though to this day EPA commits to adhering to those guidelines on its website).[4] EPA failed to adequately explain why its long-standing methods for evaluating and presenting uncertainties around its health impacts estimates are no longer appropriate. Nor did EPA acknowledge that nearly all aspects of its prior approach have been extensively vetted and endorsed by EPA's Science Advisory Board. EPA also fails to explain why it is violating the requirement in Executive Order 12,866 that compels the Agency to quantify health benefits to the fullest extent possible.

Under these circumstances, EPA's passing references to prior practice concerning quantifying environmental benefits are not enough to meet requirements for adequately explaining a shift in Agency position. EPA's obligation to "provide a reasoned explanation" for "disregarding" the specific "facts and circumstances that underlay or were engendered by the prior policy," *Fox Television Stations*, 556 U.S. at 516, encompasses an obligation to acknowledge and address all of the particular factual premises and reasoning that underpinned the Agency's longstanding prior approach to benefits quantification. Thus, EPA cannot simply acknowledge the general change in policy direction; it must also disclose each of the pertinent aspects of its Guidelines from which it is now departing, and provide a reasoned explanation for abandoning each one.

In addition, beyond failing to acknowledge all the facts and circumstances underlying its prior policy, EPA failed to provide a coherent basis for reversing its longstanding approach to economic analysis. EPA identified no new scientific evidence or flaw in the existing scientific literature that could justify entirely failing to quantify or monetize health benefits.

EPA's general invocation of uncertainty ignores that all economic benefits analyses involve uncertainty, and that, until now, EPA has consistently acknowledged such sources of uncertainty and made the degree of uncertainty clear to the public within its economic analyses. As described above, EPA in the past has exhaustively explained sources of uncertainty – and used a variety of tools to probe and present the extent of that uncertainty – at every step in the analytical process for assessing the health impacts of a proposed rule. *See also* IEc, *Uncertainty Analyses to Support the Second Section 812 Benefit-Cost Analysis of the Clean Air Act* (2011), www.epa.gov/sites/default/files/2016-01/documents/uncertaintyfullreport.pdf.

The Final Repeal, however, never persuasively explains why EPA has abandoned this well-vetted and transparent approach – or why it is reasonable for EPA to provide *no estimates whatsoever* of the health impacts of its Final Repeal. *See Ctr. for Biological Diversity*, 508 F.3d at 533 (finding that federal agency's refusal to quantify benefits of greenhouse gas reduction was arbitrary because "while the record shows that there is a range of values, the value of carbon emissions reduction is certainly not zero," and because the agency "has monetized other uncertain benefits," such as crash, noise, and congestion costs). In addition, EPA here did not discuss any alternative methodology to quantifying emissions. *See, e.g.* IEc, *Evaluating*

[4] *See* Guidelines for Economic Analyses, 3rd Edition, https://www.epa.gov/environmental-economics/guidelines-preparing-economic-analyses-3rd-edition.

Reduced-Form Tools for Estimating Air Quality Benefits (2019) , https://www.epa.gov/sites/default/files/2020-09/documents/adapted_rft_report_10.31.19.pdf.

EPA has extensively examined the role of uncertainty in characterizing the impacts of regulatory actions. In its 2002 report, *Estimating the Public Health Benefits of Proposed Air Pollution Regulations*, the National Academy of Sciences encouraged EPA to do more to characterize the uncertainty in its estimates and directly rejected the idea that uncertain results are of no value to decision-makers.[5] Partially in response to that report, in 2006 EPA completed its expert assessment of the mortality impacts of exposure to fine particulate matter , see IEc, *Expanded Expert Judgment Assessment of the Concentration-Response Relationship Between PM2.5 Exposure and Mortality* (2006), https://www.epa.gov/sites/default/files/2020-07/documents/pm_ee_report.pdf, and subsequently used those results to characterize uncertainty in its analyses of major air quality rules affecting PM2.5, such as the 2012 PM NAAQS RIA. *Regulatory Impact Analysis for the Proposed Revisions to the National Ambient Air Quality Standards for Particulate Matter* 5-12 to 5-19 (2012), https://www.epa.gov/sites/default/files/2020-07/documents/naaqs-pm_ria_proposed_2012-06.pdf.

Moreover, as discussed in Bryan Hubbell and Alan Krupnick, *How the Environmental Protection Agency Got it Wrong About Monetizing Benefits of Air Pollution Regulations* 5 (Resources for the Future 2026), Bryan Hubbell and Alan Krupnick, *How the Environmental Protection Agency Got it Wrong About Monetizing Benefits of Air Pollution Regulations* 5 (Resources for the Future 2026), https://media.rff.org/documents/Report_26-04_-_Update_2.3.26.pdf [hereinafter RFF Report], substantial uncertainties surround regulatory cost estimates, and yet EPA inconsistently makes no mention of equivalent concerns as to the industry-costs aspects of its analysis. EPA's inconsistent treatment of uncertainty when it comes to evaluating costs is unexplained and arbitrary. *See, e.g.,* Winston Harrington, Richard D. Morgenstern, and Peter Nelson, *On the Accuracy of Regulatory Cost Estimate*s, 19 J. Pol'y Analysis and Mgmt, 297-322(2000) (finding that cost estimation is also uncertain, and that regulatory costs tended to be overestimated.), https://www.jstor.org/stable/3325616. In any event, to the extent uncertainty is inherent in economic benefits analysis, the appropriate and logical response is for EPA to do what it did in the Proposed Rule and has done in every other comparable Clean Air Act rulemaking involving PM2.5 exposure in recent decades: Identify the sources of uncertainties (and run accompanying sensitivity analyses as appropriate), rather than simply declining to report quantitative benefits. EPA's previous, well-established approach aligns with the Agency's *Guidelines for Preparing Economic Analyses* as well as OMB guidance on regulatory cost-benefit analysis. *See* OMB Circular A-4 (2003) (stating that "[s]ound

[5] National Research Council, *Estimating the Public Health Benefits of Proposed Air Pollution Regulations* 148 (National Academies Press 2002), https://www.nationalacademies.org/read/10511/chapter/7#p20005c9f9970126001 ("There is a common misperception that a high degree of certainty is required for regulatory actions to take place to protect public health. As a result, primary health benefits analyses that more fully and accurately portray the uncertainties might not be considered useful. It is unrealistic for EPA to defer decisions until it can make them on the basis of perfect science. A careful and deliberate balancing of the benefits and costs is required, and this balancing must be informed by a fair assessment of the current levels of uncertainty and a realistic evaluation of the likely reductions in uncertainty attainable through further research.").

quantitative estimates of benefits and costs, where feasible, are preferable to qualitative descriptions of benefits and costs," *id.* 26, and requiring agencies to address uncertainty transparently (e.g. through describing probability distribution and characterizing evidence under alternative scenarios, rather than simply treating uncertain, but real, benefits as zero, *see id* 26-28, 38-42)).

EPA's new approach also fails to comport with Congress's general direction in the Clean Air Act. Recognizing the importance of meaningfully assessing benefits, Congress directed that EPA issue periodic reports about the impacts of the Clean Air Act and that EPA "consider all of the economic, public health, and environmental benefits." 42 U.S.C. 7612(b). Congress further specified that "where numerical values are assigned to such benefits, a default assumption of zero value shall not be assigned to such benefits unless supported by specific data." *Id.* This directive, which is expressly made applicable to Section 112 rulemakings, *id*. 7612(a)(2), 7612(b), requires quantification of health benefits where possible and bolsters the conclusion that EPA's refusal to quantify benefits based on vague assertions of uncertainty is arbitrary.

