ENVIRONMENTAL PROTECTION AGENCY

40 CFR Part 63

[EPA–HQ–OAR–2018–0794; FRL–6716.2–01–OAR]

RIN 2060–AV12

National Emission Standards for Hazardous Air Pollutants: Coal- and Oil-Fired Electric Utility Steam Generating Units—Revocation of the 2020 Reconsideration, and Affirmation of the Appropriate and Necessary Supplemental Finding; Notice of Proposed Rulemaking

AGENCY: Environmental Protection Agency (EPA).

ACTION: Proposed rule.

SUMMARY: The EPA is proposing to revoke a May 22, 2020 finding that it is not appropriate and necessary to regulate coal- and oil-fired electric utility steam generating units (EGUs) under Clean Air Act (CAA) section 112, and to reaffirm the Agency's April 25, 2016 finding that it remains appropriate and necessary to regulate hazardous air pollutant (HAP) emissions from EGUs after considering cost. The Agency is also reviewing another part of the May 22, 2020 action, a residual risk and technology review (RTR) of Mercury and Air Toxics Standards (MATS). Accordingly, in addition to soliciting comments on all aspects of this proposal, the EPA is soliciting information on the performance and cost of new or improved technologies that control HAP emissions, improved methods of operation, and risk-related information to further inform the Agency's review of the MATS RTR as directed by Executive Order 13990.

DATES: Comments must be received on or before April 11, 2022.

Public hearing: The EPA will hold a virtual public hearing on February 24, 2022. See **SUPPLEMENTARY INFORMATION** for information on the hearing.

ADDRESSES: You may send comments, identified by Docket ID No. EPA–HQ–OAR–2018–0794, by any of the following methods:

- *Federal eRulemaking Portal: https://www.regulations.gov/* (our preferred method). Follow the online instructions for submitting comments.
- *Email: a-and-r-docket@epa.gov.* Include Docket ID No. EPA–HQ–OAR–2018–0794 in the subject line of the message.
- Fax: (202) 566–9744. Attention Docket ID No. EPA–HQ–OAR–2018–0794.
- Mail: U.S. Environmental Protection Agency, EPA Docket Center, Docket ID No. EPA–HQ–OAR–2018–0794, Mail Code 28221T, 1200 Pennsylvania Avenue NW, Washington, DC 20460.
- *Hand/Courier Delivery:* EPA Docket Center, WJC West Building, Room 3334, 1301 Constitution Avenue NW, Washington, DC 20004. The Docket Center's hours of operation are 8:30 a.m.–4:30 p.m., Monday–Friday (except Federal holidays).

Instructions: All submissions received must include the Docket ID No. for this rulemaking. Comments received may be posted without change to *https://www.regulations.gov/,* including any personal information provided. For detailed instructions on sending comments and additional information on the rulemaking process, see the **SUPPLEMENTARY INFORMATION** section of this document. Out of an abundance of caution for members of the public and our staff, the EPA Docket Center and Reading Room are closed to the public, with limited exceptions, to reduce the risk of transmitting COVID–19. Our Docket Center staff will continue to provide remote customer service via email, phone, and webform. We encourage the public to submit comments via *https://www.regulations.gov/* or email, as there may be a delay in processing mail and faxes. Hand deliveries and couriers may be received by scheduled appointment only. For further information on EPA Docket Center services and the current status, please visit us online at *https://www.epa.gov/dockets.*

FOR FURTHER INFORMATION CONTACT: For questions about this proposed action, contact Melanie King, Sector Policies and Programs Division (D243–01), Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency, Research Triangle Park, North Carolina 27711; telephone number: (919) 541–2469; and email address: *king.melanie@epa.gov.*

SUPPLEMENTARY INFORMATION: The EPA is proposing to revoke a May 22, 2020 finding that it is not appropriate and necessary to regulate coal- and oil-fired EGUs under CAA section 112, and to reaffirm the Agency's April 25, 2016 finding that it remains appropriate and necessary to regulate HAP emissions from EGUs after considering cost. The 2016 finding was made in response to the U.S. Supreme Court's 2015 *Michigan* v. *EPA* decision, where the Court held that the Agency had erred by not taking cost into consideration when taking action on February 16, 2012, to affirm a 2000 EPA determination that it was appropriate and necessary to regulate HAP emissions from EGUs. In the same 2012 action, the EPA also promulgated National Emission Standards for Hazardous Air Pollutants (NESHAP) for coal- and oil-fired EGUs, commonly known as the Mercury and Air Toxics Standards or MATS.

Based on a re-evaluation of the administrative record and the statute, the EPA proposes to conclude that the framework applied in the May 22, 2020 finding was ill-suited to assessing and comparing the full range of benefits to costs, and the EPA concludes that, after applying a more suitable framework, the 2020 determination should be withdrawn. For reasons explained in this notice, the EPA further proposes to reaffirm that it is appropriate and necessary to regulate HAP emissions from EGUs after weighing the volume of pollution that would be reduced through regulation, the public health risks and harms posed by these emissions, the impacts of this pollution on particularly exposed and sensitive populations, the availability of effective controls, and the costs of reducing this harmful pollution including the effects of control costs on the EGU industry and its ability to provide reliable and affordable electricity. This notice also presents information and analysis that has become available since the 2016 finding, pertaining to the health risks of mercury emissions and the costs of reducing HAP emissions, that lend further support for this determination.

The review that led to this proposal is consistent with the direction in Executive Order 13990, ''Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis,'' signed by President Biden on January 20, 2021. In response to the Executive Order, the Agency is also reviewing another part of the May 22, 2020 action, a RTR of MATS. Accordingly, in addition to soliciting comments on all aspects of this proposal, the EPA is soliciting information on the performance and cost of new or improved technologies that control HAP emissions, improved methods of operation, and risk-related information to further inform the Agency's review of the MATS RTR as directed by the Executive Order. Results of the EPA's review of the RTR will be presented in a separate action.

Participation in virtual public hearing. Please note that the EPA is deviating from its typical approach for public hearings because the President has declared a national emergency. Due to the current Centers for Disease Control and Prevention (CDC) recommendations, as well as state and local orders for social distancing to limit the spread of COVID–19, the EPA cannot hold in-person public meetings at this time.

The virtual public hearing will be held via teleconference on February 24, 2022 and will convene at 10:00 a.m. Eastern Time (ET) and will conclude at 7:00 p.m. ET. The EPA may close a session 15 minutes after the last pre-registered speaker has testified if there are no additional speakers. For information or questions about the public hearing, please contact the public hearing team at (888) 372–8699 or by email at *SPPDpublichearing@epa.gov.* The EPA will announce further details at *https://www.epa.gov/stationary-sources-air-pollution/mercury-and-air-toxics-standards.*

The EPA will begin pre-registering speakers for the hearing no later than 1 business day following publication of this document in the **Federal Register**. The EPA will accept registrations on an individual basis. To register to speak at the virtual hearing, please use the online registration form available at *https://www.epa.gov/stationary-sources-air-pollution/mercury-and-air-toxics-standards* or contact the public hearing team at (888) 372–8699 or by email at *SPPDpublichearing@epa.gov.* The last day to pre-register to speak at the hearing will be February 18, 2022. Prior to the hearing, the EPA will post a general agenda that will list pre-registered speakers in approximate order at: *https://www.epa.gov/stationary-sources-air-pollution/mercury-and-air-toxics-standards.*

The EPA will make every effort to follow the schedule as closely as possible on the day of the hearing; however, please plan for the hearings to run either ahead of schedule or behind schedule.

Each commenter will have 5 minutes to provide oral testimony. The EPA encourages commenters to provide the EPA with a copy of their oral testimony electronically (via email) by emailing it to *king.melanie@epa.gov.* The EPA also recommends submitting the text of your oral testimony as written comments to the rulemaking docket.

The EPA may ask clarifying questions during the oral presentations but will not respond to the presentations at that time. Written statements and supporting information submitted during the comment period will be considered with the same weight as oral testimony and supporting information presented at the public hearing.

Please note that any updates made to any aspect of the hearing will be posted online at *https://www.epa.gov/stationary-sources-air-pollution/mercury-and-air-toxics-standards.* While the EPA expects the hearing to go forward as set forth above, please monitor our website or contact the public hearing team at (888) 372–8699 or by email at *SPPDpublichearing@epa.gov* to determine if there are any updates. The EPA does not intend to publish a document in the **Federal Register** announcing updates.

If you require the services of a translator or a special accommodation such as audio description, please pre-register for the hearing with the public hearing team and describe your needs by February 16, 2022. The EPA may not be able to arrange accommodations without advanced notice.

Docket. The EPA has established a docket for this rulemaking under Docket ID No. EPA–HQ–OAR–2018–0794.[1] All documents in the docket are listed in *https://www.regulations.gov/.* Although listed, some information is not publicly available, *e.g.,* Confidential Business Information (CBI) or other information whose disclosure is restricted by statute. Certain other material, such as copyrighted material, is not placed on the internet and will be publicly available only in hard copy. With the exception of such material, publicly available docket materials are available electronically in *https://www.regulations.gov/.*

Instructions. Direct your comments to Docket ID No. EPA–HQ–OAR–2018–0794. The EPA's policy is that all comments received will be included in the public docket without change and may be made available online at *https://www.regulations.gov/,* including any personal information provided, unless the comment includes information claimed to be CBI or other information whose disclosure is restricted by statute. Do not submit electronically any information that you consider to be CBI or other information whose disclosure is restricted by statute. This type of information should be submitted by mail as discussed below.

The EPA may publish any comment received to its public docket. Multimedia submissions (audio, video, *etc.*) must be accompanied by a written comment. The written comment is considered the official comment and should include discussion of all points you wish to make. The EPA will generally not consider comments or comment contents located outside of the primary submission (*i.e.,* on the Web, cloud, or other file sharing system). For additional submission methods, the full EPA public comment policy, information about CBI or multimedia submissions, and general guidance on making effective comments, please visit *https://www.epa.gov/dockets/commenting-epa-dockets.*

The *https://www.regulations.gov/* website allows you to submit your comment anonymously, which means the EPA will not know your identity or contact information unless you provide it in the body of your comment. If you send an email comment directly to the EPA without going through *https://www.regulations.gov/,* your email address will be automatically captured and included as part of the comment that is placed in the public docket and made available on the internet. If you submit an electronic comment, the EPA recommends that you include your name and other contact information in the body of your comment and with any digital storage media you submit. If the EPA cannot read your comment due to technical difficulties and cannot contact you for clarification, the EPA may not be able to consider your comment. Electronic files should not include special characters or any form of encryption and be free of any defects or viruses. For additional information about the EPA's public docket, visit the EPA Docket Center homepage at *https://www.epa.gov/dockets.*

The EPA is temporarily suspending its Docket Center and Reading Room for public visitors, with limited exceptions, to reduce the risk of transmitting COVID–19. Our Docket Center staff will continue to provide remote customer service via email, phone, and webform. We encourage the public to submit comments via *https://www.regulations.gov/* as there may be a delay in processing mail and faxes. Hand deliveries or couriers will be received by scheduled appointment only. For further information and updates on EPA Docket Center services, please visit us online at *https://www.epa.gov/dockets.*

The EPA continues to carefully and continuously monitor information from the CDC, local area health departments, and our Federal partners so that we can respond rapidly as conditions change regarding COVID–19.

Submitting CBI. Do not submit information containing CBI to the EPA

[1] As explained in a memorandum to the docket, the docket for this action includes the documents and information, in whatever form, in Docket ID Nos. EPA–HQ–OAR–2009–0234 (National Emission Standards for Hazardous Air Pollutants for Coal- and Oil-fired Electric Utility Steam Generating Units), EPA–HQ–OAR–2002–0056 (National Emission Standards for Hazardous Air Pollutants for Utility Air Toxics; Clean Air Mercury Rule (CAMR)), and Legacy Docket ID No. A–92–55 (Electric Utility Hazardous Air Pollutant Emission Study). *See* memorandum titled *Incorporation by reference of Docket Number EPA–HQ–OAR–2009–0234, Docket Number EPA–HQ–OAR–2002–0056, and Docket Number A–92–55 into Docket Number EPA–HQ–OAR–2018–0794* (Docket ID Item No. EPA–HQ–OAR–2018–0794–0005).

through *https://www.regulations.gov/* or email. Clearly mark the part or all of the information that you claim to be CBI. For CBI information on any digital storage media that you mail to the EPA, mark the outside of the digital storage media as CBI and then identify electronically within the digital storage media the specific information that is claimed as CBI. In addition to one complete version of the comments that includes information claimed as CBI, you must submit a copy of the comments that does not contain the information claimed as CBI directly to the public docket through the procedures outlined in *Instructions* above. If you submit any digital storage media that does not contain CBI, mark the outside of the digital storage media clearly that it does not contain CBI. Information not marked as CBI will be included in the public docket and the EPA's electronic public docket without prior notice. Information marked as CBI will not be disclosed except in accordance with procedures set forth in title 40 of the Code of Federal Regulations (CFR) part 2. Send or deliver information identified as CBI only to the following address: OAQPS Document Control Officer (C404–02), OAQPS, U.S. Environmental Protection Agency, Research Triangle Park, North Carolina 27711, Attention Docket ID No. EPA–HQ–OAR–2018–0794. Note that written comments containing CBI and submitted by mail may be delayed and no hand deliveries will be accepted.

Preamble acronyms and abbreviations. We use multiple acronyms and terms in this preamble. While this list may not be exhaustive, to ease the reading of this preamble and for reference purposes, the EPA defines the following terms and acronyms here:

ACI activated carbon injection
ATSDR Agency for Toxic Substances and Disease Registry
ARP Acid Rain Program
BCA benefit-cost analysis
CAA Clean Air Act
CAAA Clean Air Act Amendments of 1990
CAMR Clean Air Mercury Rule
CBI Confidential Business Information
CFR Code of Federal Regulations
CVD cardiovascular disease
DSI dry sorbent injection
EGU electric utility steam generating unit
EIA Energy Information Administration
EPA Environmental Protection Agency
ESP electrostatic precipitator
EURAMIC European Multicenter Case-Control Study on Antioxidants, Myocardial Infarction, and Cancer of the Breast Study
FF fabric filter
FGD flue gas desulfurization
FR Federal Register
GW gigawatt
HAP hazardous air pollutant(s)
HCl hydrogen chloride
HF hydrogen fluoride
IHD ischemic heart disease
IPM Integrated Planning Model
IRIS Integrated Risk Information System
KIHD Kuopio Ischaemic Heart Disease Risk Factor Study
kW kilowatt
MACT maximum achievable control technology
MATS Mercury and Air Toxics Standards
MI myocardial infarction
MIR maximum individual risk
MW megawatt
NAS National Academy of Sciences
NESHAP national emission standards for hazardous air pollutants
OMB Office of Management and Budget
O&M operation and maintenance
PM particulate matter
PUFA polyunsaturated fatty acid
RfD reference dose
RIA regulatory impact analysis
RTR residual risk and technology review
SCR selective catalytic reduction
SO2 sulfur dioxide
TSD technical support document
tpy tons per year

Organization of this document. The information in this preamble is organized as follows:

I. General Information

A. Executive Summary

On January 20, 2021, President Biden signed Executive Order 13990, ''Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis'' (86 FR 7037, January 25, 2021). The Executive Order, among other things, instructs the EPA to review the 2020 final action titled, ''National Emission Standards for Hazardous Air Pollutants: Coal- and Oil-Fired Electric Utility Steam Generating Units—Reconsideration of Supplemental Finding and Residual Risk and Technology Review'' (85 FR 31286; May 22, 2020) (2020 Final Action) and consider publishing a notice of proposed rulemaking suspending, revising, or rescinding that action. Consistent with the Executive Order, the EPA has undertaken a careful review of the 2020 Final Action, in which the EPA reconsidered its April 25, 2016 supplemental finding (81 FR 24420) (2016 Supplemental Finding). Based on that review, the Agency proposes to find that the decisional framework for making the appropriate and necessary determination under CAA section 112(n)(1)(A) that was applied in the 2020 Final Action was unsuitable because it failed to adequately account for statutorily relevant factors. Therefore, we propose to revoke the May 2020 determination that it is not appropriate and necessary to regulate HAP emissions from coal- and oil-fired EGUs under section 112 of the CAA. We further propose to reaffirm our earlier determinations—made in 2000 (65 FR 79825; December 20, 2000) (2000 Determination), 2012 (77 FR 9304; February 16, 2012) (2012 MATS Final Rule), and 2016—that it is appropriate and necessary to regulate coal- and oil-fired EGUs under section 112 of the CAA.