Moreover, the environmental benefits at issue are not nearly as uncertain as EPA now suggests. Expert scientific panels in the United States and globally have been consistent in their findings that short- and long-term exposures to PM2.5 are causally linked to premature mortality and that the overall evidence "supports the use of a linear, no-threshold relationship to estimating mortality impacts." *See* RFF Report at 4. Notably, there is also reason to believe based on input from the Science Advisory Board that EPA's methodologies may be understating health harms.[6] Beyond pointing to uncertainties, EPA suggests that it is interested in evaluating the benefits of air quality improvements relative to the national ambient air quality standards for PM2.5 and ozone, under the theory that no benefits are obtained from reducing pollution in attainment areas. *See* Final RIA at 3-12 ("As more areas achieve or maintain attainment with the NAAQS, the uncertainties associated with low-concentration health effects grow, and marginal benefits become more difficult to characterize with precision."). But as discussed in the RFF Report, the fact that a standard may be "requisite" to protect public health, see 42 U.S.C. 7409(b)(1), does not mean that there is no risk below the standard level. RFF Report at 6-7. As EPA concluded in its 2024 NAAQS PM2.5 Rule, studies examining this issue "continue to provide evidence of linear, no-threshold relationships between long-term PM2.5 exposures and all-cause and cause-specific mortality." 89 Fed. Reg. 16,202, 16,226 (Mar. 6, 2024). Moreover, as explained in the 2024 TSD for estimating health impacts from PM2.5 and ozone, the studies EPA uses to assess mortality impacts from long-term exposure to PM2.5 include substantial data from low-

[6] *See* EPA Science Advisory Board, *Review of BenMAP and Benefits Methods* at 35, 38-51 (2024) (EPA-SAB-24-003) ("There is already good evidence that the CR function is increased by co-exposure to COVID-19 … and this is not reflected in historical epidemiologic studies developing the CR function used in BenMAP, *id*, at 35); ("Emerging evidence suggests that mortality may be greater during the co-occurrence of extreme temperature and short-term peaks of PM2.5," *id.* at 35); ("Mortality associated with PM2.5 may also be enhanced by climate change," *id.* at 35); ("The studies available are not inconsistent with a linear relationship at levels below 12 ug/m3, but there is some limited evidence… for both supra and threshold effects at lower levels," *id*. at 36); "Literature suggests that exposure misclassification tends to bias reported hazard ratios downward leading to a low bias in risk estimates," *id*. at 38)).

concentration exposures. EPA's SAB-reviewed assessment of those studies includes detailed evaluation of this source of uncertainty. 2024 TSD at 104-107. In the Final Repeal, EPA has not identified any basis for ignoring its prior scientific judgment.

3. EPA's reversal of its approach to quantifying benefits violates Clean Air Act procedural requirements.

In addition to failing to satisfy requirements of reasoned decisionmaking, EPA's reversal of its longstanding quantification policy also fails to meet procedural requirements set forth in subsections 307(d)(3), 307(d)(5) and 307(d)(6) of the Clean Air Act. These provisions require that EPA provide adequate notice and opportunity for comment on significant aspects of a final rule. Subsection (d)(6)(A) further provides that a promulgated final rule must be accompanied by an explanation of the reasons for any major changes in the promulgated rule from the proposed rule along with a "statement," 42 U.S.C. 7607(d)(6)(A). similar to that which must accompany a proposed rule, which "set[s] forth or summarize[s] and provide[s] a reference to any pertinent findings, recommendations, and comments by the Scientific Review Committee . . . and the National Academy of Sciences, and, if the proposal differs in any important respect from any of these recommendations, an explanation of the reasons for such differences." 42 U.S.C. 7607(d)(6)(A).

EPA does not reconcile its rejection of recognized methods for quantifying and monetizing PM benefits with review conducted by CASAC in the PM ISA. Based on the PM ISA, there is "evidence of linear, *no-threshold* relationships between long-term $PM_{2.5}$ exposures and all-cause and cause-specific mortality." 89 Fed. Reg. 16,202, 16,266 (2024) (citing 2019 ISA, pgs 11.84-11.89, 2022 ISA) (emphasis added); *See also* EPA*, Policy Assessment for the Review of the National Ambient Air Quality Standards for Particulate Matter* 3-10 (2021), https://www.epa.gov/system/files/documents/2021-10/final-policy-assessment-for-the-review-of-the-pm-naaqs-01-2020.pdf. EPA reached this conclusion after CASAC review of its 2019 PM ISA and 2022 Supplement to the ISA. 89 Fed. Reg. at 16,253; *See Letter from Elizabeth A. (Lianne) Sheppard, Chair, Clean Air Scientific Advisory Committee to Administrator Michael S. Regan Re: CASAC Review of the EPA's Policy Assessment for the Review of the National Ambient Air Quality Standards for Particulate Matter* 16 (March 18, 2022), https://www.4cleanair.org/wp-content/uploads/PM-NAAQS-CASAC-Responses-to-EPA-PM-Draft-PA-031822.pdf. The Administrator's determination as to what level of the NAAQS will be "requisite to protect the public health" with an "adequate margin of safety" does not equate to a scientific finding that there are no or diminished health impacts below the NAAQS. RFF Report at 6.

In the Final Repeal, EPA does not confront these pertinent findings, as it is required to do under Section 307(d). EPA's failure to engage with the ISA further underscores the substantive inadequacy, discussed in Section B above, of EPA's cursory justification for abandoning its longstanding benefits practice.

B. *This Objection Could Not Practicably Have Been Raised During the Comment Period.*

As noted above, the Proposed Rule included quantified and monetized estimates of the health benefits attributable to PM2.5 and Nox reductions. Nowhere in the preamble or RIA accompanying the proposal did EPA indicate that it might remove such estimates from the final rule. Accordingly, it was impracticable for commenters to raise this objection during the period for public comment.

C. *EPA's Failure to Report and Consider Quantified Health Benefits Was a Material Error Warranting Reconsideration.*

Assuming arguendo that EPA may consider health risks and benefits at all under section 112(d)(6), *but see supra*, Section III, EPA's failure to do so in a rational way is "of central relevance to the outcome of the rule" and warrants reconsideration. 42 U.S.C. § 7607(d)(7)(B). Had EPA properly reported and considered available information concerning monetized benefits, that data would have informed its consideration of whether to repeal the 2024 emissions standards. Although a regulatory impact analysis under Executive Order 12,866 would not normally itself be grounds for mandatory reconsideration, here EPA based its repeal of the 2024 Rule upon a new interpretation of 42 U.S.C. 7412(d)(6) that gave EPA broad authority to consider costs and health risks, and that interprets the term "necessary" to embrace an array of factors not mentioned in the statute. Calculating and considering the health benefits of the 2024 standards – and the health-related costs of rescinding them – is centrally relevant given EPA's approach to the statute here. EPA asserted that it may "consider[] additional factors beyond developments when deciding whether revisions to existing standards are 'necessary,' including cost," and that it could consider risk benchmarks as part of its determination of whether and what changes to standards are "necessary." 91 Fed. Reg. at 9097. EPA's approach in the Final Repeal embraced considerable latitude as to the considerations the Agency will allow to weigh against tightening (or, as here, in favor of weakening) standards under Section 112(d)(6). For example, the Final Repeal announces that EPA will not regard controls as "necessary" under the statute if EPA deems the costs "unreasonable," 91 Fed. Reg. at 9095, 9097; that EPA may consider risk information that "is part of the overall CAA section 112 record for each source category," *id*. at 9097; that cost is properly part of the Section 112(d)(6) analysis "even though the statute does not expressly reference costs," id. at 9097; that section 112(d)(6) allows EPA to take "the low remaining risk identified in the prior residual risk review into account even though the provision does not explicitly refer to health risks," *id*. at 9098; and to consider such information as relating to "CAA section 112's purpose of protecting public health," *id*. at 9098, and to reject control options because of impacts on "industry production," *id*. at 9101. In light of EPA's claim to consider this broad array of factors, EPA cannot justify – and certainly has not justified – refusing to consider or even measure the health impacts of increases or decreases in PM and NOx emissions resulting from changes in emissions standards where that information is readily available. EPA's deliberate failure even to identify and weigh the health impacts of its actions is a major and consequential error.

Petitioners believe EPA's interpretation of Section 112(d)(6) disregards statutory limitations. Petitioners believe the best reading of the statute is that revisions to standards are "necessary" under section 7412(d)(6) when, and to the extent, more stringent standards are

"achievable" within the meaning of section 7412(d)(2). But if EPA's interpretation based on "the broad scope of the term 'necessary,'" *id.* at 9097, were correct, that statute surely requires EPA to consider the health benefits of standards as part of its review under section 112(d)(6) – and to measure those benefits using the best available tools.[7]

EPA's failure to report and consider quantified benefits, and its failure to comply with the procedural requirements of Section 307(d), were material errors "of central relevance to the outcome of the rule" and warrant reconsideration. 42 U.S.C. § 7607(d)(7)(B).[8]

CONCLUSION

For the foregoing reasons, Petitioners respectfully request that the Administrator grant this petition for reconsideration and convene a proceeding to reconsider the Final Repeal as to each of the objections cited above.