In 1990, frustrated with the EPA's pace in identifying and regulating HAP, Congress radically transformed its treatment of that pollution. It rewrote section 112 of the CAA to require the EPA to swiftly regulate 187 HAP with technology-based standards that would require all major sources (defined by the quantity of pollution a facility has the potential to emit) to meet the levels of reduction achieved in practice by the best-performing similar sources. EGUs were the one major source category excluded from automatic application of these new standards. EGUs were treated differently primarily because the 1990

Amendments to the CAA (1990 Amendments) included the Acid Rain Program (ARP), which imposed criteria pollution reduction requirements on EGUs. Congress recognized that the controls necessary to comply with this and other requirements of the 1990 Amendments might reduce HAP emissions from EGUs as well. Therefore, under CAA section 112(n)(1)(A), Congress directed the EPA to regulate EGUs if, after considering a study of ''the hazards to public health reasonably anticipated to occur as a result of [HAP] emissions by [EGUs] . . . after imposition of the [Acid Rain Program and other] requirements of this chapter,'' the EPA concluded that it ''is appropriate and necessary'' to do so. *See* CAA section 112(n)(1)(A).

The EPA completed that study in 1998 and, in 2000, concluded that it is appropriate and necessary to regulate HAP emissions from coal- and oil-fired EGUs. *See* 65 FR 79825 (December 20, 2000). The EPA reaffirmed that conclusion in 2012, explaining that the other requirements of the CAA, in particular the ARP, did not lead to the HAP emission reductions that had been anticipated because many EGUs switched to lower-sulfur coal rather than deploy pollution controls that may have also reduced emissions of HAP. Indeed, the statute contemplated that the EPA would be conducting the required study within 3 years of the 1990 Amendments; but when the EPA re-examined public health hazards remaining after imposition of the Act's requirements in 2012, the Agency accounted for over 20 years of CAA regulation, and EGUs still remained one of the largest sources of HAP pollution. Specifically, in 2012, the EPA concluded that EGUs were the largest domestic source of emissions of mercury, hydrogen fluoride (HF), hydrogen chloride (HCl), and selenium; and among the largest domestic contributors of emissions of arsenic, chromium, cobalt, nickel, hydrogen cyanide, beryllium, and cadmium. The EPA further found that a significant majority of EGUs were located at facilities that emitted above the statutory threshold set for major sources (*e.g.,* 10 tons per year (tpy) of any one HAP or 25 tpy or more of any combination of HAP). *See* 77 FR 9304 (February 16, 2012). In 2012, the EPA also established limits for emissions of HAP from coal- and oil-fired EGUs. *Id.*

Many aspects of the EPA's appropriate and necessary determination and the CAA section 112 regulations were challenged in the U.S. Court of Appeals for the District of Columbia Circuit (D.C. Circuit), and all challenges were denied and the finding and standards upheld in full in *White Stallion Energy Center* v. *EPA,* 748 F.3d 1222 (2014). The Supreme Court granted review on a single issue and, in *Michigan* v. *EPA,* 576 U.S. 743 (2015), the Court held that the EPA erred when it failed to consider the costs of its regulation in determining that it is appropriate and necessary to regulate HAP emissions from EGUs, and remanded that determination to the D.C. Circuit for further proceedings. Following *Michigan,* in 2016 the EPA issued a Supplemental Finding that it is appropriate and necessary to regulate EGU HAP after considering the costs of such regulation. *See* 81 FR 24420 (April 25, 2016). In 2020, the Agency reversed that determination.[2] In this action, we conclude that the methodology we applied in 2020 is ill-suited to the appropriate and necessary determination because, among other reasons, it did not give adequate weight to the significant volume of HAP emissions from EGUs and the attendant risks remaining after imposition of the other requirements of the CAA, including many adverse health and environmental effects of EGU HAP emissions that cannot be quantified or monetized. We propose, therefore, to revoke the 2020 Final Action.

We further propose to affirm, once again, that it is appropriate and necessary to regulate coal- and oil-fired EGUs under CAA section 112. We first examine the benefits or advantages of regulation, including new information on the risks posed by EGU HAP. We then examine the costs or disadvantages of regulation, including both the costs of compliance (which we explain we significantly overestimated in 2012) and how those costs affect the industry and the public. We then weigh these benefits and costs to reach the conclusion that it is appropriate and necessary to regulate using two alternative methodologies.

Our preferred methodology, as it was in the 2016 Supplemental Finding, is to consider all of the impacts of the regulation—both costs and benefits to society—using a totality-of the-circumstances approach rooted in the *Michigan* court's direction to ''pay[ ] attention to the advantages *and* disadvantages of [our] decision[ ].'' 576 U.S. at 753; *see id.* at 752 (''In particular, 'appropriate' is 'the classic broad all-encompassing term that naturally includes consideration of all relevant factors.''). To help determine the relevant factors to weigh, we look to CAA section 112(n)(1)(A), the other provisions of CAA section 112(n)(1), and to the statutory design of CAA section 112.

Initially, we consider the human health advantages of reducing HAP emissions from EGUs because in CAA section 112(n)(1)(A) Congress directed the EPA to make the appropriate and necessary determination after considering the results of a ''study of the hazards to public health reasonably anticipated to occur as a result of [HAP] emissions'' from EGUs. *See* CAA section 112(n)(1)(A). We consider all of the advantages of reducing emissions of HAP (*i.e.,* the risks posed by HAP) regardless of whether those advantages can be quantified or monetized, and we explain why almost none of those advantages can be monetized. Consistent with CAA section 112(n)(1)(B)'s direction to examine the rate and mass of mercury emissions, and the design of CAA section 112, which required swift reduction of the volume of HAP emissions based on an assumption of risk, we conclude that we should place substantial weight on reducing the large volume of HAP emissions from EGUs—both in absolute terms and relative to other source categories—that, absent MATS, was entering our air, water, and land, thus reducing the risk of grave harms that can occur as a result of exposure to HAP. Also consistent with the statutory design of CAA section 112, in considering the advantages of HAP reductions, we consider the distribution of those benefits, and the statute's clear goal in CAA section 112(n)(1)(C) and other provisions of CAA section 112 to protect the most exposed and susceptible populations, such as communities that are reliant on local fish for their survival, and developing fetuses. We think it is highly relevant that while EGUs generate power for all, and EGU HAP pollution poses risks to all Americans exposed to such HAP, a smaller set of Americans who live near EGUs face a disproportionate risk of being significantly harmed by toxic pollution. Finally, we also consider the identified risks to the environment posed by mercury and acid-gas HAP, consistent with CAA section 112(n)(1)(B) and the general goal of CAA

[2] The 2020 Final Action, while reversing the 2016 Supplemental Finding as to the EPA's determination that it was ''appropriate'' to regulate HAP from EGUs, did not rescind the Agency's prior determination that it was necessary to regulate. *See* 84 FR 2674 (February 7, 2019). Instead, the 2020 rulemaking stated that its rescission was based on the appropriate prong alone: ''CAA section 112(n)(1)(A) requires the EPA to determine that both the appropriate *and* necessary prongs are met. Therefore, if the EPA finds that either prong is not satisfied, it cannot make an affirmative appropriate and necessary finding. The EPA's reexamination of its determination . . . focuses on the first prong of that analysis.'' *Id.*

section 112 to reduce risks posed by HAP to the environment.

We next weigh those advantages against the disadvantages of regulation, principally in the form of the costs incurred to control HAP before they are emitted into the environment. Consistent with the statutory design, we consider those costs comprehensively, examining them in the context of the effect of those expenditures on the economics of power generation more broadly, the reliability of electricity, and the cost of electricity to consumers. These metrics are relevant to our weighing exercise because they give us a more complete picture of the disadvantages to producers and consumers of electricity imposed by this regulation, and because our conclusion might change depending on how this burden affects the ability of the industry to thrive and to provide reliable, affordable electricity to the benefit of all Americans. These metrics are relevant measures for evaluating costs to the utility sector in part because they are the types of metrics considered by the owners and operators of EGUs themselves. *See* 81 FR 24428 (April 25, 2016). Per CAA section 112(n)(1)(B), we further consider the availability and cost of control technologies, including the relationship of that factor to controls installed under the ARP.

As explained in detail in this document, we ultimately propose to conclude that, weighing the risks posed by HAP emissions from EGUs against the costs of reducing that pollution on the industry and society as a whole, it is worthwhile (*i.e.,* ''appropriate'') to regulate those emissions to protect all Americans, and in particular the most vulnerable populations, from the inherent risks posed by exposure to HAP emitted by coal- and oil-fired EGUs. We propose to find that this is true whether we are looking at the record in 2016 (*i.e.,* information available as of the time of the 2012 threshold finding and rulemaking) or at the updated record in 2021, in which we quantify additional risks posed by HAP emissions from EGUs and conclude that the actual cost of complying with MATS was almost certainly significantly less than the EPA's projected estimate in the 2011 RIA, primarily because fewer pollution controls were installed than projected and because the unexpected increases in natural gas supply led to a dramatic decrease in the price of natural gas.

In the 2016 Supplemental Finding we did not consider non-HAP health benefits that occur by virtue of controlling HAP from EGUs as a relevant factor for our consideration under the preferred approach. However, because the Supreme Court in *Michigan* directed us to consider health and environmental effects beyond those posed by HAP, ''including, for instance, harms that regulation might do to human health or the environment,'' and stressed that ''[n]o regulation is 'appropriate' if it does significantly more harm than good,'' 576 U.S. at 752, we take comment on whether it is reasonable to also consider the advantages associated with non-HAP emission reductions that result from the application of HAP controls as part of our totality-of-the-circumstances approach. In the 2012 MATS Final Rule, we found that regulating EGUs for HAP resulted in substantial health benefits accruing from coincidental reductions in particulate matter (PM) pollution and its precursors. We also projected that regulating EGUs for HAP would similarly result in an improvement in ozone pollution. While we propose to reach the conclusion that HAP regulation is appropriate even absent consideration of these additional benefits, adding these advantages to the weighing inquiry would provide further support for our proposed conclusion that the advantages of regulation outweigh the disadvantages.

We recognize, as we did in 2016, that our preferred, totality-of-the-circumstances approach to making the appropriate and necessary determination is an exercise in judgment, and that ''[r]easonable people, and different decision-makers, can arrive at different conclusions under the same statutory provision'' (81 FR 24431; April 25, 2016). However, this type of weighing of factors and circumstances is an inherent part of regulatory decision-making, and we think it is a reasonable approach where the factors the statute identifies as important to consider cannot be quantified or monetized.

Next, we turn to our alternative approach of a formal benefit-cost analysis (BCA). This approach independently supports the determination that it is appropriate to regulate EGU HAP. Based on the 2011 Regulatory Impacts Analysis (2011 RIA) [3] performed as part of the 2012 MATS Final Rule, the total net benefits of MATS were overwhelming even though the EPA was only able to monetize one of the many benefits of reducing HAP emissions from EGUs. Like the preferred approach, this conclusion is further supported by newer information on the risks posed by HAP emissions from EGUs as well as the actual costs of implementing MATS, which almost certainly were significantly lower than estimated in the 2011 RIA.

Our proposal is organized as follows. In section II.A of this preamble, we provide as background the regulatory and procedural history leading up to this proposal. We also detail, in preamble section II.B, the statutory design of HAP regulation that Congress added to the CAA in 1990 in the face of the EPA's failure to make meaningful progress in regulating HAP emissions from stationary sources. In particular, we point out that many provisions of CAA section 112 demonstrate the value Congress placed on reducing the volume of HAP emissions from stationary sources as much as possible and quickly, with a particular focus on reducing HAP related risks to the most exposed and most sensitive members of the public. This background assists in identifying the relevant statutory factors to weigh in considering the advantages and disadvantages of HAP regulation.

Against this backdrop, we propose to revoke the 2020 Final Action and reaffirm the 2016 determination that it remains appropriate to regulate HAP emissions from EGUs after a consideration of cost. Specifically, in section III.A of this preamble, we review the long-standing and extensive body of evidence, as well as new mercury-related risk analyses performed since 2016, identifying substantial risks to human health and the environment from HAP emissions from coal- and oil-fired EGUs that support a conclusion that regulating HAP emissions from EGUs is appropriate. In preamble section III.B, we analyze information regarding how the power sector elected to comply with MATS, and how our 2012 projections for the cost of regulation almost certainly overestimated the actual costs of the regulation by a significant amount. In preamble section III.C, we explain our reasons for revoking the 2020 Final Action, which applied an ill-suited framework for evaluating cost because it gave little to no weight to the statutory concern with reducing the volume of and risks from HAP emissions to protect even the most exposed and most vulnerable members of the public. In section III.D of this preamble, we describe and apply our preferred, totality-of-the-circumstances approach, giving particular weight to the factors identified in CAA section 112(n)(1) and 112 more generally. We propose to conclude that after considering all of the

[3] U.S. EPA. 2011. *Regulatory Impact Analysis for the Final Mercury and Air Toxics Standards.* EPA–452/R–11–011. Available at: *https://www3.epa.gov/ttn/ecas/docs/ria/utilities_ria_final-mats_2011-12.pdf.*

relevant factors and weighing the advantages of regulation against the cost of doing so, it is appropriate and necessary to regulate EGUs under CAA section 112. In section III.E of this preamble, we propose an alternative formal benefit-cost approach for making the appropriate and necessary determination. Under this approach, we propose to conclude that it remains appropriate to regulate HAP emissions from EGUs after considering cost because the BCA issued with the MATS rule indicated that the total net benefits of MATS were overwhelming even though the EPA was only able to monetize one of many statutorily identified benefits of regulating HAP emissions from EGUs. The new information examined by the EPA with respect to updated science and cost information only strengthens our conclusions under either of these methodologies. Section IV of this preamble notes that because this proposal reaffirms prior determinations and does not impact implementation of MATS, this action, if finalized, would not change those standards.

Finally, in preamble section V, in addition to soliciting comments on all aspects of this proposed action, we separately seek comment on any data or information that will assist in the EPA's ongoing review of the RTR that the Agency completed for MATS in 2020.

B. Does this action apply to me?

The source category that is the subject of this proposal is Coal- and Oil-Fired EGUs regulated by NESHAP under 40 CFR 63, subpart UUUUU, commonly known as MATS. The North American Industry Classification System (NAICS) codes for the Coal- and Oil-Fired EGU source category are 221112, 221122, and 921150. This list of NAICS codes is not intended to be exhaustive, but rather provides a guide for readers regarding the entities that this proposed action is likely to affect.

C. Where can I get a copy of this document and other related information?

In addition to being available in the docket, an electronic copy of this action is available on the internet. Following signature by the EPA Administrator, the EPA will post a copy of this proposed action at *https://www.epa.gov/stationary-sources-air-pollution/mercury-and-air-toxics-standards.* Following publication in the **Federal Register**, the EPA will post the **Federal Register** version of the proposal and key technical documents at this same website.

II. Background

A. Regulatory History

In the 1990 Amendments, Congress substantially modified CAA section 112 to address hazardous air pollutant emissions from stationary sources. CAA section 112(b)(1) sets forth a list of 187 identified HAP, and CAA sections 112(b)(2) and (3) give the EPA the authority to add or remove pollutants from the list. CAA section 112(a)(1) and (2) specify the two types of sources to be addressed: major sources and area sources. A major source is any stationary source or group of stationary sources at a single location and under common control that emits or has the potential to emit, considering controls, 10 tpy or more of any HAP or 25 tpy or more of any combination of HAP. CAA section 112(a)(1). Any stationary source of HAP that is not a major source is an area source.[4] CAA section 112(a)(2). All major source categories, besides EGUs, and certain area source categories, were required to be included on an initial published list of sources subject to regulation under CAA section 112. *See* CAA sections 112(a)(1) and (c)(1). The EPA is required to promulgate emission standards under CAA section 112(d) for every source category on the CAA section 112(c)(1) list.

The general CAA section 112(c) process for listing source categories does not apply to EGUs. Instead, Congress enacted a special provision, CAA section 112(n)(1)(A), which establishes a separate process by which the EPA determines whether to add EGUs to the CAA section 112(c) list of source categories that must be regulated under CAA section 112. Because EGUs were subject to other CAA requirements under the 1990 Amendments, most importantly the ARP, CAA section 112(n)(1)(A) directs the EPA to conduct a study to evaluate the hazards to public health that are reasonably anticipated to occur as a result of the HAP emissions from EGUs ''after imposition of the requirements of this chapter.'' *See* CAA section 112(n)(1)(A); *see also Michigan* v. *EPA,* 576 U.S. at 748 (''Quite apart from the hazardous-air-pollutants program, the Clean Air Act Amendments of 1990 subjected power plants to various regulatory requirements. The parties agree that these requirements were expected to have the collateral effect of reducing power plants' emissions of hazardous air pollutants, although the extent of the reduction was unclear.''). The provision directs that the EPA shall regulate EGUs under CAA section 112 if the Administrator determines, after considering the results of the study, that such regulation is ''appropriate and necessary.'' CAA section 112(n)(1)(A), therefore, sets a unique process by which the Administrator is to determine whether to add EGUs to the CAA section 112(c) list of sources that must be subject to regulation under CAA section 112.

The study required under CAA section 112(n)(1)(A) is one of three studies commissioned by Congress under CAA section 112(n)(1), a subsection entitled ''Electric utility steam generating units.'' The first, which, as noted, the EPA was required to consider before making the appropriate and necessary determination, was completed in 1998 and was entitled the *Study of Hazardous Air Pollutant Emissions from Electric Utility Steam Generating Units–Final Report to Congress* (Utility Study).[5] The Utility Study contained an analysis of HAP emissions from EGUs, an assessment of the hazards and risks due to inhalation exposures to these emitted pollutants, and a multipathway (inhalation plus non-inhalation exposures) risk assessment for mercury and a subset of other relevant HAP. The study indicated that mercury was the HAP of greatest concern to public health from coal- and oil-fired EGUs. The study also concluded that numerous control strategies were available to reduce HAP emissions from this source category. The second study commissioned by Congress under CAA section 112(n)(1)(B), the Mercury Study Report to Congress (Mercury Study),[6] was released in 1997. Under this provision, the statute tasked the EPA with focusing exclusively on mercury, but directed the Agency to look at other stationary sources of mercury emission in addition to EGUs, the rate and mass of emissions coming from those sources, available technologies for controlling mercury and the costs of such technologies, and a broader scope of impacts including environmental effects. As in the Utility Study, the EPA confirmed that mercury is highly toxic, persistent, and bioaccumulates in food chains. Fish consumption is the primary pathway for human exposure to mercury, which can lead to higher risks in certain populations. The third study, required under CAA section 112(n)(1)(C),

[4] The statute includes a separate definition of ''EGU'' that includes both major and area source power plant facilities. CAA section 112(a)(8).

[5] U.S. EPA. *Study of Hazardous Air Pollutant Emissions from Electric Utility Steam Generating Units—Final Report to Congress.* EPA–453/R–98–004a. February 1998.

[6] U.S. EPA. 1997. *Mercury Study Report to Congress.* EPA–452/R–97–003 December 1997.

directed the National Institute of Environmental Health Sciences (NIEHS) to conduct a study to determine the threshold level of mercury exposure below which adverse human health effects were not expected to occur (NIEHS Study). The statute required that the study include a threshold for mercury concentrations in the tissue of fish that could be consumed, even by sensitive populations, without adverse effects to public health. NIEHS submitted the required study to Congress in 1995.[7] *See* 76 FR 24982 (May 3, 2011). Later, after submission of the CAA section 112(n)(1) reports and as part of the fiscal year 1999 appropriations, Congress further directed the EPA to fund the National Academy of Sciences (NAS) to perform an independent evaluation of the data related to the health impacts of methylmercury, and, similar to the CAA section 112(n)(1)(C) inquiry, specifically to advise the EPA as to the appropriate reference dose (RfD) for methylmercury. Congress also indicated in the 1999 conference report directing the EPA to fund the NAS Study, that the EPA should not make the appropriate and necessary regulatory determination until the EPA had reviewed the results of the NAS Study. *See* H.R. Conf. Rep. No. 105–769, at 281–282 (1998). This last study, completed by the NAS in 2000, was entitled Toxicological Effects of Methylmercury (NAS Study),[8] and it presented a rigorous peer-review of the EPA's RfD for methylmercury. Based on the results of these studies and other available information, the EPA determined on December 20, 2000, pursuant to CAA section 112(n)(1)(A), that it is appropriate and necessary to regulate HAP emissions from coal- and oil-fired EGUs and added such units to the CAA section 112(c) list of source categories that must be regulated under CAA section 112. *See* 65 FR 79825 (December 20, 2000) (2000 Determination).[9]

In 2005, the EPA revised the original 2000 Determination and concluded that it was neither appropriate nor necessary to regulate EGUs under CAA section 112 in part because the EPA concluded it could address risks from EGU HAP emissions under a different provision of the statute. *See* 70 FR 15994 (March 29, 2005) (2005 Revision). Based on that determination, the EPA removed coal- and oil-fired EGUs from the CAA section 112(c) list of source categories to be regulated under CAA section 112. In a separate but related 2005 action, the EPA also promulgated the Clean Air Mercury Rule (CAMR), which established CAA section 111 standards of performance for mercury emissions from EGUs. *See* 70 FR 28605 (May 18, 2005). Both the 2005 Revision and the CAMR were vacated by the D.C. Circuit in 2008. *New Jersey* v. *EPA,* 517 F.3d 574 (DC Cir. 2008). The D.C. Circuit held that the EPA failed to comply with the requirements of CAA section 112(c)(9) for delisting source categories, and consequently also vacated the CAA section 111 performance standards promulgated in CAMR, without addressing the merits of those standards. *Id.* at 582–84.

Subsequent to the *New Jersey* decision, the EPA conducted additional technical analyses, including peer-reviewed risk assessments on human health effects associated with mercury (2011 Final Mercury TSD)[10] and non-mercury metal HAP emissions from EGUs (2011 Non-Hg HAP Assessment).[11] Those analyses, which focused on populations with higher fish consumption (*e.g.,* subsistence fishers) and residents living near the facilities who experienced increased exposure to HAP through inhalation, found that mercury and non-mercury HAP emissions from EGUs remain a public health hazard and that EGUs were the largest anthropogenic source of mercury emissions to the atmosphere in the U.S. Based on these findings, and other relevant information regarding the volume of HAP, environmental effects, and availability of controls, in 2012, the EPA affirmed the original 2000 Determination that it is appropriate and necessary to regulate EGUs under CAA section 112. *See* 77 FR 9304 (February 16, 2012).

In the same 2012 action, the EPA established a NESHAP, commonly referred to as MATS, that required coal- and oil-fired EGUs to meet HAP emission standards reflecting the application of the maximum achievable control technology (MACT) for all HAP emissions from EGUs.[12] MATS applies to existing and new coal- and oil-fired EGUs located at both major and area sources of HAP emissions. An EGU is a fossil fuel-fired steam generating combustion unit of more than 25 megawatts (MW) that serves a generator that produces electricity for sale. *See* CAA section 112(a)(8) (defining EGU). A unit that cogenerates steam and electricity and supplies more than one-third of its potential electric output capacity and more than 25 MW electric output to any utility power distribution system for sale is also an EGU. *Id.*

For coal-fired EGUs, MATS includes standards to limit emissions of mercury, acid gas HAP, non-mercury HAP metals (*e.g.,* nickel, lead, chromium), and organic HAP (*e.g.,* formaldehyde, dioxin/furan). Standards for HCl serve as a surrogate for the acid gas HAP, with an alternate standard for sulfur dioxide (SO_2) that may be used as a surrogate for acid gas HAP for those coal-fired EGUs with flue gas desulfurization (FGD) systems and SO_2 continuous emissions monitoring systems that are installed and operational. Standards for filterable PM serve as a surrogate for the non-mercury HAP metals, with standards for total non-mercury HAP metals and individual non-mercury HAP metals provided as alternative equivalent standards. Work practice standards that require periodic combustion process tune-ups were established to limit formation and emissions of the organic HAP.

For oil-fired EGUs, MATS includes standards to limit emissions of HCl and HF, total HAP metals (*e.g.,* mercury, nickel, lead), and organic HAP (*e.g.,* formaldehyde, dioxin/furan). Standards for filterable PM serve as a surrogate for total HAP metals, with standards for total HAP metals and individual HAP metals provided as alternative equivalent standards. Periodic combustion process tune-up work practice standards were established to

[7] National Institute of Environmental Health Sciences (NIEHS) Report on Mercury; available in the rulemaking docket at EPA–HQ–OAR–2009–0234–3053.

[8] National Research Council (NAS). 2000. *Toxicological Effects of Methylmercury.* Committee on the Toxicological Effects of Methylmercury, Board on Environmental Studies and Toxicology, National Research Council. Many of the peer-reviewed articles cited in this section are publications originally cited in the NAS report.

[9] In the same 2000 action, the EPA Administrator found that regulation of HAP emissions from natural gas-fired EGUs is not appropriate or necessary because the impacts due to HAP emissions from such units are negligible. *See* 65 FR 79831 (December 20, 2000).

[10] U.S. EPA. 2011. *Revised Technical Support Document: National-Scale Assessment of Mercury Risk to Populations with High Consumption of Self-caught Freshwater Fish in Support of the Appropriate and Necessary Finding for Coal- and Oil-Fired Electric Generating Units.* Office of Air Quality Planning and Standards. December 2011. EPA–452/R–11–009. Docket ID Item No. EPA–HQ–OAR–2009–0234–19913 (2011 Final Mercury TSD).

[11] U.S. EPA. 2011. *Supplement to the Non-Hg Case Study Chronic Inhalation Risk Assessment In Support of the Appropriate and Necessary Finding for Coal- and Oil-Fired Electric Generating Units.* Office of Air Quality Planning and Standards. November 2011. EPA–452/R–11–013. Docket ID Item No. EPA–HQ–OAR–2009–0234–19912 (2011 Non-Hg HAP Assessment).

[12] Although the 2012 MATS Final Rule has been amended several times, the amendments are not a result of actions regarding the appropriate and necessary determination and, therefore, are not discussed in this preamble. Detail regarding those amendatory actions can be found at *https://www.epa.gov/stationary-sources-air-pollution/mercury-and-air-toxics-standards.*

limit formation and emissions of the organic HAP.

Additional detail regarding the types of units regulated under MATS and the regulatory requirements that they are subject to can be found in 40 CFR 63, subpart UUUUU.[13] The existing source compliance date was April 16, 2015, but many existing sources were granted an additional 1-year extension of the compliance date for the installation of controls.

After MATS was promulgated, both the rule itself and many aspects of the EPA's appropriate and necessary determination were challenged in the D.C. Circuit. In *White Stallion Energy Center* v. *EPA,* the D.C. Circuit unanimously denied all challenges to MATS, with one exception discussed below in which the court was not unanimous. 748 F.3d 1222 (D.C. Cir. 2014). As part of its decision, the D.C. Circuit concluded that the ''EPA's 'appropriate and necessary' determination in 2000, and the reaffirmation of that determination in 2012, are amply supported by EPA's findings regarding the health effects of mercury exposure.'' *Id.* at 1245.[14] While joining the D.C. Circuit's conclusions as to the adequacy of the EPA's identification of public health hazards, one judge dissented on the issue of whether the EPA erred by not considering costs together with the harms of HAP pollution when making the ''appropriate and necessary'' determination, finding that cost was a required consideration under that determination. *Id.* at 1258–59 (Kavanaugh, J., dissenting).

The U.S. Supreme Court subsequently granted *certiorari,* directing the parties to address a single question posed by the Court itself: ''Whether the Environmental Protection Agency unreasonably refused to consider cost in determining whether it is appropriate to regulate hazardous air pollutants emitted by electric utilities.'' *Michigan* v. *EPA,* 135 S. Ct. 702 (Mem.) (2014). In 2015, the U.S. Supreme Court held that ''EPA interpreted [CAA section 112(n)(1)(A)] unreasonably when it deemed cost irrelevant to the decision to regulate power plants.'' *Michigan,* 576 U.S. at 760. In so holding, the U.S. Supreme Court found that the EPA ''must consider cost–including, most importantly, cost of compliance–before deciding whether regulation is appropriate and necessary.'' *Id.* at 2711. It is ''up to the Agency,'' the Court added, ''to decide (as always, within the limits of reasonable interpretation) how to account for cost.'' *Id.* The rule was ultimately remanded back to the EPA to complete the required cost analysis, and the D.C. Circuit left the MATS rule in place pending the completion of that analysis. *White Stallion Energy Center* v. *EPA,* No. 12–1100, ECF No. 1588459 (D.C. Cir. December 15, 2015).