[7] If reducing regulatory costs is to play a major role in EPA's decision whether to weaken emission standards, EPA should evenhandedly also examine all of the health costs of deregulation. Cf. *Michigan v. Envtl. Prot. Agency*, 576 U.S. 743 (2015) ("In addition, 'cost' includes more than the expense of complying with regulations; any disadvantage could be termed a cost. EPA's interpretation precludes the Agency from considering *any* type of cost—including, for instance, harms that regulation might do to human health or the environment."); 42 U.S.C. § 7412(d)(2) (requiring that EPA, in setting emission standards for hazardous air pollutants, "tak[e] into consideration the cost of achieving such emission reduction, and any non-air quality health and environmental impacts and energy requirements").

[8] If EPA were to conclude that the health costs objection is not subject to mandatory reconsideration, given the gravity of the error, the abruptness of the departure from prior agency practice, and the importance of the issue, EPA should grant reconsideration and invite public comment on the issue of its own accord.

Respectfully submitted,

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EXHIBIT

Andover Technology Partners 978-683-9599
Consulting to the Air Pollution Control Industry

April 21, 2026

To: Environmental Defense Fund

Fm: Jim Staudt, PhD, Andover Technology Partners

Re: EPA Repeal of 2024 MATS Update Rule, PM Cost Estimates

1. INTRODUCTION

On February 24, 2026, US EPA published the repeal of the 2024 MATS update rule.[1] EPA made an estimate of incremental control costs associated with the rule. An Excel workbook, with an associated memo[2] was used to calculate the incremental cost of PM control and cost-effectiveness in terms of $/ton or $/lb of reduced emissions. In this workbook, EPA included numerical values in cells without including the underlying equations, making it impossible to verify the variable operating and maintenance (VOM) calculations by examining the workbook's formulas. Using the Sargent & Lundy (S&L) costing methodology that EPA relied upon, I have reconstructed the calculations and identified significant errors in EPA's VOM cost estimates for fabric filter installations. These errors inflate the cost-effectiveness values that serve as the primary basis for the repeal. For both the 2024 update rule and the recent repeal, EPA's cost-effectiveness calculations were performed with a Microsoft Excel workbook. For those units expected by EPA to require a PM improvement, the workbooks were used to calculate the unit-by-unit incremental annualized cost of the fPM control upgrades, such as an upgraded electrostatic precipitator (ESP), fabric filter improvement, or a new fabric filter. The workbooks were also used to calculate the unit-by-unit annual reduction in PM emissions (as well as reduction in non-mercury metals emissions) that would result from those PM control upgrades. The resulting total incremental annualized cost was divided by the total annual emission reductions to directly calculate the cost-effectiveness values relied upon by EPA in its decision to finalize as well as later repeal the rule.

EPA's analysis has significant issues that affect its estimate of the incremental cost of installing a fabric filter. EPA showed its assumptions for the calculation in the Excel workbook. EPA made a significant error in that for facilities that added a fabric filter, the agency used an excessively high incremental variable operating cost that included the cost of disposing *all* fly ash—not just the small incremental amount attributable to the fabric filter installation. This results in unreasonably high VOM. Prior to installing a new fabric filter in lieu of the existing control device, fly ash is already being disposed of in some manner, or possibly even sold for beneficial reuse. The addition of a fabric filter does not adversely effect the composition of the fly ash in any way, and the fly ash marketability may be improved with a fabric filter due to lower activated carbon or sorbent content. With a fabric filter, the fly ash can therefore be disposed of or reutilized in the very same manner as before the installation of the fabric filter, and it may even *reduce* disposal costs in some cases. For this reason, it is incorrect to include the cost of disposing all coal fly ash in the VOM cost, as EPA did in its incremental annualized cost and the associated cost-effectiveness calculation. This error was apparently present in the original 2024 calculation but did not have as great an impact on the resulting cost because EPA had also erroneously annualized the VOM using the capital charge rate.[3]

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[1] 91 Fed. Reg. 9088 (Feb. 24, 2026).

[2] Nov. 2025 Technical Memo attach. 1^J EPA-HQ-OAR-2018-0794-8480_attachment_1.xlsx; US EPA/OAR; 2025 Update to the 2024 Technology Review for the Coal- and Oil-Fired EGU Source Category (2025 Technical Memo); November 2025

[3] 2025 Update to the 2024 Technology Review for the Coal- and Oil-Fired EGU Source Category (2025 Technical Memo); November 2025, page 6.

A separate issue is EPA's failure to account for the impact on mercury control cost in its calculation. Although EPA included the effect of the fabric filter on activated carbon injection in its Integrated Planning Model (IPM) modeling, that is not accounted for in its cost effectiveness calculation. EPA relied upon a cost effectiveness calculation resulting from the costs and emissions reductions calculated in the Excel workbook that does not rely upon IPM modeling. That Excel workbook does not account for the impact on the cost of mercury control, and therefore EPA's cost effectiveness calculation that it relied upon in the original rulemaking and the repeal decision does not incorporate this effect. Because this reduction in Hg control cost is a direct result of a change in the PM control device and has a significant impact on compliance costs, this effect should have been accounted for. All significant impacts of a change in a control device – both those that add cost and those that reduce cost – should be considered as part of EPA's analysis. While EPA acknowledged this effect in its response to comments,[4] the Agency did not actually incorporate this effect into its calculations.

In this memo, I will describe the sources of the issues, why they are significant, and the impact on cost-effectiveness calculations.

2. THE SOURCE OF THE ISSUES

As already discussed, EPA in its 2024 Final Rule and in its recent repeal conducted an analysis of cost-effectiveness of reducing the PM and non-Hg metals emissions. The calculation was conducted using Excel workbooks where emissions reductions were estimated for those units that EPA determined would install control technology. The Excel workbook also calculated the incremental annualized cost of deploying the associated technologies. Dividing the total incremental annualized cost by the total mass reductions was performed to calculate the cost-effectiveness.

Fabric Filter Cost Estimating Background

To estimate the cost of a fabric filter (or baghouse), EPA used a cost-estimating method developed for EPA by Sargent & Lundy that has been documented in a series of memos dating back to at least 2010.[5] Although the November 2025 technical memo cited in the recent repeal cites a 2023 memo,[6] this memo does not address the cost of a fabric filter addition, but improvement of existing PM reduction systems. Prior Sargent & Lundy memos provide the framework for cost-estimating the addition of a fabric filter. The cost-estimating methodology in these memos has been used to calculate the cost of equipment when modeling impacts on the generating fleet with IPM, but the methodology can also be used independently of IPM to estimate costs for control technology just as it was used in EPA's Excel workbooks for both the 2024 final rule and the 2026 repeal. Importantly, the Sargent & Lundy memos were originally developed to assess the cost of Hg or acid gas control with sorbent injection where, in some cases, Sargent & Lundy

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[4] US EPA, National Emission Standards for Hazardous Air Pollutants: Coal- and Oil-Fired Electric Utility Steam Generating Units: Final Repeal Summary of Public Comments and Responses on Proposed Rule (90 FR 25535 | June 17, 2025), February 2026, page 42

[5] Sargent & Lundy, *Updates to Cost and Performance for APC Technologies, Dry Sorbent Injection Cost Development Methodology,* Final, Project 12301-007, August 2010

Sargent & Lundy, *Updates to Cost and Performance for APC Technologies, Mercury Control Cost Development Methodology*, Final, Project 12301-009, March 2011

Sargent & Lundy, *Updates to Cost and Performance for APC Technologies, Dry Sorbent Injection for SO2 Control Cost Development Methodology*, Final, Project 12847-002, March 2013

Sargent & Lundy, *Updates to Cost and Performance for APC Technologies, Mercury Control Cost Development Methodology*, Final, Project 12847-002, March 2013

Sargent & Lundy, *Updates to Cost and Performance for APC Technologies, Dry Sorbent Injection for SO2 Control Cost Development Methodology*, Final, Project 12847-002, March 2013

Sargent & Lundy, *Updates to Cost and Performance for APC Technologies, Mercury Control Cost Development Methodology*, Final, Project 13527-001, January 2017

Sargent & Lundy, *Updates to Cost and Performance for APC Technologies, Dry Sorbent Injection for SO2/HCl Control Cost Development Methodology,* Final, Project 13527-001, April 2017

[6] EPA-HQ-OAR-2018-0794-5836

determined that fabric filters were necessary in order to achieve sufficiently high capture efficiency. As a result, in addition to the cost of sorbent injection or activated carbon injection systems, these memos included cost-estimating methods for fabric filters. Therefore, the algorithms in these memos could serve the purpose of estimating the cost of a Hg control or dry sorbent injection (DSI) upgrade or, while excluding the cost components unique to mercury or sorbent injection, a standalone fabric filter installation.