In response to the U.S. Supreme Court's direction, the EPA finalized a supplemental finding on April 25, 2016, that evaluated the costs of complying with MATS and concluded that the appropriate and necessary determination was still valid. The 2016 Supplemental Finding promulgated two different approaches to incorporate cost into the decision-making process for the appropriate and necessary determination. *See* 81 FR 24420 (April 25, 2016). The EPA determined that both approaches independently supported the conclusion that regulation of HAP emissions from EGUs is appropriate and necessary.

The EPA's preferred approach to incorporating cost evaluated estimated costs of compliance with MATS against several cost metrics relevant to the EGU sector (*e.g.,* historical annual revenues, annual capital expenditures, and impacts on retail electricity prices), and found that the projected costs of MATS were reasonable for the sector in comparison with historical data on those metrics. The evaluation of cost metrics that the EPA applied was consistent with approaches commonly used to evaluate environmental policy cost impacts.[15] The EPA also examined as part of its cost analysis what the impact of MATS would be on retail electricity prices and the reliability of the power grid. Using a totality-of-the-circumstances approach, the EPA weighed these supplemental findings as to cost against the existing administrative record detailing the identified hazards to public health and the environment from mercury, non-mercury metal HAP, and acid gas HAP that are listed under CAA section 112, and the other advantages to regulation. Based on that balancing, the EPA concluded under the preferred approach that it remains appropriate to regulate HAP emissions from EGUs after considering cost. *See* 81 FR 24420 (April 25, 2016) (''After evaluating cost reasonableness using several different metrics, the Administrator has, in accordance with her statutory duty under CAA section 112(n)(1)(A), weighed cost against the previously identified advantages of regulating HAP emissions from EGUs—including the agency's prior conclusions about the significant hazards to public health and the environment associated with such emissions and the volume of HAP that would be reduced by regulation of EGUs under CAA section 112.'')

In a second alternative and independent approach (referred to as the alternative approach), the EPA considered the BCA in the 2011 RIA for the 2012 MATS Final Rule. *Id.* at 24421. In that analysis, even though the EPA was only able to monetize one HAP-specific endpoint, the EPA estimated that the final MATS rule would yield annual monetized net benefits (in 2007 dollars) of between $37 billion to $90 billion using a 3-percent discount rate and between $33 billion to $81 billion using a 7-percent discount rate, in comparison to the projected $9.6 billion in annual compliance costs. *See id.* at 24425. The EPA therefore determined that the alternative approach also independently supported the conclusion that regulation of HAP emissions from EGUs remains appropriate after considering cost. *Id.*

Several state and industry groups petitioned for review of the 2016 Supplemental Finding in the D.C. Circuit. *Murray Energy Corp.* v. *EPA,* No. 16–1127 (D.C. Cir. filed April 25, 2016). In April 2017, the EPA moved the D.C. Circuit to continue oral argument and hold the case in abeyance in order to give the then-new Administration an opportunity to review the 2016 action, and the D.C. Circuit ordered that the consolidated challenges to the 2016

[13] Available at *www.ecfr.gov/cgi-bin/text-idx?node=sp40.15.63.uuuuu.*

[14] In discussing the 2011 Final Mercury TSD, the D.C. Circuit concluded that the EPA considered the available scientific information in a rational manner, and stated:

As explained in the technical support document (TSD) accompanying the Final Rule, EPA determined that mercury emissions posed a significant threat to public health based on an analysis of women of child-bearing age who consumed large amounts of freshwater fish. *See* [2011 Final] Mercury TSD . . . . The design of EPA's TSD was neither arbitrary nor capricious; the study was reviewed by EPA's independent Science Advisory Board, stated that it ''support[ed] the overall design of and approach to the risk assessment'' and found ''that it should provide an objective, reasonable, and credible determination of potential for a public health hazard from mercury emissions emitted from U.S. EGUs.'' . . . In addition, EPA revised the final TSD to address SAB's remaining concerns regarding EPA's data collection practices.

Id. at 1245–46.

[15] For example, see ''Economic Impact and Small Business Analysis–Mineral Wool and Wool Fiberglass RTRs and Wool Fiberglass Area Source NESHAP'' (U.S. EPA, 2015; *https://www.epa.gov/sites/default/files/2020-07/documents/mwwf_eia_neshap_final_07-2015.pdf*) or ''Economic Impact Analysis of Final Coke Ovens NESHAP'' (U.S. EPA, 2002; *https://www.epa.gov/sites/default/files/2020-07/documents/coke-ovens_eia_neshap_final_08-2002.pdf*).

Supplemental Finding be held in abeyance (*i.e.,* temporarily on hold).[16]

Accordingly, the EPA reviewed the 2016 action, and on May 22, 2020, finalized a revised response to the *Michigan* decision. *See* 85 FR 31286 (May 22, 2020). In the 2020 Final Action, after primarily comparing the projected costs of compliance to the one post control HAP emission reduction benefit that could be monetized, the EPA reconsidered its previous determination and found that it is not appropriate to regulate HAP emissions from coal- and oil-fired EGUs after a consideration of cost, thereby reversing the Agency's conclusion under CAA section 112(n)(1)(A), first made in 2000 and later affirmed in 2012 and 2016. Specifically, in its reconsideration, the Agency asserted that the 2016 Supplemental Finding considering the cost of MATS was flawed based on its assessment that neither of the two approaches to considering cost in the 2016 Supplemental Finding satisfied the EPA's obligation under CAA section 112(n)(1)(A), as that provision was interpreted by the U.S. Supreme Court in *Michigan.* Additionally, the EPA determined that, while finalizing the action would reverse the 2016 Supplemental Finding, it would not remove the Coal- and Oil-Fired EGU source category from the CAA section 112(c)(1) list, nor would it affect the existing CAA section 112(d) emissions standards regulating HAP emissions from coal- and oil-fired EGUs that were promulgated in the 2012 MATS Final Rule.[17] *See* 85 FR 31312 (May 22, 2020).

In the 2020 Final Action, the EPA also finalized the risk review required by CAA section 112(f)(2) and the first technology review required by CAA section 112(d)(6) for the Coal- and Oil-Fired EGU source category regulated under MATS.[18] The EPA determined that residual risks due to emissions of air toxics from the Coal- and Oil-Fired EGU source category are acceptable and that the current NESHAP provides an ample margin of safety to protect public health and to prevent an adverse environmental effect. In the technology review, the EPA did not identify any new developments in HAP emission controls to achieve further cost-effective emissions reductions. Based on the results of these reviews, the EPA found that no revisions to MATS were warranted. *See* 85 FR 31314 (May 22, 2020).

Several states, industry, public health, environmental, and civil rights groups petitioned for review of the 2020 Final Action in the D.C. Circuit. *American Academy of Pediatrics* v. *Regan,* No. 20–1221 and consolidated cases (D.C. Cir. filed June 19, 2020). On September 28, 2020, the D.C. Circuit granted the EPA's unopposed motion to sever from the lead case and hold in abeyance two of the petitions for review: *Westmoreland Mining Holdings LLC* v. *EPA,* No. 20–1160 (D.C. Cir. filed May 22, 2020) (challenging the 2020 Final Action as well as prior EPA actions related to MATS, including a challenge to the MATS CAA section 112(d) standards on the basis that the 2020 Final Action's reversal of the appropriate and necessary determination provided a "grounds arising after" for filing a petition outside the 60-day window for judicial review of MATS), and *Air Alliance Houston* v. *EPA,* No. 20–1268 (D.C. Cir. filed July 21, 2020) (challenging only the RTR portion of the 2020 Final Action).[19]

On January 20, 2021, President Biden signed Executive Order 13990, "Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis." The Executive Order, among other things, instructs the EPA to review the 2020 Final Action and consider publishing a notice of proposed rulemaking suspending, revising, or rescinding that action. In February 2021, the EPA moved the D.C. Circuit to hold *American Academy of Pediatrics* and consolidated cases in abeyance, pending the Agency's review of the 2020 Final Action as prompted in Executive Order 13990, and on February 16, 2021, the D.C. Circuit granted the Agency's motion.[20]

In the meantime, the requirements of MATS have been fully implemented, resulting in significant reductions in HAP emissions from EGUs and the risks associated with those emissions. The EPA had projected that annual EGU mercury emissions would be reduced by 75 percent with MATS implementation. In fact, EGU emission reductions have been far more substantial (down to approximately 4 tons in 2017), which represents an 86 percent reduction compared to 2010 (pre-MATS) levels. *See* Table 4 at 84 FR 2689 (February 7, 2019). Acid gas HAP and non-mercury metal HAP have similarly been reduced—by 96 percent and 81 percent, respectively—as compared to 2010 levels. *Id.* MATS is the only Federal requirement that guarantees this level of HAP control from EGUs.

The EPA is now proposing to revoke the 2020 reconsideration of the 2016 Supplemental Finding and to reaffirm once again that it is appropriate and necessary to regulate emissions of HAP from coal- and oil-fired EGUs. We will provide notice of the results of our review of the 2020 RTR in a separate future action.

B. Statutory Background

Additional statutory context is useful to help identify the relevant factors that the Administrator should weigh when making the appropriate and necessary determination.

1. Pre-1990 History of HAP Regulation

In 1970, Congress enacted CAA section 112 to address the millions of pounds of HAP emissions that were estimated to be emitted from stationary sources in the country. At that time, the CAA defined HAP as "an air pollutant to which no ambient air quality standard is applicable and which, in the judgment of the Administrator may cause, or contribute to, an increase in mortality or an increase in serious irreversible, or incapacitating reversible, illness," but the statute left it to the EPA to identify and list pollutants that were HAP. Once a HAP was listed, the statute required the EPA to regulate sources of that identified HAP "at the level which in [the Administrator's] judgment provides an ample margin of safety to protect the public health from such hazardous air pollutants." CAA section 112(b)(1)(B) (pre-1990 amendments); Legislative History of the CAA Amendments of 1990 ("Legislative

[16] Order, *Murray Energy Corp.* v. *EPA,* No. 16–1127 (D.C. Cir. April 27, 2017), ECF No. 1672987. In response to a joint motion from the parties to govern future proceedings, the D.C. Circuit issued an order in February 2021 to continue to hold the consolidated cases in *Murray Energy Corp.* v. *EPA* in abeyance. Order, *Murray Energy Corp.* v. *EPA,* No. 16–1127 (D.C. Cir. February 25, 2021), ECF No. 1887125.

[17] This finding was based on *New Jersey* v. *EPA,* 517 F.3d 574 (D.C. Cir. 2008), which held that the EPA is not permitted to remove source categories from the CAA section 112(c)(1) list unless the CAA section 112(c)(9) criteria for delisting have been met.

[18] CAA section 112(f)(2) requires the EPA to conduct a one-time review of the risks remaining after imposition of MACT standards under CAA section 112(d)(2) within 8 years of the effective date of those standards (risk review). CAA section 112(d)(6) requires the EPA to conduct a review of all CAA section 112(d) standards at least every 8 years to determine whether it is necessary to establish more stringent standards after considering, among other things, advances in technology and costs of additional control (technology review). The EPA has always conducted the first technology review at the same time it conducts the risk review and collectively the actions are known at RTRs.

[19] Order, *Westmoreland Mining Holdings LLC* v. *EPA,* No. 20–1160 (D.C. Cir. September 28, 2020), ECF No. 1863712.

[20] Order, *American Academy of Pediatrics* v. *Regan,* No. 20–1221 (D.C. Cir. February 16, 2021), ECF No. 1885509.

History''), at 3174–75, 3346 (Comm. Print 1993). The statute did not define the term ''ample margin of safety'' or provide a risk metric on which the EPA was to establish standards, and initially the EPA endeavored to account for costs and technological feasibility in every regulatory decision. In *Natural Resources Defense Council (NRDC)* v. *EPA,* 824 F.2d 1146 (D.C. Cir. 1987), the D.C. Circuit concluded that the CAA required that in interpreting what constitutes ''safe,'' the EPA was prohibited from considering cost and technological feasibility. *Id.* at 1166.

The EPA subsequently issued the NESHAP for benzene in accordance with the *NRDC* holding.[21] Among other things, the Benzene NESHAP concluded that there is a rebuttable presumption that any cancer risk greater than 100-in-1 million to the most exposed individual is unacceptable, and per *NRDC,* must be addressed without consideration of cost or technological feasibility. The Benzene NESHAP further provided that, after evaluating the acceptability of cancer risks, the EPA must evaluate whether the current level of control provides an ample margin of safety for any risk greater than 1-in-1 million and, if not, the EPA will establish more stringent standards as necessary after considering cost and technological feasibility.[22]

2. Clean Air Act 1990 Amendments to Section 112

In 1990, Congress radically transformed section 112 of the CAA and its treatment of hazardous air pollution. The legislative history of the amendments indicates Congress' dissatisfaction with the EPA's slow pace addressing these pollutants under the 1970 CAA: ''In theory, [hazardous air pollutants] were to be stringently controlled under the existing Clean Air Act section 112. However, . . . only seven of the hundreds of potentially hazardous air pollutants have been regulated by EPA since section 112 was enacted in 1970.'' H.R. Rep. No. 101–490, at 315 (1990); *see also id.* at 151 (noting that in 20 years, the EPA's establishment of standards for only seven HAP covered ''a small fraction of the many substances associated . . . with cancer, birth defects, neurological damage, or other serious health impacts.''). Congress was concerned with how few sources had been addressed during this time. *Id.* (''[The EPA's] regulations sometimes apply only to limited sources of the relevant pollutant. For example, the original benzene standard covered just one category of sources (equipment leaks). Of the 50 toxic substances emitted by industry in the greatest volume in 1987, only one—benzene—has been regulated even partially by EPA.''). Congress noted that state and local regulatory efforts to act in the face of ''the absence of Federal regulations'' had ''produced a patchwork of differing standards,'' and that ''[m]ost states . . . limit the scope of their program by addressing a limited number of existing sources or source categories, or by addressing existing sources only on a case-by-case basis as problem sources are identified'' and that ''[o]ne state exempts all existing sources from review.'' *Id.*

In enacting the 1990 Amendments with respect to the control of hazardous air pollution, Congress noted that ''[p]ollutants controlled under [section 112] tend to be less widespread than those regulated [under other sections of the CAA], but are often associated with more serious health impacts, such as cancer, neurological disorders, and reproductive dysfunctions.'' *Id.* at 315. In its substantial 1990 Amendments, Congress itself listed 189 HAP (CAA section 112(b)) and set forth a statutory structure that would ensure swift regulation of a significant majority of these HAP emissions from stationary sources. Specifically, after defining major and area sources and requiring the Agency to list all major sources and many area sources of the listed pollutants (CAA section 112(c)), the new CAA section 112 required the Agency to establish technology-based emission standards for listed source categories on a prompt schedule and to revisit those technology-based standards every 8 years (CAA section 112(d) (emission standards); CAA section 112(e) (schedule for standards and review)). The 1990 Amendments also obligated the EPA to evaluate the residual risk within 8 years of promulgation of technology-based standards. CAA section 112(f)(2).

In setting the standards, CAA section 112(d) requires the Agency to establish technology-based standards that achieve the ''maximum degree of reduction,'' ''including a prohibition on such emissions where achievable.'' CAA section 112(d)(2). Congress specified that the maximum degree of reduction must be at least as stringent as the average level of control achieved in practice by the best performing sources in the category or subcategory based on emissions data available to the Agency at the time of promulgation. This technology-based approach permitted the EPA to swiftly set standards for source categories without determining the risk or cost in each specific case, as the EPA had done prior to the 1990 Amendments. In other words, this approach to regulation quickly required that all major sources and many area sources of HAP install control technologies consistent with the top performers in each category, which had the effect of obtaining immediate reductions in the volume of HAP emissions from stationary sources. The statutory requirement that sources obtain levels of emission limitation that have actually been achieved by existing sources, instead of levels that could theoretically be achieved, inherently reflects a built-in cost consideration.[23]

Further, after determining the minimum stringency level of control, or MACT floor, CAA section 112(d)(2) requires the Agency to determine whether more stringent standards are achievable after considering the cost of achieving such standards and any non-air-quality health and environmental impacts and energy requirements of additional control. In doing so, the statute further specifies in CAA section 112(d)(2) that the EPA should consider requiring sources to apply measures that, among other things, ''reduce the volume of, or eliminate emissions of, such pollutants . . .'' (CAA section 112(d)(2)(A)), ''enclose systems or processes to eliminate emissions'' (CAA section 112(d)(2)(B)), and ''collect, capture, or treat such pollutants when released . . .'' (CAA section 112(d)(2)(C)). The 1990 Amendments also built in a regular review of new

[21] National Emissions Standards for Hazardous Air Pollutants: Benzene Emissions from Maleic Anhydride Plants, Ethylbenzene/Styrene Plants, Benzene Storage Vessels, Benzene Equipment Leaks, and Coke By-Product Recovery Plants (Benzene NESHAP). 54 FR 38044 (September 14, 1989).

[22] ''In protecting public health with an ample margin of safety under section 112, EPA strives to provide maximum feasible protection against risks to health from hazardous air pollutants by (1) protecting the greatest number of persons possible to an individual lifetime risk level no higher than approximately 1 in 1 million and (2) limiting to no higher than approximately 1 in 10 thousand the estimated risk that a person living near a plant would have if he or she were exposed to the maximum pollutant concentrations for 70 years.'' Benzene NESHAP, 54 FR 38044–5, September 14, 1989.

[23] Congress recognized as much:

''The Administrator may take the cost of achieving the maximum emission reduction and any non-air quality health and environmental impacts and energy requirements into account when determining the emissions limitation which is achievable for the sources in the category or subcategory. Cost considerations are reflected in the selection of emissions limitations which have been achieved in practice (rather than those which are merely theoretical) by sources of a similar type or character.''

A Legislative History of the Clean Air Act Amendments of 1990 (CAA Legislative History), Vol 5, pp. 8508 –8509 (CAA Amendments of 1989; p. 168–169; Report of the Committee on Environment and Public Works S. 1630).

technologies and a one-time review of risks that remain after imposition of MACT standards. CAA section 112(d)(6) requires the EPA to evaluate every NESHAP no less often than every 8 years to determine whether additional control is necessary after taking into consideration ''developments in practices, processes, and control technologies,'' without regard to risk. CAA section 112(f) requires the EPA to ensure that the risks are acceptable and that the MACT standards provide an ample margin of safety.

The statutory requirement to establish technology-based standards under CAA section 112 avoided the need for the EPA to identify hazards to public health and the environment in order to justify regulation of HAP emissions from stationary sources, reflecting Congress' judgment that such emissions are inherently dangerous. *See* S. Rep. No. 101–228, at 148 (''The MACT standards are based on the performance of technology, and not on the health and environmental effects of the [HAP].''). The technology review required in CAA section 112(d)(6) further mandates that the EPA continually evaluate standards to determine if additional reductions can be obtained, without consideration of the specific risk associated with the HAP emissions that would be reduced. Notably, the CAA section 112(d)(6) review of what additional reductions may be obtained based on new technology is required *even after* the Agency has conducted the CAA section 112(f)(2) review and determined that the existing standard will protect the public with an ample margin of safety.

The statutory structure and legislative history also demonstrate Congress' concern with the many ways that HAP can harm human health and Congress' goal of protecting the most exposed and vulnerable members of society. The committee report accompanying the 1990 Amendments discussed the scientific understanding regarding HAP risk at the time, including the 1989 report on benzene performed by the EPA noted above. H.R. Rep. No. 101–490, at 315. Specifically, Congress highlighted the EPA's findings as to cancer incidence, and importantly, lifetime individual risk to the most exposed individuals. *Id.* The report also notes the limitations of the EPA's assessment: ''The EPA estimates evaluated the risks caused by emissions of a single toxic air pollutant from each plant. But many facilities emit numerous toxic pollutants. The agency's risk assessments did not consider the combined or synergistic effects of exposure to multiple toxics, or the effect of exposure through indirect pathways.'' *Id.* Congress also noted the EPA's use of the maximum exposed individual (MEI) tool to assess risks faced by heavily exposed citizens. *Id.* The report cited particular scientific studies demonstrating that some populations are more affected than others—for example, it pointed out that ''[b]ecause of their small body weight, young children and fetuses are especially vulnerable to exposure to PCB-contaminated fish. One study has found long-term learning disabilities in children who had eaten high-levels of Great Lakes fish.'' *Id.*

The statutory structure confirms Congress' approach to risk and sensitive populations. As noted, the CAA section 112(f)(2) residual risk review requires the EPA to consider whether, after imposition of the CAA section 112(d)(2) MACT standard, there are remaining risks from HAP emissions that warrant more stringent standards to provide an ample margin of safety to protect public health or to prevent an adverse environmental effect. *See* CAA section 112(f)(2)(A). Specifically, the statute requires the EPA to promulgate standards under the risk review provision if the CAA section 112(d) standard does 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.'' *Id.* Thus, even after the application of MACT standards, the statute directs the EPA to conduct a rulemaking if even *one* person has a risk, not a guarantee, of getting cancer. This demonstrates the statutory intent to protect even the most exposed member of the population from the harms attendant to exposure to HAP emissions.

If a residual risk rulemaking is required, as noted above, the statute incorporates the detailed rulemaking approach set forth in the Benzene NESHAP for determining whether HAP emissions from stationary sources pose an unacceptable risk and whether standards provide an ample margin of safety. *See* CAA section 112(f)(2)(B) (preserving the prior interpretation of ''ample margin of safety'' set forth in the Benzene NESHAP). That approach includes a rebuttable presumption that any cancer risk greater than 100-in-1 million to the most exposed person is per se unacceptable. For non-cancer chronic and acute risks, the EPA has more discretion to determine what is acceptable, but even then, the statute requires the EPA to evaluate the risks to the most exposed individual and our RfDs are developed with the goal of being protective of even sensitive members of the population. *See e.g.,* CAA section 112(n)(1)(C) (requiring, in part, the development of ''a threshold for mercury concentration in the tissue of fish which may be consumed (including consumption by sensitive populations) without adverse effects to public health''). If risks are found to be unacceptable, the EPA must impose additional control requirements to ensure that post CAA section 112(f) risks from HAP emissions are at an acceptable level, regardless of cost and technological feasibility.

After determining whether the risks are acceptable and developing standards to achieve an acceptable level of risk if necessary, the EPA must then determine whether more stringent standards are necessary to provide an ample margin of safety to protect public health, and at this stage we must take into consideration cost, technological feasibility, uncertainties, and other relevant factors. As stated in the Benzene NESHAP, ''In protecting public health with an ample margin of safety under section 112, EPA strives to provide maximum feasible protection against risks to health from hazardous air pollutants by . . . protecting the greatest number of persons possible to an individual lifetime risk level no higher than approximately 1 in 1 million.'' *See* 54 FR 38044–45 (September 14, 1989); *see also NRDC* v. *EPA,* 529 F.3d 1077, 1082 (D.C. Cir. 2008) (finding that ''the Benzene NESHAP standard established a maximum excess risk of 100-in-one million, while adopting the one-in-one million standard as an aspirational goal.'').

The various listing and delisting provisions of CAA section 112 further demonstrate a statutory intent to reduce risk and protect the most exposed members of the population from HAP emissions. *See, e.g.,* CAA section 112(b)(2) (requiring the EPA to add pollutants to the HAP list if the EPA determines the HAP ''presents, or may present'' adverse human health or adverse environmental effects); *id.* at CAA section 112(b)(3)(B) (requiring the EPA to add a pollutant to the list if a petitioner shows that a substance is known to cause or ''may reasonably be anticipated to cause adverse effects to human health or adverse environmental effects''); *id.* at CAA section 112(b)(3) (authorizing the EPA to delete a substance only on a showing that ''the substance may not reasonably be anticipated to cause any adverse effects to human health or adverse environmental effects.''); *id.* at CAA section 112(c)(9)(B)(i) (prohibiting the EPA from delisting a source category if even one source in the category causes a lifetime cancer risk greater than 1-in-1 million to ''the individual in the population who is most exposed to emissions of such pollutants from the source.''); *id.* at CAA section 7412(c)(9)(B)(i) (prohibiting the EPA from delisting a source category unless the Agency determines that the non-cancer causing HAP emitted from the source category do not ''exceed a level which is adequate to protect public health with an ample margin of safety and no adverse environmental effect will result from emissions of any source'' in the category); *id.* at CAA section 112(n)(1)(C) (requiring a study to determine the level of mercury in fish tissue that can be consumed by even sensitive populations without adverse effect to public health).

The deadlines for action included in the 1990 Amendments indicate that Congress wanted HAP pollution addressed quickly. The statute requires the EPA to list all major source categories within 1 year of the 1990 Amendments and to regulate those listed categories on a strict schedule that prioritizes the source categories that are known or suspected to pose the greatest risks to the public. *See* CAA sections 112(c)(1), 112(e)(1) and 112(e)(2). For area sources, where the statute provides the EPA with greater discretion to determine the sources to regulate, it also directs the Agency to collect the information necessary to make the listing decision for many area source categories and requires the Agency to act on that information by a date certain.

For example, CAA section 112(k) establishes an area source program designed to identify and list at least 30 HAP that pose the greatest threat to public health in the largest number of urban areas (urban HAP) and to list for regulation area sources that account for at least 90 percent of the area source emissions of the 30 urban HAP. *See* CAA sections 112(k) and 112(c)(3). In addition to the urban air toxics program, CAA section 112(c)(6) directs the EPA to identify and list sufficient source categories to ensure that at least 90 percent of the aggregate emissions of seven bioaccumulative and persistent HAP, including mercury, are subject to standards pursuant to CAA sections 112(d)(2) or (d)(4). *See* CAA section 112(c)(6). Notably, these requirements were *in addition to* any controls on mercury and other CAA section 112(c)(6) HAP that would be imposed if the EPA determined it was appropriate and necessary to regulate EGUs under CAA section 112. This was despite the fact that it was known at the time of enactment that other categories with much lower emissions of mercury would have to be subject to MACT standards because of the exclusion of EGUs from CAA section 112(c)(6).

As the preceding discussion demonstrates, throughout CAA section 112 and its legislative history, Congress made clear its intent to quickly secure large reductions in the volume of HAP emissions from stationary sources because of its recognition of the hazards to public health and the environment inherent in exposure to such emissions. CAA section 112 and its legislative history also reveal Congress' understanding that fully characterizing the risks posed by HAP emissions was exceedingly difficult; thus, Congress purposefully replaced a regime that required an assessment of risk in the first instance with one that assumed that risk and directed swift and substantial reductions. The statutory design and direction also repeatedly emphasize that the EPA should regulate with the most exposed and most sensitive members of the population in mind in order to achieve an acceptable level of HAP emissions with an ample margin of safety. As explained further below, this statutory context informs the EPA's judgment as to the relevant factors to weigh in the analysis of whether regulation remains appropriate after a consideration of cost.

III. Proposed Determination Under CAA Section 112(n)(1)(A)

In this action, the EPA is proposing to revoke the 2020 Final Action and to reaffirm the appropriate and necessary determination made in 2000, and reaffirmed in 2012 and 2016.[24] We propose to find that, under either our preferred totality-of-the-circumstances framework or our alternative formal BCA framework, the information that would have been available to the Agency as of the time of the 2012 rulemaking supports a determination that it is appropriate and necessary to regulate HAP from EGUs. We also consider new information regarding the hazards to public health and the environment and the costs of compliance with MATS that has become available since the 2016 Supplemental Finding, and find that the updated information strengthens the EPA's conclusion that it is appropriate and necessary to regulate HAP from coal- and oil-fired EGUs.

At the outset, we note that CAA section 112(n)(1)(A) is silent as to whether the EPA may consider updated information when acting on a remand of the appropriate and necessary determination. CAA section 112(n)(1)(A) directs the EPA to conduct the Utility Study within 3 years, and requires the EPA to regulate EGUs if the Administrator makes a finding that it is appropriate and necessary to do so ''after'' considering the results of the Utility Study. Consistent with the EPA's interpretation in 2005, 2012, 2016, and 2020, we do not read this language to *require* the EPA to consider the most-up-to-date information where the Agency is compelled to revisit the determination, but nor do we interpret the provision to *preclude* consideration of new information where reasonable. *See* 70 FR 16002 (March 29, 2005); 77 FR 9310 (February 16, 2012); 81 FR 24432 (April 25, 2016); 85 FR 31306 (May 22, 2020). As such, the Agency has applied its discretion in determining when to consider new information under this provision based on the circumstances. For example, when the EPA was revisiting the determination in 2012, we noted that ''[b]ecause several years had passed since the 2000 finding, the EPA performed additional technical analyses for the proposed rule, even though those analyses were not required.'' 77 FR 9310 (February 16, 2012).[25] Similarly, we think that it is reasonable to consider new information in the context of this proposal, given that almost a decade has passed since we last considered updated information. In this proposed reconsideration of the

[24] Our proposal focuses on an analysis of the ''appropriate'' prong of the CAA section 112(n)(1)(A). The *Michigan* decision and subsequent EPA actions addressing that decision have been centered on supplementing the Agency's record with a consideration of the cost of regulation as part of the ''appropriate'' aspect of the overall determination. As noted, the 2020 Final Action, while reversing the 2016 Supplemental Finding as to the EPA's determination that it was ''appropriate'' to regulate HAP from EGUs, did not rescind the Agency's prior determination that it was necessary to regulate. *See* 84 FR 2674 (February 7, 2019) (''CAA section 112(n)(1)(A) requires the EPA to determine that both the appropriate *and* necessary prongs are met. Therefore, if the EPA finds that either prong is not satisfied, it cannot make an affirmative appropriate and necessary finding. The EPA's reexamination of its determination . . . focuses on the first prong of that analysis.''). The ''necessary'' determination rested on two primary bases: (1) In 2012, the EPA determined that the hazards posed to human health and the environment by HAP emissions from EGUs would not be addressed in its future year modeling, which accounted for all CAA requirements to that point; and (2) our conclusion that the only way to ensure permanent reductions in U.S. EGU emissions of HAP and the associated risks to public health and the environment was through standards set under CAA section 112. *See* 76 FR 25017 (May 23, 2011). We therefore continue our focus in this proposal on reinstating the ''appropriate'' prong of the determination, leaving undisturbed the Agency's prior conclusions that regulation of HAP from EGUs is ''necessary.'' *See* 65 FR 79830 (December 20, 2000); 76 FR 25017 (May 3, 2011); 77 FR 9363 (February 16, 2012).