For a sorbent injection system or an activated carbon injection system, the chemical composition of the fly ash can change, which may result in a change in how collected fly ash is dealt with. Because Sargent & Lundy determined that in some cases a mixture of sorbent and fly ash might render the fly ash unmarketable (a great deal of fly ash is sold into reutilization markets), in those cases all of the fly ash collected as well as the collected sorbent by-product would need to be disposed of at a cost. Per Sargent & Lundy, "As a worst case cost estimate, the entire fly ash amount is included in the waste rate."[7] The memos include algorithms to estimate:

- The total process capital (TPC) cost of the equipment, including all process equipment, engineering, installation, commissioning, and other fees associated with the equipment. Process equipment would include both the fabric filter (if necessary) as well as the sorbent injection equipment. To annualize these costs, a capital charge rate is assumed that is used to allocate the total capital cost by multiplying the total cost by the capital charge rate.
- Fixed operating and maintenance cost (FOM), including operating and maintenance costs associated with the installed equipment and associated overhead associated with the equipment. This is an annual cost and does not need to be multiplied by a capital charge rate.
- Variable operating and maintenance costs (VOM), including costs associated with parasitic loads, periodic filter bag replacement, reagents, and additional disposal costs. Reagent costs would not apply when only a fabric filter is added. As will be discussed, disposal costs should also not apply when only a fabric filter is added. This is an annual cost and does not need to be multiplied by a capital charge rate.

The annualized capital cost, the FOM and the VOM are added to arrive at a total cost per year. This total cost per year may be divided by the annual quantity of emissions reduced to arrive at a $/ton or $/lb cost-effectiveness value.

Issue #1: Variable Operating and Maintenance Cost (VOM) Used by EPA Includes Fly Ash Disposal

An error may result when using these algorithms to estimate the *incremental* cost of using a fabric filter in lieu of an existing PM control device, such as an existing ESP or venturi scrubber. This is a result of the fact that fly ash was already being disposed of in some way when using the ESP or venturi scrubber. It might have been sold for beneficial reuse, or it might have been landfilled or carted off at some cost. If the only change is the addition of a fabric filter – without adding a sorbent injection system –the impact on fly ash will not make it any more expensive to address, and potentially less expensive to address.[8] A 2017 Sargent & Lundy memo includes a discussion of VOM associated with addition of a fabric filter in combination with a sorbent injection system as it relates to waste:[9]

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[7] Sargent & Lundy, *Updates to Cost and Performance for APC Technologies, Mercury Control Cost Development Methodology*, Final, Project 12301-009, March 2011, page 10

[8] In a situation where a fabric filter is installed downstream of an ESP where sorbent injection is already operating, it may be possible and indeed preferable to move the sorbent injection downstream of the ESP and before the fabric filter, which will permit segregation of the fly ash and sorbent with much of the fly ash captured in the ESP. Also, a fabric filter will reduce the need for sorbent, which will reduce the adverse impact on fly ash marketability even when sorbent and fly ash are comingled.

[9] Sargent & Lundy, *Updates to Cost and Performance for APC Technologies, Particulate Control Cost Development Methodology, Final*, Project 13527-001, April 2017, page 10

- The waste-generation rate, which is based on the reaction of Trona or hydrated lime with SO_3, is a function of the sorbent feed rate. The waste-generation rate is also adjusted for excess sorbent fed. The waste-generation rate is based on the reaction products of $CaSO_4$ and Na_2SO_4 and unreacted dry sorbent such as $Ca(OH)_2$ and Na_2CO_3.
- The user can remove fly ash disposal volume from the waste disposal cost to reflect the situation where the unit has separate particulate capture devices for fly ash and dry sorbent.
- If Trona is the selected sorbent, the fly ash captured with this sodium sorbent in the same particulate control device must be landfilled. Typical ash content for each fuel is used to calculate a total fly ash production rate. The fly ash production is added to the sorbent waste to account for a total waste stream in the O&M analysis.
- When a fabric filter is installed downstream of an ESP, the sorbent could be injected before the fabric filter with no effect on the fly ash collection. The disposal costs of Trona-only waste, however, should be increased because disposing of the pure sodium waste product is more difficult.

A similar effect can occur when adding a fabric filter as part of a mercury control system, because the fly ash composition will change, and that may change the manner in which fly ash is disposed.

Therefore, this memo acknowledged that in some cases the total fly ash loading should not be included in the waste cost. However, it did not expressly discuss the use of a new fabric filter on a facility that has an existing PM control device where neither a new sorbent injection system nor activated carbon injection system is added as well. *It is only when a sorbent injection system or activated carbon injection system is added that there is a risk of adversely impacting the fly ash composition such that a more expensive disposal approach may be necessary.* Since the 2024 MATS fPM standard requires only adding a fabric filter – not an ACI or sorbent injection system –there is no need to incorporate the cost of disposing fly ash, as that cost will be unchanged, or may even drop.

The impact of including the waste cost in VOM is substantial. The inset below shows an example calculation from Attachment 5-9b to the IPM documentation. As shown below, of a total estimated VOM multiplier factor of $2.50/MWh, the waste component (VOMW) is $2.07/MWh.[10] This means that approximately 83% of EPA's VOM cost estimate consists of fly ash disposal costs that should not have been included. The remaining VOM, accounting for parasitic loads and bag replacement, is about $0.43/MWh (2016 dollars).

Variable O&M Cost			
VOMB ($/MWh) = L/(J*A*341640)*if(J = 6.0 Air-to-Cloth then ((AC)/3+(AD)/9) else J = 4.0 Air-to-Cloth then ((AC)/5+(AD)/10))	$	0.06	Variable O&M costs for bags and cages.
VOMP ($/MWh) =Y*(AB)*10	$	0.36	Variable O&M costs for additional auxiliary power required.
VOMR ($/MWh) = U*Z/(2000*A)	$	-	Variable O&M costs for sorbent, as applicable
VOMW ($/MWh) = X*(AA)/A	$	2.07	Variable O&M costs for waste disposal that includes fly ash and sorbent waste, as applicable
VOM ($/MWh) = VOMP + VOMB + VOMR + VOMW	**$**	**2.50**	

For the situation where a fabric filter is added to a facility with an existing fPM control device, it is incorrect to include the cost of disposing fly ash because the composition of the fly ash is not adversely affected with respect to disposal and may even improve. It will continue to be reutilized or disposed of in the same manner as it was prior to installing the fabric filter, or perhaps it may be less costly to dispose of. Therefore, the only VOM components that should be included are VOMB (for bag replacements) and VOMP (incremental parasitic power). The error of incorrectly including the cost of disposing all fly ash when it shouldn't be included – approximately $2.07/MWh of the $2.50/MWh total VOM – is quite significant. The resulting VOM is nearly six times too high ($2.50/MWh versus $0.43/MWh).

[10] https://www.epa.gov/system/files/documents/2024-04/attachment-5-9b-pm-control-cost-development-methodology.pdf

EPA's error is clearly evident in the incremental VOM cost factor that was used by EPA when using a fabric filter. The VOM cost factors used by EPA for the different units assessed for new fabric filters range from $2.04/MWh to $3.40/MWh.[11] The Sargent & Lundy models demonstrate that EPA assumed that all of the fly ash from the coal was included in the waste stream. There is no possible way to reach such high VOM rates without including all of the fly ash in the incremental waste stream that gets disposed of. I have independently performed calculations that confirm this, and it is apparent from the examples in each of the Sargent & Lundy memos.

The size of the actual incremental waste stream (assuming that it is disposed of rather than sold) is shown in the Excel workbook[12] column labeled "fPM Reductions (tons/year)" in the three worksheets labeled "0.015 Limit Assumptions", "0.010 Limit Assumptions", and "0.006 Limit Assumptions". This incremental waste stream is well below the total ash collected, and the attendant waste disposal costs are minimal. For example, with a limit of 0.010 lb/MMBtu, EPA estimates that each Colstrip unit produces about 500 tons per year of additional collected fly ash. At a cost of about $50/ton disposed, that is about $50,000 in total cost for the plant – a negligible cost compared to the annualized cost of a fabric filter retrofit. For a limit of 0.010 lb/MMBtu, the EPA's estimate of the total incremental fly ash collected for all affected units is 2,567 tons per year. Some of this may be sold into fly ash utilization markets, so the total to be disposed of as waste is possibly even less. But, even if all 2,567 tons of ash is disposed of at $50/ton, that amounts to only $128,000 - approximately 0.14% of EPA's estimated total compliance cost of over $93 million per year. This negligible incremental disposal cost stands in stark contrast to the millions of dollars in fly ash disposal costs that EPA erroneously included in its VOM calculation. EPA correctly excluded fly ash disposal costs for those units where it estimated incremental annualized costs for upgrade of existing ESPs or improvement to existing fabric filters; the error applies only to new fabric filter installations.