[25] The EPA was not challenged on this interpretation in *White Stallion.*

determination per the President's Executive Order, both the growing scientific understanding of public health risks associated with HAP emissions and a clearer picture of the cost of control technologies and the make-up of power sector generation over the last decade may inform the question of whether it is appropriate to regulate, and, in particular, help address the inquiry that the Supreme Court directed us to undertake in *Michigan.* We believe the evolving scientific information with regard to benefits and the advantage of hindsight with regard to costs warrant considering currently available information in making this determination. To the extent that our determination should flow from information that would have been available at the ''initial decision to regulate,'' *Michigan,* 576 U.S. at 754, we propose conclusions here based on analyses limited to this earlier record. But we also believe it is reasonable to consider new data, and propose to find that the new information regarding both public health risks and costs bolsters the finding and supports a determination that it is appropriate and necessary to regulate EGUs for HAP.

In section III.A of this preamble, we first describe the advantages of regulation—the reduction in emissions of HAP and attendant reduction of risks to human health and the environment, including the distribution of these health benefits. We carefully document the numerous risks to public health and the environment posed by HAP emissions from EGUs. This includes information previously recognized and documented in the statutorily mandated CAA section 112(n)(1) studies, the 2000 Determination, the 2012 MATS Final Rule, and the 2016 Supplemental Finding about the nature and extent of health and environmental impacts from HAP that are emitted by EGUs, as well as additional risk analyses supported by new scientific studies. Specifically, new risk screening analyses on the connection between mercury and heart disease as well as IQ loss in children across the U.S. further supports the conclusion that HAP emissions from EGUs pose hazards to public health and the environment warranting regulating under CAA section 112. The EPA also discusses the challenges associated with fully quantifying and monetizing the human health and environmental effects associated with HAP emissions. Finally, we note that in addition to reducing the identified risks posed by HAP emissions from EGUs, regulation of such HAP emissions results in significant health and environmental co-benefits.

We then turn in preamble section III.B. to the disadvantages of regulation—the costs associated with reducing EGU HAP emissions and other potential impacts to the sector and the economy associated with MATS. With the benefit of hindsight, we first consider whether MATS actually cost what we projected in the 2011 RIA and conclude that the projection in the 2011 RIA was almost certainly a significant overestimate of the actual costs. We then evaluate the costs estimated in the 2011 RIA against several metrics relevant to the impacts those costs have on the EGU sector and American electricity consumers (*e.g.,* historical annual revenues, annual capital and production expenditures, impacts on retail electricity prices, and impacts on resource adequacy and reliability). These analyses, based on data available in 2012 and based on updated data, all show that the costs of MATS were within the bounds of typical historical fluctuations and that the industry would be able to comply with MATS and continue to provide a reliable source of electricity without price increases that were outside the range of historical variability.

In section III.C of this preamble, we explain why the methodology used in our 2020 Finding was ill-suited to determining whether EGU HAP regulation is appropriate and necessary because it gave virtually no weight to the volume of HAP that would be reduced, and the vast majority of the benefits of reducing EGU HAP, including the reduction of risk to sensitive populations, based on the Agency's inability to quantify or monetize post-control benefits of HAP regulations.

In preamble section III.D, we explain our preferred totality-of-the-circumstances methodology that we propose to use to make the appropriate determination, and our application of that methodology. This approach looks to the statute, and particularly CAA section 112(n)(1)(A) and the other provisions in CAA section 112(n)(1), to help identify the relevant factors to weigh and what weight to afford those factors. Under that methodology we weigh the significant health and environmental advantages of reducing EGU HAP, and in particular the benefits to the most exposed and sensitive individuals, against the disadvantages of expending money to achieve those benefits—*i.e.,* the effects on the electric generating industry and its ability to provide reliable and affordable electricity. We ultimately propose to conclude that the advantages outweigh the disadvantages whether we look at the record from 2012 or at our new record, which includes an expanded understanding of the health risks associated with HAP emissions and finds that the costs projected in the 2011 RIA were almost certainly significantly overestimated. We further consider that, if we also account for the non-HAP benefits in our preferred totality-of-the-circumstances approach, such as the benefits (including reduced mortality) of coincidental reductions in PM and ozone that flow from the application of controls on HAP, the balance weighs even more heavily in favor of regulating HAP emissions from coal- and oil-fired EGUs.

Finally, in section III.E, we consider an alternative methodology to make the appropriate determination, using a formal BCA of MATS that was conducted consistent with economic principles. This methodology is not our preferred way to consider advantages and disadvantages for the CAA section 112(n)(1)(A) determination, because the EPA's inability to generate a monetized estimate of the full benefits of HAP reductions can lead to an underestimate of the monetary value of the net benefits of regulation. To the extent that a formal BCA is appropriate for making the CAA section 112(n)(1)(A) determination, however, that approach demonstrates that the monetized benefits of MATS outweigh the monetized costs by a considerable margin, whether we look at the 2012 record or our updated record. We therefore propose that it is appropriate to regulate EGUs for HAP applying a BCA approach as well.

In sum, the EPA proposes to conclude that it is appropriate and necessary to regulate HAP emissions from coal- and oil-fired EGUs, whether we are applying the preferred totality-of-the-circumstances methodology or the alternative formal benefit-cost approach, and whether we are considering only the administrative record as of the original EPA response on remand to *Michigan* in 2016 or based on new information made available since that time. The information and data amassed by the EPA over the decades of administrative analysis and rulemaking devoted to this topic overwhelmingly support the conclusion that the advantages of regulating HAP emissions from coal- and oil-fired EGUs outweigh the costs. The EPA requests comment on this proposed finding and on the supporting information presented in this proposal, including information related to the risks associated with HAP emissions from U.S. EGUs and the actual costs incurred by the power sector due to MATS, as well as on the preferred and alternative methodologies for reaching the proposed conclusion.

A. Public Health Hazards Associated With Emissions From EGUs

1. Overview

The administrative record for the MATS rule detailed several hazards to public health and the environment from HAP emitted by EGUs that remained after imposition of the ARP and other CAA requirements. *See* 80 FR 75028–29 (December 1, 2015). *See also* 65 FR 79825–31 (December 20, 2000); 76 FR 24976–25020 (May 3, 2011); 77 FR 9304–66 (February 16, 2012). The EPA considered all of this information again in the 2016 Supplemental Finding, noting that this sector represented a large fraction of U.S. emissions of mercury, non-mercury metal HAP, and acid gases. Specifically, the EPA found that even after imposition of the other requirements of the CAA, but absent MATS, EGUs remained the largest domestic source of mercury, HF, HCl, and selenium and among the largest domestic contributors of arsenic, chromium, cobalt, nickel, hydrogen cyanide, beryllium, and cadmium, and that a significant majority of EGU facilities emitted above the major source thresholds for HAP emissions.

Further, the EPA noted that the totality of risks that accrue from these emissions were significant. These hazards include potential neurodevelopmental impairment, increased cancer risks, contribution to chronic and acute health disorders, as well as adverse impacts on the environment. Specifically, the EPA pointed to results from its revised nationwide Mercury Risk Assessment (contained in the 2011 Final Mercury TSD)[26] as well as an inhalation risk assessment (2011 Non-Hg HAP Assessment) for non-mercury HAP (*i.e.,* arsenic, nickel, chromium, selenium, cadmium, HCl, HF, hydrogen cyanide, formaldehyde, benzene, acetaldehyde, manganese, and lead). The EPA estimated lifetime cancer risks for inhabitants near some coal- and oil-fired EGUs to exceed 1-in-1 million[27] and noted that this case-study-based estimate likely underestimated the true maximum risks for the EGU source category. *See* 77 FR 9319 (February 16, 2012). The EPA also found that mercury emissions pose a hazard to wildlife, adversely affecting fish-eating birds and mammals, and that the large volume of acid gas HAP associated with EGUs also pose a hazard to the environment.[28] These technical analyses were all challenged in the *White Stallion* case, and the D.C. Circuit found that the EPA's risk finding as to mercury alone—that is, before reaching any other risk finding—established a significant public health concern. The court stated that ''EPA's 'appropriate and necessary' determination in 2000, and its reaffirmation of that determination in 2012, are amply supported by EPA's finding regarding the health effects of mercury exposure.'' *White Stallion Energy Center* v. *EPA,* 748 F.3d 1222, 1245 (D.C. Cir. 2014). Additional scientific evidence about the human health hazards associated with EGU HAP emissions that has been collected since the 2016 Supplemental Finding and is discussed in this section has extended our confidence that these emissions pose an unacceptable risk to the American public and in particular, to vulnerable, exposed populations.

This section of the preamble starts by briefly reviewing the long-standing and extensive body of evidence, including new scientific information made available since the 2016 Supplemental Finding, which demonstrates that HAP emissions from oil- and coal-fired EGUs present hazards to public health and the environment warranting regulation under CAA section 112 (section III.A.2). This is followed by an expanded discussion of the health risks associated with domestic EGU mercury emissions based on additional evidence regarding cardiovascular effects that has become available since the 2016 Supplemental Finding (section III.A.3). In section III.A.4, the EPA describes the reasons why it is extremely difficult to estimate the full health and environmental impacts associated with exposure to HAP. We note the longstanding challenges associated with quantifying and monetizing these effects, which may be permanent and life-threatening and are often distributed unevenly (*i.e.,* concentrated among highly exposed individuals). Next, the section provides an expanded discussion of some identified environmental justice (EJ) issues associated with these emissions (section III.A.5). Section III.A.6 identifies health effects associated with other, non-HAP emissions from EGUs such as SO_2, direct $PM_{2.5}$ and other $PM_{2.5}$ and ozone precursors. Because these pollutants are co-emitted with HAP, the controls necessary to reduce HAP emissions from EGUs often reduce these pollutants as well. After assessing all the evidence, the EPA concludes again (section III.A.7) that regulation of HAP emissions from EGUs under CAA section 112 greatly improves public health for Americans by reducing the risks of premature mortality from heart attacks, cancer, and neurodevelopmental delays in children, and by helping to restore economically vital ecosystems used for recreational and commercial purposes. Further, we conclude that these public health improvements will be particularly pronounced for certain segments of the American population that are especially vulnerable (*e.g.,* subsistence fishers[29] and their children) to impacts from EGU HAP emissions. In addition, the concomitant reductions in co-emitted pollutants will also provide substantial public health and environmental benefits.

2. Overview of Health Effects Associated With Mercury and Non-Mercury HAP

In calling for the Agency to consider the regulation of HAP from EGUs, the

[26] U.S. EPA. 2011. *Revised Technical Support Document: National-Scale Assessment of Mercury Risk to Populations with High Consumption of Self-caught Freshwater Fish In Support of the Appropriate and Necessary Finding for Coal- and Oil-Fired Electric Generating Units.* Office of Air Quality Planning and Standards. November. EPA–452/R–11–009. Docket ID Item No. EPA–HQ–OAR–2009–0234–19913.

[27] The EPA determined the 1-in-1 million standard was the correct metric in part because CAA section 112(c)(9)(B)(1) prohibits the EPA from removing a source category from the list if even one person is exposed to a lifetime cancer risk greater than 1-in-1 million, and CAA section 112(f)(2)(A) directs the EPA to conduct a residual risk rulemaking if even one person is exposed to a lifetime excess cancer risk greater than 1-in-1 million. *See White Stallion* at 1235–36 (agreeing it was reasonable for the EPA to consider the 1-in-1 million delisting criteria in defining ''hazard to public health'' under CAA section 112(n)(1)(A)).

[28] The EPA had determined it was reasonable to consider environmental impacts of HAP emissions from EGUs in the appropriate determination because CAA section 112 directs the EPA to consider impacts of HAP emissions on the environment, including in the CAA section 112(n)(1)(B) Mercury Study. *See White Stallion* at 1235–36 (agreeing it was reasonable for the EPA to consider the environmental harms when making the appropriate and necessary determination).

[29] Subsistence fishers, who by definition obtain a substantial portion of their dietary needs from self-caught fish consumption, can experience elevated levels of exposure to chemicals that bioaccumulate in fish including, in particular, methylmercury. Subsistence fishing activity can be related to a number of factors including socio-economic status (poverty) and/or cultural practices, with ethnic minorities and tribal populations often displaying increased levels of self-caught fish consumption (Burger *et al.,* 2002, Shilling *et al.,* 2010, Dellinger 2004).

Burger J, (2002). *Daily consumption of wild fish and game: exposures of high end recreationalists.* International Journal of Environmental Health Research 12:4, p. 343–354.

Shilling F, White A, Lippert L, Lubell M, (2010). *Contaminated fish consumption in California's Central Valley Delta.* Environmental Research 110, p. 334–344.

Dellinger J, (2004). *Exposure assessment and initial intervention regarding fish consumption of tribal members in the Upper Great Lakes Region in the United States.* Environmental Research 95, p. 325–340.

CAA stipulated that the EPA complete three studies (all of which were extensively peer-reviewed) exploring various aspects of risk posed to human health and the environment by HAP released from EGUs. The first of these studies, the Utility Study, published in 1998, focused on the hazards to public health specifically associated with EGU-sourced HAP including, but not limited to, mercury. *See* CAA section 112(n)(1)(A). A second study, the Mercury Study, released in 1997, while focusing exclusively on mercury, was broader in scope including not only human health, but also environmental impacts and specifically addressed the potential for mercury released from multiple emissions sources (in addition to EGUs) to affect human health and the environment. *See* CAA section 112(n)(1)(B). The third study, required under CAA section 112(n)(1)(C), the NIEHS Study, submitted to Congress in 1995, considered the threshold level of mercury exposure below which adverse human health effects were not expected to occur. An additional fourth study, the NAS Study, directed by Congress in 1999 and completed in 2000, focused on determining whether a threshold for mercury health effects could be identified for sensitive populations and, as such, presented a rigorous peer review of the EPA's RfD for methylmercury. The aggregate results of these peer-reviewed studies commissioned by Congress as part of CAA section 112(n)(1) supported the determination that HAP emissions from EGUs represented a hazard to public health and the environment that would not be addressed through imposition of the other requirements of the CAA. In the 2 decades that followed, the EPA has continued to conduct additional research and risk assessments and has surveyed the latest science related to the risk posed to human health and the environment by HAP released from EGUs.

a. Review of Health Effects and Previous Risk Analyses for Methylmercury

Mercury is a persistent and bioaccumulative toxic metal that, once released from power plants into the ambient air, can be readily transported and deposited to soil and aquatic environments where it is transformed by microbial action into methylmercury. *See* Mercury Study; 76 FR 24976 (May 3, 2011) (2011 NESHAP Proposal); 80 FR 75029 (December 1, 2015) (2015 Proposal). Methylmercury bioaccumulates in the aquatic food web eventually resulting in highly concentrated levels of methylmercury within the larger and longer-living fish, which can then be consumed by humans.[30] As documented in both the NAS Study and the Mercury Study, fish and seafood consumption is the primary route of human exposure to methylmercury, with populations engaged in subsistence-levels of consumption being of particular concern.[31] The NAS Study reviewed the effects of methylmercury on human health, concluding that it is highly toxic to multiple human and animal organ systems. Of particular concern is chronic prenatal exposure via maternal consumption of foods containing methylmercury. Elevated exposure has been associated with developmental neurotoxicity and manifests as poor performance on neurobehavioral tests, particularly on tests of attention, fine motor function, language, and visual-spatial ability. Evidence also suggests potential for adverse effects on the cardiovascular system, adult nervous system, and immune system, as well as potential for causing cancer.[32] Below we review the broad range of public health hazards associated with methylmercury exposure.