Issue #2: The Impact of Adding a Fabric Filter on Hg Control Costs Was Not Accounted for in the Incremental Annualized Cost or Cost-Effectiveness Calculations

It is well established that when a coal facility replaces another PM control device with a fabric filter or adds a fabric filter to the facility, it will reduce the demand for activated carbon (or other reagents) to capture Hg. It will also increase the intrinsic Hg capture without activated carbon.

Comments on EPA's proposed repeal stated that EPA did not adequately account for the impact on Hg control costs in its cost-effectiveness calculation for the Colstrip plant, which EPA estimated would install a fabric filter to meet the 0.010 lb/MMBtu limit of the 2024 final rule. The savings, according to the commenter, could be quite substantial, as high as $15 million for the plant. A full accounting of the cost impacts of the addition of a fabric filter would account for the impact on the mercury control cost. In its response to comments,[13] EPA states:

> *[T]he EPA notes that the compliance cost modeling appropriately reflects the decrease in Hg controls costs associated with the installation of a FF. For additional detail on how EPA modeled FF and ACI control costs, see Chapter 5 of EPA's 2025 Reference Case Documentation, which the Agency provides in the docket.*

EPA, therefore, acknowledges that the impact of a fabric filter installation on Hg control costs should reasonably be accounted for. But *EPA **did not** account for this effect in the cost-effectiveness calculations it relied upon that are in the Excel workbooks*.

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[11] See tab FF Install Estimated Costs column G in Nov. 2025 Technical Memo attach. 1^J EPA-HQ-OAR-2018-0794-8480_attachment_1.xlsx

[12] Ibid

[13] US EPA, *National Emission Standards for Hazardous Air Pollutants: Coal- and Oil-Fired Electric Utility Steam Generating Units: Final Repeal Summary of Public Comments and Responses on Proposed Rule (90 FR 25535* | June 17, 2025), February 2026, page 42

As noted earlier, for both the 2024 update rule and the recent repeal, EPA's cost-effectiveness calculations were performed with a Microsoft Excel workbook. The workbooks were used to calculate the unit-by-unit annualized incremental cost of the fPM control upgrades, such as upgraded ESP, fabric filter improvement, or a new fabric filter. The workbooks were also used to calculate the unit-by-unit annual reduction in PM emissions (as well as reduction in non-Hg metals emissions) that would result from those PM control upgrades. The resulting total incremental annualized cost was divided by the total annual emission reductions to directly calculate the cost-effectiveness values relied upon by EPA in its decision to finalize as well as later repeal the rule. These Excel workbooks do not address any impact on Hg reduction costs and therefore do not incorporate the effect of reduced Hg control costs on cost-effectiveness.

So, with regard to EPA's response to comments noted earlier, while IPM modeling that may have been performed would be expected to have incorporated a change in Hg control cost through the use of the associated cost algorithms, IPM modeling is not what EPA relied upon when calculating cost-effectiveness in either the 2024 final rule or the 2026 repeal of that rule. EPA relied solely upon the Excel workbooks that did not account for Hg emission cost reductions. As a result, while EPA has acknowledged the significance of this effect in its response to comments, EPA excluded this effect from the incremental annualized cost or PM cost-effectiveness estimates in the Microsoft Excel workbooks that EPA relied upon. Therefore, in relying on the cost-effectiveness value, EPA did not consider this significant effect in its decision to repeal the 2024 rule. At a minimum, EPA should have acknowledged the impact of this in *reducing the cost of complying with the 2012 MATS rule*. EPA could have also accounted for this by adjusting its cost effectiveness calculation, since it is reasonable to take into account all cost impacts associated with the addition of a new control device to control a pollutant.

3. IMPACT ON COST EFFECTIVENESS CALCULATIONS

Approach for correcting VOM

Using the same TPC and FOM costs used by EPA and using a corrected VOM cost multiple developed with the Sargent & Lundy model, a corrected incremental annualized cost estimate can be developed that does not include the cost of disposing all of the fly ash generated by the coal unit. Based on the 2017 Sargent & Lundy model, which has costs in 2016 dollars and escalating using the Chemical Engineering Plant Cost Index (CEPCI), I have estimated a corrected VOM rate of about $0.48/MWh, which includes both bag replacement VOM and parasitic power VOM. Reagent VOM and VOM for fly ash disposal are not included because they do not apply for the reasons already discussed.

Results of calculations for each step of the calculation are shown in the Appendix.

Approach for accounting for the effect of fabric filter on Hg emissions control costs

Sargent & Lundy's 2017 [14] memo on the cost of Hg control uses a treatment rate of 5 lb/million acf for a coal unit equipped with an ESP versus 2 lb/ million acf for a unit equipped with a fabric filter. As this is the most recent mercury control cost-estimating document assembled by Sargent & Lundy for EPA, it is reasonable to estimate the cost impact with these values. Halogenated Powdered Activated Carbon (PAC), the most common PAC. It is used on any Powder River Basin- (PRB, which is very widely used) or lignite-fired units because of the low halogen content of these fuels. It is also used on many bituminous units. Halogenated PAC is shown in this document to cost $2,100/ per ton (2016 dollars). Escalating to 2019 dollars with the CEPCI results in $2355 per ton or $1.18/lb.

To estimate the cost impacts on Hg control, I utilize the algorithms used in the Sargent & Lundy 2017 mercury control memo with:

[14] Sargent & Lundy, *Updates to Cost and Performance for APC Technologies, Mercury Control Cost Development Methodology, Final, Project 13527-001*, January 2017

- Actual cubic feet of flue gas per minute (acfm) estimated as = Capacity (in MW)*9500*0.4, per the Sargent & Lundy document, with the total acf treated over the course of a year is determined by:
    - [(total generation in MWh)/(capacity in MW)]*60*acfm
- Total carbon used = treatment rates of 5 lb/million acf for without a fabric filter and 2 lb/million acf for with a fabric filter multiplied by the total acf over the year divided by 1,000,000 acf per million acf
- an activated carbon cost of $1.18/lb

Detailed results of the annualized incremental cost calculations are shown in the Appendix.

Corrected and Adjusted Incremental Annualized Cost Results

Using the above VOM and the TPC and FOM cost factors used by EPA and proper accounting for corrected VOM and Hg control impacts, Table 1 shows the corrected and adjusted incremental annualized costs for fabric filters. The first column shows the unit identifying Unique_ID. The second column shows EPA's estimated annualized cost for the specific unit in the 2026 repeal. The third and fourth columns show the corrected or adjusted annualized cost. The third column shows the corrected annualized cost after using the correct VOM value accounting for the fly ash. The last column shows the annualized cost correcting for the VOM value accounting for the fly ash and adjusting for the impact on Hg control. The effect of the cost of Hg will depend upon the specific savings for the unit. However, since the Oak Grove facility had a baghouse with an activated carbon injection rate of 0.5 lb/million acf, the savings could be much greater than what is shown here. As shown here, the total savings at Colstrip are estimated at about $8.5 million, but as previously noted, might be much higher. More detailed values of calculations are shown in the Appendix.