Neurodevelopmental Effects of Exposure to Methylmercury. Methylmercury is a powerful neurotoxin. Because the impacts of the neurodevelopmental effects of methylmercury are greatest during periods of rapid brain development, developing fetuses and young children are particularly vulnerable. Children born to populations with high fish consumption (*e.g.,* people consuming fish as a dietary staple) or impaired nutritional status (*e.g.,* people with iron or vitamin C deficiencies) are especially vulnerable to adverse neurodevelopmental outcomes. These dietary and nutritional vulnerabilities are often particularly pronounced in underserved communities with minority populations and low-income populations that have historically faced economic and environmental injustice and are overburdened by cumulative levels of pollution.[33]

Infants in the womb can be exposed to methylmercury when their mothers eat fish and shellfish that contain methylmercury. This exposure can adversely affect unborn infants' growing brains and nervous systems. Children exposed to methylmercury while they are in the womb can have impacts to their cognitive thinking, memory, attention, language, fine motor skills, and visual spatial skills. Based on scientific evidence reflecting concern about a range of neurodevelopmental effects seen in children exposed *in utero* to methylmercury, the EPA defined an RfD of 0.0001 mg/kg-day for methylmercury.[34] An RfD is defined as an estimate (with uncertainty spanning perhaps an order of magnitude) of a daily exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime (EPA, 2002).[35]

Prenatal exposure to methylmercury from maternal consumption of fish has been associated with several adverse neurodevelopmental outcomes in various fish consuming populations. Although data are limited, the EPA has focused on several subpopulations likely to be at higher risk from methylmercury exposure associated with EGU HAP due to fish consumption. As part of the 2011 Final Mercury TSD, the EPA completed a national-scale risk assessment focused on mercury emissions from domestic EGUs. Specifically, we examined risk associated with mercury released from U.S. EGUs that deposits to watersheds within the continental U.S., bioaccumulates in fish as methylmercury, and is consumed when fish are eaten by female subsistence fishers of child-bearing age and other freshwater self-caught fish consumers. There is increased risk for *in utero* exposure and adverse outcomes in children born to female subsistence fishers with elevated exposure to methylmercury. The risk assessment modeled scenarios representing high-end self-caught fish consumers active at inland freshwater lakes and streams. The analysis estimated that 29 percent of the watersheds studied would lead to

[30] We recognize that mercury deposition over land with subsequent impacts to agricultural-sourced food may also represent a public health concern, however as noted below, primary exposure to the U.S. population is through fish consumption.

[31] In light of the methylmercury impacts, the EPA and the Food and Drug Administration have collaborated to provide advice on eating fish and shellfish as part of a healthy eating pattern (*https://www.fda.gov/food/consumers/advice-about-eating-fish*). In addition, states provide fish consumption advisories designed to protect the public from eating fish from waterbodies within the state that could harm their health based on local fish tissue sampling.

[32] National Research Council. 2000. *Toxicological Effects of Methylmercury.* Washington, DC: The National Academies Press. *https://doi.org/10.17226/9899.*

[33] Burger J, 2002. *Daily consumption of wild fish and game: Exposures of high end recreationalists.* International Journal of Environmental Health Research 12:4, p. 343–354.

[34] U.S. EPA. 2001. *IRIS Summary for Methylmercury.* U.S. Environmental Protection Agency, Washington, DC. (USEPA, 2001).

[35] U.S. EPA. 2002. *A Review of the Reference Dose and Reference Concentration Processes.* EPA/630/P–02/002F, December 2002.

female subsistence fishers having exposures which exceeded the methylmercury RfD, based on *in utero* effects, due in whole or in part to the contribution of domestic EGU emissions of mercury. This included up to 10 percent of modeled watersheds where deposition from U.S. EGUs alone leads to potential exposures that exceed the RfD.[36]

In addition to the 2011 Final Mercury TSD focusing on subsistence fishers referenced above, the EPA also completed a RIA in 2011 including the characterization of benefits associated with the prospective reduction of U.S. EGU mercury emissions under MATS.[37] However, due to limitations on the available data with regard to the extent of subsistence fishing activity in the U.S., which prevented the enumeration of subsistence fisher populations, the EPA was unable to develop a quantitative estimate of the reduction in population-level risk or associated dollar benefits for children of female subsistence fishers. Instead, in the 2011 MATS RIA, the EPA focused on a different population of self-caught fish consumers that could be enumerated. Specifically, we quantitatively estimated the amount and value of IQ loss associated with prenatal methylmercury exposure among the children of recreational anglers consuming self-caught fish from inland freshwater lakes, streams and rivers (unlike subsistence fishers, available data allow the characterization of recreational fishing activity across the U.S. including enumeration of these populations). Although the EPA acknowledged uncertainty about the size of the affected population and acknowledged that it could be underestimated, these unborn children associated with recreational anglers represented precisely the type of sensitive population most at risk from mercury exposure that CAA section 112 is designed to protect. The results generated in the 2011 RIA for recreational anglers suggested that by reducing methylmercury exposure, MATS was estimated to yield an additional 511 IQ points among the affected population of children, which would increase their future lifetime earnings. The EPA noted at the time that the analysis likely underestimated potential benefits for children of recreational anglers since, due to data limitations, it did not cover consumption of recreationally caught seafood from estuaries, coastal waters, and the deep ocean which was expected to contribute significantly to overall exposure. Nevertheless, this single endpoint alone, evaluated solely for the recreational angler, provides evidence of potentially significant health harm from methylmercury exposure.

In 2011 we noted that other, more difficult to quantify endpoints may also contribute to the overall burden across a broader range of subgroups. The metrics studied in addition to IQ include those measured by performance on neurobehavioral tests, particularly on tests of attention, fine motor-function, language, and visual spatial ability (USEPA, 2001; Agency for Toxic Substances and Disease Registry (ATSDR), 1999).[38] Such adverse neurodevelopmental effects are well documented in cohorts of subsistence fisher populations (*i.e.,* Faroe Islands and the Nunavik region of Arctic Canada).

At this time, the EPA is conducting an updated methylmercury IRIS assessment and recently released preliminary assessment materials, an IRIS Assessment Plan (IAP) and Systematic Review Protocol for methylmercury.[39] The update to the methylmercury IRIS assessment will focus on updating the quantitative aspects of neurodevelopmental outcomes associated with methylmercury exposure. As noted in these early assessment materials, new studies are available, since 2001, assessing the effects of methylmercury exposure on cognitive function, motor function, behavioral, structural, and electrophysiological outcomes at various ages following prenatal or postnatal exposure to methylmercury (USEPA, 2001; NAS Study; 84 FR 13286 (April 4, 2019);[40] 85 FR 32037 (May 8, 2020)).[41]

Cardiovascular Impacts of Exposure to Methylmercury. The NAS Study indicated that there was evidence that exposure to methylmercury in humans and animals can have adverse effects on both the developing and adult cardiovascular system. Infant exposure in the womb to methylmercury has been associated with altered blood-pressure and heart-rate variability in children. In adults, dietary exposure to methylmercury has been linked to a higher risk of acute myocardial infarction (MI), coronary heart disease, or cardiovascular heart disease. To date, the EPA has not attempted to utilize a quantitative dose-response assessment for cardiovascular effects associated with methylmercury exposures because of a lack of consensus among scientists on the dose-response functions for these effects and inconsistency among available studies as to the association between methylmercury exposure and various cardiovascular system effects.

However, additional studies have become available that have increased the EPA's confidence in characterizing the dose-response relationship between methylmercury and adverse cardiovascular outcomes. These new studies were leveraged to inform new quantitative screening analyses (described in section III.A.3, below) to estimate one cardiovascular endpoint—incidence of MI mortality—that may potentially be linked to U.S. EGU mercury emissions as well as the number of U.S. EGU impacted watersheds. In addition to a new meta-analysis (Hu *et al.,* 2021)[42] on the association of methylmercury generally with cardiovascular disease (CVD), stroke, and ischemic heart disease (IHD), there is a limited body of existing literature that has examined associations between mercury and various cardiovascular outcomes. These include acute MI, hypertension, atherosclerosis, and heart rate variability (Roman *et al.,* 2011).[43]

[36] The EPA chose this risk metric in part because CAA section 112(n)(1)(C) directed the NIEHS to develop a threshold for mercury concentration in fish tissue that can be consumed by even sensitive populations without adverse effect and because CAA section 112(c)(6) demonstrates a special interest in protecting the public from exposure to mercury.

[37] The 2011 MATS RfD-based risk assessment focusing on the subsistence fisher population was designed as a screening-level analysis to inform consideration for whether U.S. EGU-sourced mercury represented a public health hazard. As such, the most appropriate risk metric was modeled exposure (for highly-exposed subsistence fishers) compared to the RfD for methylmercury. By contrast, the 2011 RIA was focused on estimating the dollar benefits associated with MATS and as such focused on a health endpoint which could be readily enumerated and then monetized, which at the time was IQ for infants born to recreational anglers.

[38] Agency for Toxic Substances and Disease Registry (ATSDR). 1999. *Toxicological profile for mercury.* Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

[39] *https://iris.epa.gov/ChemicalLanding/&substance_nmbr=73.*

[40] *Availability of the IRIS Assessment Plan for Methylmercury.* 84 FR 13286 (April 4, 2019).

[41] *Availability of the Systematic Review Protocol for the Methylmercury Integrated Risk Information System (IRIS) Assessment.* 85 FR 32037 (May 28, 2020).

[42] Hu, X. F., Lowe, M., Chan, H.M., *Mercury exposure, cardiovascular disease, and mortality: A systematic review and dose-response meta-analysis.* Environmental Research 193 (2021),110538.

[43] Roman HA, Walsh TL, Coull BA, Dewailly É, Guallar E, Hattis D, Mariën K, Schwartz J, Stern AH, Virtanen JK, Rice G. *Evaluation of the cardiovascular effects of methylmercury exposures: Current evidence supports development of a dose-response function for regulatory benefits analysis.*

Continued

Immunotoxic Effects of Exposure to Methylmercury. Although exposure to some forms of mercury can result in a decrease in immune activity or an autoimmune response (ATSDR, 1999), evidence for immunotoxic effects of methylmercury is limited (NAS Study).

Other Mercury-Related Human Toxicity Data Including Potential Carcinogenicity. The Mercury Study noted that methylmercury is not a potent mutagen but is capable of causing chromosomal damage in a number of experimental systems. The NAS Study indicated that the evidence that human exposure to methylmercury causes genetic damage is inconclusive; it noted that some earlier studies showing chromosomal damage in lymphocytes may not have controlled sufficiently for potential confounders. One study of adults living in the Tapajos River region in Brazil (Amorim *et al.,* 2000) [44] reported a relationship between methylmercury concentration in hair and DNA damage in lymphocytes, as well as effects on chromosomes. Long-term methylmercury exposures in this population were believed to occur through consumption of fish, suggesting that genotoxic effects (largely chromosomal aberrations) may result from dietary, chronic methylmercury exposures similar to and above those seen in the populations studied in the Faroe Islands and Republic of Seychelles. Since 2000, more recent studies have evaluated methylmercury genotoxicity *in vitro* in human and animal cell lines and *in vivo* in rats.

Based on limited human and animal data, methylmercury is classified as a ''possible human carcinogen'' by the International Agency for Research on Cancer (IARC, 1993) [45] and in IRIS (USEPA, 2001). However, a quantitative estimate of the carcinogenic risk of methylmercury has not been assessed under the IRIS program at this time. Multiple human epidemiological studies have found no significant association between methylmercury exposure and overall cancer incidence, although a few studies have shown an association between methylmercury exposure and specific types of cancer incidence (*e.g.,* acute leukemia and liver cancer) (NAS Study).

Some evidence of reproductive and renal toxicity in humans from methylmercury exposure exists. However, overall, human data regarding reproductive, renal, and hematological toxicity from methylmercury are very limited and are based on studies of the two high-dose poisoning episodes in Iraq and Japan or animal data, rather than epidemiological studies of chronic exposures at the levels of interest in this analysis.

b. Review of Health Effects for Non-Mercury HAP

As noted earlier, EGUs are the largest source of HCl, HF, and selenium emissions, and are a major source of metallic HAP emissions including arsenic, chromium, nickel, cobalt, and others. Exposure to these HAP, depending on exposure duration and levels of exposures, is associated with a variety of adverse health effects. These adverse health effects may include chronic health disorders (*e.g.,* irritation of the lung, skin, and mucus membranes; decreased pulmonary function, pneumonia, or lung damage; detrimental effects on the central nervous system; damage to the kidneys; and alimentary effects such as nausea and vomiting).

As of 2021, three of the key metal HAP emitted by EGUs (arsenic, chromium, and nickel) have been classified as human carcinogens, while three others (cadmium, selenium, and lead) are classified as probable human carcinogens. Overall (metal and non-metal), the EPA has classified four of the HAP emitted by EGUs as human carcinogens and five as probable human carcinogens. *See* 76 FR 25003–25005 (May 3, 2011) for a fuller discussion of the health effects associated with these pollutants.