Table 1. Corrected incremental annualized fabric filter costs

UniqueID_Final	EPA 2026 estimated annualized cost, $	With Corrected VOM	With adjustment for Hg control and VOM
6823_B_W1	$18,002,207.92	$11,215,095.58	$8,970,046
136_B_2	$23,817,435.54	$14,835,699.36	$11,628,086
6076_B_4	$28,084,919.10	$19,749,852.06	$15,597,243
6076_B_3	$28,226,699.20	$19,713,523.17	$15,472,179
2103_B_1	$22,804,426.03	$16,055,138.82	$12,563,255
2103_B_4	$22,699,746.70	$16,030,510.52	$12,580,042
2103_B_3	$22,068,376.49	$15,881,965.70	$12,681,297
2103_B_2	$22,760,578.27	$16,044,822.59	$12,570,287
6183_B_SM-1	$21,001,194.80	$13,519,096.29	$11,450,992
3944_B_3	$26,037,791.92	$15,706,258.31	$12,112,018
3944_B_2	$26,277,140.40	$15,747,285.92	$12,084,052
6250_B_1A	$13,627,468.80	$9,680,499.07	$8,436,114
6250_B_1B	$13,627,468.80	$9,680,499.07	$8,436,114

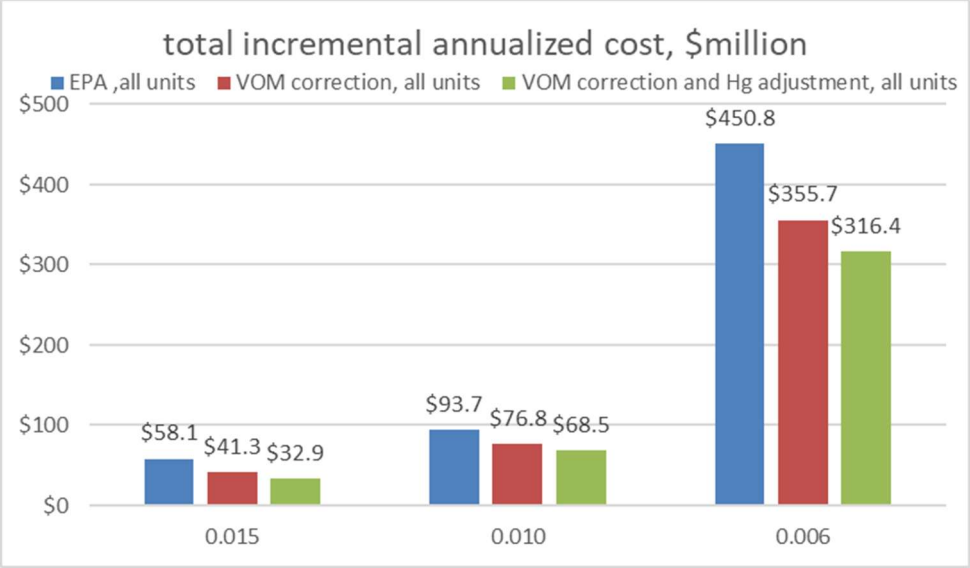
4. ADJUSTED INCREMENTAL ANNUAL COST AND COST-EFFECTIVENESS RESULTS

Total incremental annualized cost was determined by adding the incremental annualized cost for each unit under each control level. To determine the cost-effectiveness, the total incremental annualized cost is divided by the mass emission reduction for the associated pollutant.

Total Incremental Annualized Cost

The total incremental annual cost was determined for each of the control levels while comparing the corrected costs to EPA's estimate of total incremental annualized cost. The results are shown in Figure 1. As shown, for each control level there is a significant reduction in the total annualized cost of control. For the emission limit of 0.010 lb/MMBtu - the limit established by the 2024 MATS update rule – EPA estimated the total incremental annual cost to be $93.7 million. The VOM correction reduces the cost by 16.8 million to $76.8 million. The adjustment for reduction in Hg control costs lowers it by an additional $8.4 million to reach $68.5 million.

Figure 1. Total incremental annualized cost ($ million), for different control levels and with adjustments applied



Cost-effectiveness

This has significant impact on cost effectiveness.

Table 2 shows corrected results for the cost-effectiveness of various control levels and different controlled emissions when applying both the VOM correction and Hg adjustment. Table 3 is an equivalent table with just the VOM correction applied and Table 4 shows the results with just the Hg adjustment applied. These tables are comparable to Table 4 of EPA's November 2025 Technical Memo that shows EPA's estimate of control effectiveness. Figure 2 and Figure 3 show the fPM and non-Hg metal cost effectiveness values in the tables for the three different fPM control levels in a bar-chart form. As shown, with both corrections applied the corrected cost-effectiveness of fPM at the limit of 0.010 lb/MMBtu is $13.3/lb versus EPA's incorrect estimate of $18.3/lb – a reduction of approximately 27%. At that fPM control level, the cost effectiveness of non-Hg metal HAPs drops from EPA's incorrect estimate of $5,570/lb ($11.14 million per ton), to $5,077 per lb ($10.15 million per ton) with the Hg control adjustment, to

$4,574/lb ($9.15 million per ton) with the correct VOM, and to $4,074/lb ($8.15 million per ton) with both the Hg adjustment and VOM correction.

The appendix includes the results of calculations that compare the total incremental annualized costs and cost-effectiveness between those facilities that install a fabric filter (only Colstrip in the case of limits of 0.015 lb/MMBtu and 0.010 lb/MMBtu). As demonstrated in those calculations, when the costs are corrected, the cost-effectiveness of controlling with fabric filters drops. This has significant impact on cost effectiveness.

Table 2. Results of Updated and Corrected PM analysis for three potential limits – both VOM and Hg effects accounted for

Assessed Limits (lb/MMBtu)		**0.015**	**0.010**	**0.006**
Number of EGUs		11	37	111
Capacity (GW)		4.7	16.8	50.2
Annualized Costs ($M)		$32.9	$68.5	$316.4
Emission Reductions (tons/year)	fPM	1,258	2,567	6,383
	fPM2.5	676	1,326	3,211
	Total non-Hg metal HAP	3.0	8.4	24.9
	As	0.17	0.36	0.97
	Be	0.01	0.02	0.06
	Cd	0.03	0.05	0.12
	Co	0.03	0.10	0.30
	Cr	0.49	2.1	6.5
	Mn	0.83	1.5	4.2
	Ni	0.32	1.0	3.1
	Pb	0.25	0.43	1.0
	Sb	0.06	0.13	0.31
	Se	0.80	2.7	8.3
Cost-Effectiveness, ($/lb)	fPM	$13.07	$13.33	$24.78
	fPM2.5	$24.32	$25.81	$49.26
	Total non-Hg metal HAP	$5,481	$4,074	$6,353
	As	$96,720	$95,071	$163,079
	Be	$1,644,242	$1,711,283	$2,636,451
	Cd	$548,081	$684,513	$1,318,226
	Co	$548,081	$342,257	$527,290
	Cr	$33,556	$16,298	$24,336
	Mn	$19,810	$22,817	$37,664
	Ni	$51,383	$34,226	$51,028
	Pb	$65,770	$79,595	$158,187
	Sb	$274,040	$263,274	$510,281
	Se	$20,553	$12,676	$19,059
	fPM	$26,141	$26,666	$49,565
	fPM2.5	$48,646	$51,622	$98,528

Assessed Limits (lb/MMBtu)		0.015	0.010	0.006
Cost-Effectiveness, ($/ton)	Total non-Hg metal HAP	$10,961,615	$8,148,969	$12,705,789
	As	$193,440,266	$190,142,610	$326,158,905
	Be	$3,288,484,528	$3,422,566,973	$5,272,902,291
	Cd	$1,096,161,509	$1,369,026,789	$2,636,451,146
	Co	$1,096,161,509	$684,513,395	$1,054,580,458
	Cr	$67,111,929	$32,595,876	$48,672,944
	Mn	$39,620,296	$45,634,226	$75,327,176
	Ni	$102,765,141	$68,451,339	$102,056,173
	Pb	$131,539,381	$159,189,162	$316,374,137
	Sb	$548,080,755	$526,548,765	$1,020,561,734
	Se	$41,106,057	$25,352,348	$38,117,366

Table 3. Results of Updated and Corrected PM analysis for three potential limits – VOM correction only

Assessed Limits (lb/MMBtu)		0.015	0.010	0.006
Number of EGUs		11	37	111
Capacity (GW)		4.7	16.8	50.2
Annualized Costs ($M)		$41.3	$76.8	$355.7
Emission Reductions (tons/year)	fPM	1,258	2,567	6,383
	fPM2.5	676	1,326	3,211
	Total non-Hg metal HAP	3.0	8.4	24.9
	As	0.17	0.36	0.97
	Be	0.01	0.02	0.06
	Cd	0.03	0.05	0.12
	Co	0.03	0.10	0.30
	Cr	0.49	2.1	6.5
	Mn	0.83	1.5	4.2
	Ni	0.32	1.0	3.1
	Pb	0.25	0.43	1.0
	Sb	0.06	0.13	0.31
	Se	0.80	2.7	8.3
Cost-Effectiveness, ($/lb)	fPM	$16.41	$14.97	$27.86
	fPM2.5	$30.53	$28.98	$55.38
	Total non-Hg metal HAP	$6,879.80	$4,574.12	$7,141.62
	As	$121,408.23	$106,729.57	$183,326.11
	Be	$2,063,939.94	$1,921,132.33	$2,963,772.17
	Cd	$687,979.98	$768,452.93	$1,481,886.09
	Co	$687,979.98	$384,226.47	$592,754.43
	Cr	$42,121.22	$18,296.50	$27,357.90
	Mn	$24,866.75	$25,615.10	$42,339.60

Assessed Limits (lb/MMBtu)		0.015	0.010	0.006
	Ni	$64,498.12	$38,422.65	$57,363.33
	Pb	$82,557.60	$89,354.99	$177,826.33
	Sb	$343,989.99	$295,558.82	$573,633.32
	Se	$25,799.25	$14,230.61	$21,424.86
Cost-Effectiveness, ($/ton)	fPM	$32,813	$29,936	$55,719
	fPM2.5	$61,063	$57,953	$110,761
	Total non-Hg metal HAP	$13,759,600	$9,148,249	$14,283,239
	As	$242,816,464	$213,459,147	$366,652,227
	Be	$4,127,879,884	$3,842,264,652	$5,927,544,342
	Cd	$1,375,959,961	$1,536,905,861	$2,963,772,171
	Co	$1,375,959,961	$768,452,930	$1,185,508,868
	Cr	$84,242,447	$36,592,997	$54,715,794
	Mn	$49,733,493	$51,230,195	$84,679,205
	Ni	$128,996,246	$76,845,293	$114,726,665
	Pb	$165,115,195	$178,709,984	$355,652,661
	Sb	$687,979,981	$591,117,639	$1,147,266,647
	Se	$51,598,499	$28,461,220	$42,849,718

Table 4. Results of Updated and Corrected PM analysis for three potential limits – Hg adjustment only

Assessed Limits (lb/MMBtu)		0.015	0.010	0.006
Number of EGUs		11	37	111
Capacity (GW)		4.7	16.8	50.2
Annualized Costs ($M)		$49.7	$85.3	$411.5
Emission Reductions (tons/year)	fPM	1,258	2,567	6,383
	fPM2.5	676	1,326	3,211
	Total non-Hg metal HAP	3.0	8.4	24.9
	As	0.17	0.36	0.97
	Be	0.01	0.02	0.06
	Cd	0.03	0.05	0.12
	Co	0.03	0.10	0.30
	Cr	0.49	2.1	6.5
	Mn	0.83	1.5	4.2
	Ni	0.32	1.0	3.1
	Pb	0.25	0.43	1.0
	Sb	0.06	0.13	0.31
	Se	0.80	2.7	8.3

Assessed Limits (lb/MMBtu)		0.015	0.010	0.006
Cost-Effectiveness, ($/lb)	fPM	$19.77	$16.61	$32.24
	fPM2.5	$36.78	$32.16	$64.08
	Total non-Hg metal HAP	$8,288.85	$5,077.36	$8,264.04
	As	$146,273.79	$118,471.64	$212,138.84
	Be	$2,486,654.42	$2,132,489.56	$3,429,577.87
	Cd	$828,884.81	$852,995.83	$1,714,788.94
	Co	$828,884.81	$426,497.91	$685,915.57
	Cr	$50,748.05	$20,309.42	$31,657.64
	Mn	$29,959.69	$28,433.19	$48,993.97
	Ni	$77,707.95	$42,649.79	$66,378.93
	Pb	$99,466.18	$99,185.56	$205,774.67
	Sb	$414,442.40	$328,075.32	$663,789.27
	Se	$31,083.18	$15,796.22	$24,792.13
Cost-Effectiveness, ($/ton)	fPM	$39,533	$33,229	$64,476
	fPM2.5	$73,570	$64,328	$128,169
	Total non-Hg metal HAP	$16,577,696	$10,154,712	$16,528,086
	As	$292,547,578	$236,943,285	$424,277,675
	Be	$4,973,308,834	$4,264,979,126	$6,859,155,749
	Cd	$1,657,769,611	$1,705,991,651	$3,429,577,875
	Co	$1,657,769,611	$852,995,825	$1,371,831,150
	Cr	$101,496,099	$40,618,849	$63,315,284
	Mn	$59,919,384	$56,866,388	$97,987,939
	Ni	$155,415,901	$85,299,583	$132,757,853
	Pb	$198,932,353	$198,371,122	$411,549,345
	Sb	$828,884,806	$656,150,635	$1,327,578,532
	Se	$62,166,360	$31,592,438	$49,584,258

Figure 2. fPM cost effectiveness, $/ton, at different fPM control levels – EPA estimates versus estimates with VOM correction and VOM correction and Hg adjustment

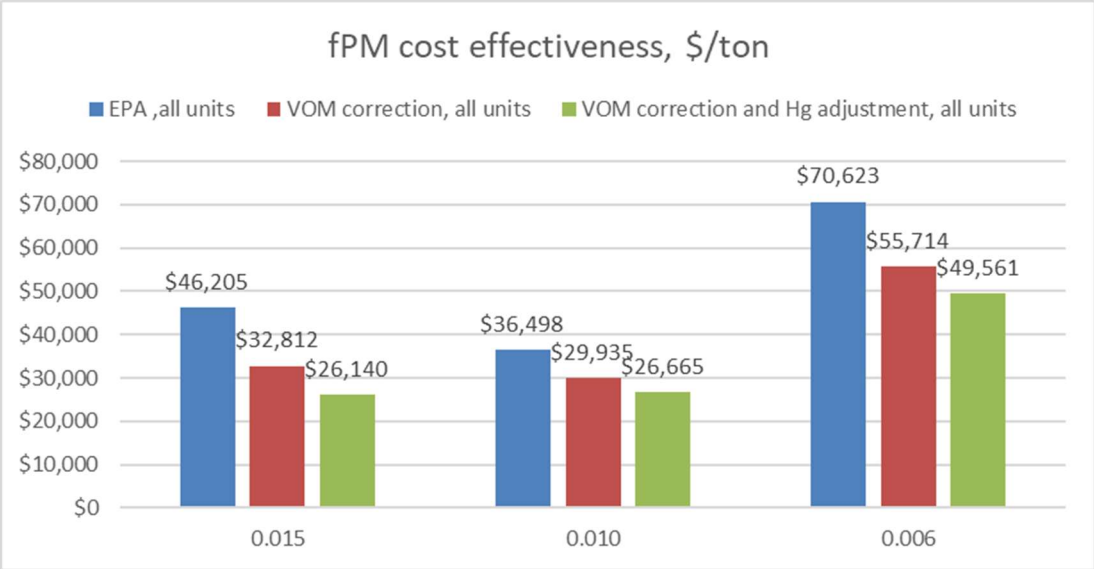
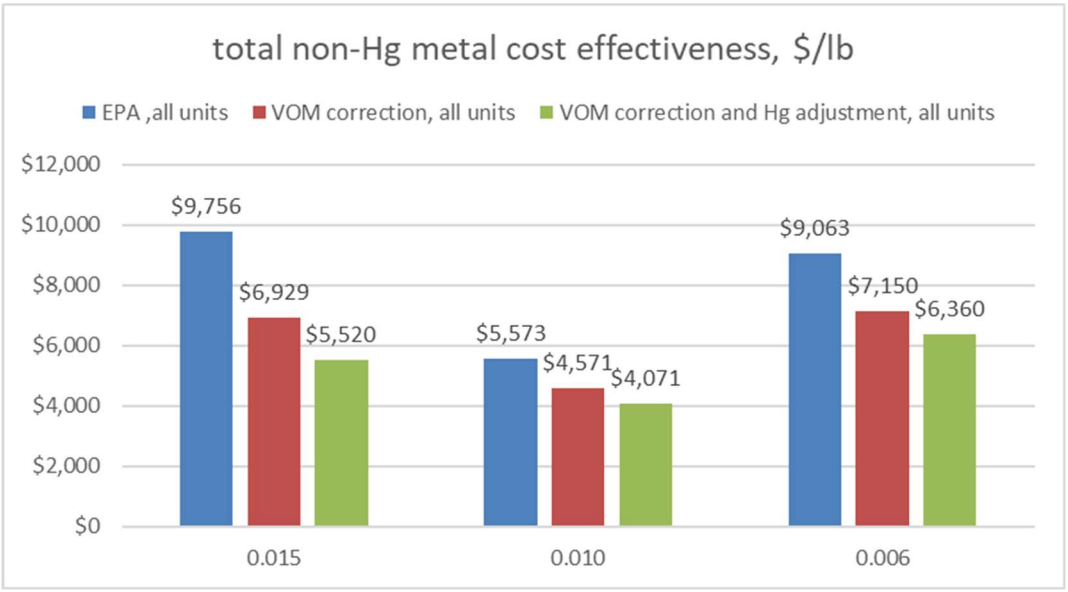


Figure 3. Total Non-Hg metals cost effectiveness, $/lb at different fPM control levels – EPA estimates versus estimates with VOM correction and VOM correction and Hg adjustment



5. APPENDIX

EPA cost information and annualized incremental cost with corrected VOM for units that add a fabric filter

From Nov. 2025 Technical Memo attach. 1^J EPA-HQ-OAR-2018-0794-8480_attachment_1.xlsx								Breakout of costs						
								Using EPA estimate				With Corrected VOM Estimate		
UniqueID_Final	Capacity (MW)	Average Annual Gross Generation (MWh)	Capital Charge Rate (%)	Capital Cost (2019/kW)	VOM (2019$/MWh)	FOM (2019$/kW yr)	Incremental Annual Cost	annualized capital	VOM	FOM	Total	Corrected VOM, $/MWhr	Corrected VOM, $/yr	Corrected Incremental Annual Cost
6823_B_W1	417	2,781,556	11.04	208	2.92	0.73	$18,002,208	$9,575,654	$8,122,144	$304,410	$18,002,208	$0.48	$1,335,031	$11,215,096
136_B_2	634	3,974,146	11.04	179	2.74	0.63	$23,817,436	$12,528,85	$10,889,161	$399,420	$23,817,436	$0.48	$1,907,425	$14,835,699
6076_B_4	740	5,144,971	11.04	205	2.1	0.72	$28,084,919	$16,747,68	$10,804,439	$532,800	$28,084,919	$0.48	$2,469,372	$19,749,852
6076_B_3	740	5,254,912	11.04	204	2.1	0.71	$28,226,699	$16,665,98	$11,035,315	$525,400	$28,226,699	$0.48	$2,522,139	$19,713,523
2103_B_1	593	4,326,351	11.04	207	2.04	0.72	$22,804,426	$13,551,71	$8,825,756	$426,960	$22,804,426	$0.48	$2,076,468	$16,055,139
2103_B_4	593	4,275,037	11.04	207	2.04	0.72	$22,699,747	$13,551,71	$8,721,076	$426,960	$22,699,747	$0.48	$2,051,840	$16,030,511
2103_B_3	593	3,965,542	11.04	207	2.04	0.72	$22,068,376	$13,551,71	$8,089,706	$426,960	$22,068,376	$0.48	$1,903,295	$15,881,966
2103_B_2	593	4,304,857	11.04	207	2.04	0.72	$22,760,578	$13,551,71	$8,781,908	$426,960	$22,760,578	$0.48	$2,066,152	$16,044,823
6183_B_SM-1	391	2,562,326	11.04	276	3.4	0.96	$21,001,195	$11,913,92	$8,711,908	$375,360	$21,001,195	$0.48	$1,229,810	$13,519,096
3944_B_3	651	4,453,167	11.04	183	2.8	0.64	$26,037,792	$13,152,28	$12,468,869	$416,640	$26,037,792	$0.48	$2,137,335	$15,706,258
3944_B_2	651	4,538,649	11.04	183	2.8	0.64	$26,277,140	$13,152,28	$12,708,217	$416,640	$26,277,140	$0.48	$2,178,363	$15,747,286
6250_B_1A	352	1,541,760	11.04	223	3.04	0.78	$13,627,469	$8,665,958	$4,686,950	$274,560	$13,627,469	$0.48	$739,981	$9,680,499
6250_B_1B	352	1,541,760	11.04	223	3.04	0.78	$13,627,469	$8,665,958	$4,686,950	$274,560	$13,627,469	$0.48	$739,981	$9,680,499
Total							**$289,035,454**	**$165,275,4**	**$118,532,400**	**$5,227,630**	**$289,035,454**		**$23,357,1**	**$193,860,246**

Annualized incremental cost calculations after adjusting for the effect of reduced mercury control costs when adding a fabric filter

UniqueID_Final	EPA estimated annualized cost, $	Annualized cost with Corrected VOM	Impact of reducing carbon from 5 lb/million acf to 2 lb/million acf					
			acfm	Million acf/yr	carbon use before FF, lb/yr	Carbon cost before FF $/yr	carbon savings after FF	Annualized cost with reduction in Hg control cost
6823_B_W1	$18,002,208	$11,215,096	1,584,600	634,195	3,170,974	$3,741,749	$2,245,049	$8,970,046
136_B_2	$23,817,436	$14,835,699	2,409,200	906,105	4,530,527	$5,346,022	$3,207,613	$11,628,086
6076_B_4	$28,084,919	$19,749,852	2,812,000	1,173,053	5,865,267	$6,921,015	$4,152,609	$15,597,243
6076_B_3	$28,226,699	$19,713,523	2,812,000	1,198,120	5,990,600	$7,068,908	$4,241,345	$15,472,179
2103_B_1	$22,804,426	$16,055,139	2,253,400	986,408	4,932,040	$5,819,807	$3,491,884	$12,563,255
2103_B_4	$22,699,747	$16,030,511	2,253,400	974,709	4,873,543	$5,750,780	$3,450,468	$12,580,042
2103_B_3	$22,068,376	$15,881,966	2,253,400	904,144	4,520,718	$5,334,447	$3,200,668	$12,681,297
2103_B_2	$22,760,578	$16,044,823	2,253,400	981,507	4,907,537	$5,790,893	$3,474,536	$12,570,287
6183_B_SM-1	$21,001,195	$13,519,096	1,485,800	584,210	2,921,052	$3,446,841	$2,068,105	$11,450,992
3944_B_3	$26,037,792	$15,706,258	2,473,800	1,015,322	5,076,611	$5,990,401	$3,594,240	$12,112,018
3944_B_2	$26,277,140	$15,747,286	2,473,800	1,034,812	5,174,060	$6,105,391	$3,663,234	$12,084,052
6250_B_1A	$13,627,469	$9,680,499	1,337,600	351,521	1,757,606	$2,073,976	$1,244,385	$8,436,114
6250_B_1B	$13,627,469	$9,680,499	1,337,600	351,521	1,757,606	$2,073,976	$1,244,385	$8,436,114
Total	**$289,035,454**	**$193,860,246**				**$65,464,205**	**$39,278,523**	**$154,581,723**

The cost of controlling to 0.015 lb/MMBtu, EPA and corrected estimates

	Total incremental annualized cost	fPM		Non-Hg metals	
		tons PM	$/ton	tons	$/lb
EPA, all	$58,127,042	1,258	$46,205	2.98	$9,756
EPA, excl. Colstrip	$1,815,424	249	$7,288	0.71	$1,280
EPA, Colstrip	$56,311,618	1,009	$55,814	2.27	$12,403
Corrected VOM, Colstrip	$39,463,375	1,009	$39,114	2.27	$8,692
Corrected VOM, all	$41,278,799	1,258	$32,812	2.98	$6,929
with Hg adjustment and VOM correction, Colstrip	$31,069,422	1,009	$30,795	2.27	$6,843
with Hg adjustment and VOM correction, all	$32,884,845	1,258	$26,140	2.98	$5,520

The cost of controlling to 0.010 lb/MMBtu, EPA and corrected estimates

	Total incremental annualized cost	fPM		Non-Hg metals	
		tons PM	$/ton	tons	$/lb
EPA, all	$93,693,536	2,567	$36,498	8.41	$5,573
EPA, excl. Colstrip	$37,381,918	1,558	$23,991	6.14	$3,046
EPA, Colstrip	$56,311,618	1,009	$55,814	2.27	$12,403
Corrected VOM, Colstrip	$39,463,375	1,009	$39,114	2.27	$8,692
Corrected VOM, all	$76,845,293	2,567	$29,935	8.41	$4,571
with Hg adjustment and VOM correction, Colstrip	$31,069,422	1,009	$30,795	2.27	$6,843
with Hg adjustment and VOM correction, all	$68,451,339	2,567	$26,665	8.41	$4,071

The cost of controlling to 0.006 lb/MMBtu, EPA and corrected estimates

	Total incremental annualized cost	fPM		Non-Hg metals	
		tons PM	$/ton	tons	$/lb
EPA, all	$450,827,868	6,384	$70,623	24.87	$9,063
EPA excl. FF	$161,792,414	2,928	$55,260	13.08	$6,186
EPA, FF	$289,035,454	3,456	$83,640	11.80	$12,252
Corrected VOM, FF	$193,860,246	3,456	$56,098	11.80	$8,218
Corrected VOM, all	$355,652,661	6,384	$55,714	24.87	$7,150
with Hg adjustment and VOM correction, FF	$154,581,723	3,456	$44,732	11.80	$6,553
with Hg adjustment and VOM correction, all	$316,374,137	6,384	$49,561	24.87	$6,360