As summarized in the *Supplement to the Non-Hg Case Study Chronic Inhalation Risk Assessment In Support of the Appropriate and Necessary Finding for Coal- and Oil-Fired Electric Generating Units* (2011 Non-Hg HAP Assessment),[46] the EPA previously completed a refined chronic inhalation risk assessment for 16 EGU case studies in order to assess potential public health risk associated with non-mercury HAP. The 16 case studies included one unit that used oil and 15 that used coal. As noted in the 2015 Proposal, this set of case studies was designed to include those facilities with potentially elevated cancer and non-cancer risk based on an initial risk screening of prospective EGU units completed utilizing the Human Exposure Model paired with HAP emissions data obtained from the 2005 National Emissions Inventory. For each of the 16 case study facilities, we conducted refined dispersion modeling with the EPA's AERMOD (American Meteorological Society/Environmental Protection Agency Regulatory Model) system to calculate annual ambient concentrations (*see* 2011 Non-Hg HAP Assessment). Average annual concentrations were calculated at census block centroids. We calculated the MIR for each facility as the cancer risk associated with a continuous lifetime (24 hours per day, 7 days per week, and 52 weeks per year for a 70-year period) exposure to the maximum concentration at the centroid of an inhabited census block, based on application of the unit risk estimate from the EPA's IRIS program. Based on estimated actual emissions, the highest estimated individual lifetime cancer risk from any of the 16 case study facilities was 20-in-1 million, driven by nickel emissions from the one case study facility with oil-fired EGUs. Of the facilities with coal-fired EGUs, five facilities had MIR greater than 1-in-1 million (the highest was 5-in-1 million), with the risk from four due to emissions of chromium VI and the risk from one due to emissions of nickel. There were also two facilities with coal-fired EGUs that had MIR equal to 1-in-1 million. Based on this analysis, the EPA concludes that cancer risks associated with these HAP emissions supports a finding that it is appropriate to regulate HAP emissions from EGUs.

c. Review of Other Adverse Environmental Effects Associated With EGU HAP Emissions

Ecological Effects of Methylmercury. Along with the human health hazards associated with methylmercury, it is well-established that birds and mammals are also exposed to methylmercury through fish consumption (Mercury Study). At higher levels of exposure, the harmful effects of methylmercury include slower growth and development, reduced reproduction, and premature mortality. The effects of methylmercury on wildlife are variable across species but have been observed in the environment

Environ Health Perspect. 2011 May;119(5):607–14. doi: 10.1289/ehp.1003012. Epub 2011 Jan 10.

[44] Amorim MI, Mergler D, Bahia MO, Dubeau H, Miranda D, Lebel J, Burbano RR, Lucotte M. *Cytogenetic damage related to low levels of methyl mercury contamination in the Brazilian Amazon.* An Acad Bras Cienc. 2000 Dec;72(4):497–507. doi: 10.1590/s0001–37652000000400004.

[45] International Agency for Research on Cancer (IARC) Working Group on the Evaluation of Carcinogenic Risks to Humans. *Beryllium, Cadmium, Mercury, and Exposures in the Glass Manufacturing Industry.* Lyon (FR): International Agency for Research on Cancer; 1993. (IARC Monographs on the Evaluation of Carcinogenic Risks to Humans, No. 58.) Mercury and Mercury Compounds. Available from: *https://www.ncbi.nlm.nih.gov/books/NBK499780.*

[46] U.S. EPA. 2011. *Supplement to the Non-Hg Case Study Chronic Inhalation Risk Assessment In Support of the Appropriate and Necessary Finding for Coal- and Oil-Fired Electric Generating Units.* Office of Air Quality Planning and Standards. November. EPA–452/R–11–013. Docket ID Item No. EPA–HQ–OAR–2009–0234–19912.

for numerous avian species and mammals including polar bears, river otters, and panthers. These adverse effects can propagate into impacts on human welfare to the extent they influence economies that depend on robust ecosystems (*e.g.,* tourism).

Ecological Effects of Acid Gas HAP. Even after the ARP was largely implemented in 2005, EGU sources comprised 82 percent of all anthropogenic HCl (a useful surrogate for all acid gas HAP) emissions in the U.S. When HCl dissolves in water, hydrochloric acid is formed. When hydrochloric acid is deposited by rainfall into terrestrial and aquatic ecosystems, it results in acidification of those systems. The MATS rule was expected to result in an 88 percent reduction in HCl emissions. As part of a recent Integrated Science Assessment (EPA, 2020),[47] the EPA concluded that the body of evidence is sufficient to infer a causal relationship between acidifying deposition and adverse changes in freshwater biota. Affected biota from acidification of freshwater include plankton, invertebrates, fish, and other organisms. Adverse effects can include physiological impairment, as well as alteration of species richness, community composition, and biodiversity in freshwater ecosystems. This evidence is consistent and coherent across multiple species. More species are lost with greater acidification.

3. Post-2016 Screening-Level Risk Assessments of Methylmercury Impacts

This section of the preamble describes three screening-level risk assessments completed since the 2016 Supplemental Finding that further strengthen the conclusion that U.S. EGU-sourced mercury represents a hazard to public health. These ''screening-level'' assessments are designed as broad bounding exercises intended to illustrate the potential scope and public health importance of methylmercury risks associated with U.S. EGU emissions. In some cases, they incorporate newer peer-reviewed literature that was not available to the Agency previously. Remaining uncertainties, however, prohibit the EPA from generating a more precise estimate at this time. Two of the three risk assessments focus on the potential for methylmercury exposure to increase the risk of MI-related mortality in adults and for that reason, section III.A.3.a begins by describing the methodology used in the analyses, including discussion of the concentration response (CR) function[48] for MI-related mortality and the incorporation of confidence cutpoints designed to address uncertainty. Then, the EPA describes an extension of the original watershed-level subsistence fisher methylmercury risk assessment to evaluate the potential for elevated MI-mortality risk among subsistence fishers (section III.A.3.b). In addition, a separate risk assessment is presented for elevated MI mortality among all adults utilizing a bounding approach that explores potential risks associated with exposure of the general U.S. population to methylmercury (sourced from U.S. EGUs) through fish consumption (section III.A.3.c). Finally, focusing on neurodevelopmental outcomes, another bounding analysis is presented that focuses on the risk of IQ points loss in children exposed *in utero* through maternal fish consumption by the population of general U.S. fish consumers (section III.A.3.d). Each of these analyses quantify potential impacts on incidence of adverse health effects. Section III.A.4 provides illustrative examples of how these incidence estimates translate to monetized benefits.

a. Methodology for Estimating MI-Mortality

This section describes the methodology used in the new screening-level risk assessments related to mortality, including the EPA's application of a CR function characterizing the relationship between increased MI-mortality and methylmercury exposure. As discussed further in the 2021 Risk TSD,[49] which is contained in the docket for this action, the approach draws on recommendations provided by an expert panel convened by the EPA in 2010 to evaluate the cardiovascular effects associated with methylmercury exposure (the findings of the expert panel were summarized as a peer-reviewed paper, Roman *et al.,* 2011). The panel ''found the body of evidence exploring the link between [methylmercury] and acute myocardial infarction (MI) to be sufficiently strong to support its inclusion in future benefits analyses, based both on direct epidemiological evidence of [a methylmercury]–MI link and on [methylmercury's] association with intermediary impacts that contribute to MI risk.'' Given the likely mechanism of action associated with MI, the panel further recommended that either hair-mercury or toenail-mercury be used as an exposure metric because both reflect a longer-term pattern of exposure. Regarding the shape of the CR function, the panel noted that the EURAMIC study (Guallar *et al.,* 2002)[50] had identified a log-linear model form with log-of exposure providing the best fit using toenail mercury as the biomarker of exposure. The panel also discussed the issue of potential effect modification by cardioprotective compounds including polyunsaturated fatty acids (PUFA).[51] Kuopio Ischaemic Heart Disease Risk Factor Study (KIHD) and European Multicenter Case-Control Study on Antioxidants, Myocardial Infarction, and Cancer of the Breast Study (EURAMIC) datasets ''provide the strongest and most useful data sets for quantifying methylmercury-related incidence of MI.'' However, the panel did note the disconnect between typical levels of exposure to methylmercury in the U.S. population and the relatively higher levels of exposure reflected in the two recommended epidemiology studies (KIHD and EURAMIC). Therefore, the panel suggested that consideration be given to restricting modeling MI mortality to those with higher concentrations reflecting the levels of exposure found in the two key epidemiology studies (corresponding to roughly 75th to 95th percentile hair-mercury levels for U.S. women of child-bearing age, as characterized in National Health and Nutrition Examination

[47] U.S. EPA. *Integrated Science Assessment (ISA) for Oxides of Nitrogen, Oxides of Sulfur and Particulate Matter Ecological Criteria* (Final Report). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R–20/278, 2020.

[48] Concentration-response functions relate levels of exposure for the chemical of interest to the probability or rate of response for the adverse health outcome in the exposed individual or population. Typically these mathematical relationships are based on data obtained either from human epidemiology studies, clinical studies, or toxicological (animal) studies. In this case, CR functions for MI-related mortality are based on epidemiology studies as discussed further below.

[49] U.S. EPA. 2021. *National-Scale Mercury Risk Estimates for Cardiovascular and Neurodevelopmental Outcomes for the National Emission Standards for Hazardous Air Pollutants: Coal- and Oil-Fired Electric Utility Steam Generating Units—Revocation of the 2020 Reconsideration, and Affirmation of the Appropriate and Necessary Supplemental Finding; Notice of Proposed Rulemaking.*

[50] Guallar E, Sanz-Gallardo MI, van't Veer P, Bode P, Aro A, Gómez-Aracena J, Kark JD, Riemersma RA, Martín-Moreno JM, Kok FJ; Heavy Metals and Myocardial Infarction Study Group. *Mercury, fish oils, and the risk of myocardial infarction.* N Engl J Med. 2002 Nov 28;347(22):1747–54. doi: 10.1056/NEJMoa020157.

[51] Virtanen JK, Voutilainen S, Rissanen TH, Mursu J, Tuomainen TP, Korhonen MJ, Valkonen VP, Seppänen K, Laukkanen JA, Salonen JT. *Mercury, fish oils, and risk of acute coronary events and cardiovascular disease, coronary heart disease, and all-cause mortality in men in eastern Finland.* Arterioscler Thromb Vasc Biol. 2005 Jan;25(1):228–33. doi: 10.1161/01.ATV.0000150040.20950.61. Epub 2004 Nov 11.

Survey (NHANES) data and referenced by the panel).

In the intervening period since the release of the expert panel's findings in 2011 (Roman *et al.,* 2011), the EPA has continued to review literature characterizing the relationship between methylmercury exposure and cardiovascular effects. While the EPA has not yet conducted a systematic review, two recent studies are of particular interest for quantifying the potential relationship between U.S. EGU mercury emissions and acute MI that informed a modeling approach. Giang and Selin (2016) [52] presented an approach for modeling MI mortality reflecting a number of the recommendations presented in Roman *et al.,* 2011 including the use of the KIHD and EURAMIC studies as the basis for a CR function including both the log-linear functional form and the effect estimate derived from the KIHD study results. A second study, Hu *et al.* 2021,[53] presented a meta-analysis looking at the relationship between methylmercury exposure and mortality. That paper utilized eight studies each determined to be of good quality and reflecting at a minimum, adjustments for age, sex, and n-3 PUFA in specifying dose-response relationships. Historically, studies which account for n-3 PUFA have assumed a linear relationship between PUFAs and risk of MI (Roman *et al.,* 2011). However, the association between PUFA intake and cardiovascular risk may not be linear (Mozaffarian and Rimm, 2006).[54] The potential for confounding and effect modification by PUFA and selenium makes it difficult to interpret the relationship between methylmercury and MI, particularly at lower doses where there is potential for masking of methylmercury toxicity. The results of the meta-analysis by Hu *et al.,* 2021 illustrated this phenomenon with their J-shaped functions for both IHD and CVD, both of which showed an initial region of negative slope (diminishing net risk with methylmercury exposure) before reaching an inflection point (between 1 and 2 microgram per gram (µg/g) hair-mercury depending on the endpoint) where the function turns positive (increasing risk).

For the EPA's new screening-level assessment, we have considered the recommendations presented in Roman *et al.,* 2011, as well as the J-shaped functions presented in Hu *et al.,* 2021, and their implications for considering overall confidence in specifying the relationship between cardiovascular-related mortality and methylmercury exposure. In particular, the EPA has higher confidence in the log-linear relationship at levels of hair-mercury exposure above the selected confidence cutpoints. In specifying these confidence cutpoints (for modeling MI mortality) we have looked to recommendations presented in Roman *et al.,* 2011, specifically that we consider modeling risk for levels of exposure reflected in the EURAMIC and KIHD studies (with these equating to roughly 0.66 and 1.9 µg/g hair-mercury, respectively, or approximately the 75th-95th percentile of hair-mercury levels seen in women of childbearing age in available 1999–2000 NHANES survey data [55]). Further, we note that these confidence cutpoints roughly match the inflection point for IHD and CVD seen in the J-shaped plot presented in Hu *et al.,* 2021, which further supports their use in defining regions of methylmercury exposure above which we have increased confidence in modeling MI mortality. However, as noted earlier, we are not concluding here that there is an absence of risk below these cutpoints, as such conclusions would require a weight of the evidence analysis and subsequent independent peer review. Rather, we are less confident in our ability to specify the nature of the CR function in those lower exposure regions due to possible effect modification and/or confounding by PUFA and/or selenium. Therefore, in applying the CR function in modeling MI mortality, we included a set of three functions–two including the cutpoints described above and a third no-cutpoint version of the function reflecting the assumption that risk extends across the entire range of methylmercury exposure. In terms of the other elements of the CR function (shape and effect estimate), we have also followed the advice presented in Roman *et al.,* 2011, as further illustrated through the analysis published by Giang and Selin 2016, and utilized a log-linear form and an effect estimate of 0.10 for MI mortality obtained from the KIHD study (*see* 2021 Risk TSD). As with the other risk estimates presented for methylmercury, these estimates reflect the baseline for U.S. EGUs prior to implementation of MATS (*i.e.,* 29 tons).

b. Increased MI-Mortality Risk in Subsistence Fishers Exposed to Methylmercury

This screening-level analysis of MI-mortality risk is an extension of the female subsistence-fisher-based at-risk watershed analysis originally completed as part of the 2011 risk assessment supporting the appropriate and necessary determination (USEPA, 2011) and documented in the 2011 Final Mercury TSD. In that original analysis, a series of female subsistence fisher risk scenarios was evaluated for a subset of 3,141 watersheds within the continental U.S. for which there were sampled methylmercury fish tissue data (that fish tissue data allowing a higher-confidence empirically-based assessment of methylmercury risk to be generated for those watersheds). For each watershed, we used the fish tissue methylmercury data to characterize total mercury-related risk and then we estimated the portion of that total risk attributable to U.S. EGUs (based on the fraction of total mercury deposition to those watersheds associated with U.S. EGU emissions as supported by the Mercury Maps approach, USEPA, 2011).[56]

We have now extended the at-risk watershed analysis completed in 2011 for the subsistence fisher scenarios to include an assessment of the potential for increased MI mortality risk.[57] Specifically, we have utilized the U.S. EGU-attributable methylmercury exposure estimates (µg/kg-day methylmercury intake) generated for the subsistence fisher scenario in each

[52] Giang A, Selin NE. *Benefits of mercury controls for the United States.* Proc Natl Acad Sci U S A. 2016 Jan 12;113(2):286–91. doi: 10.1073/pnas.1514395113. Epub 2015 Dec 28.

[53] Hu XF, Lowe M, Chan HM. *Mercury exposure, cardiovascular disease, and mortality: A systematic review and dose-response meta-analysis.* Environ Res. 2021 Feb;193:110538. doi: 10.1016/j.envres.2020.110538. Epub 2020 Dec 5.

[54] Mozaffarian D, Rimm EB. *Fish intake, contaminants, and human health: Evaluating the risks and the benefits.* JAMA. 2006 Oct 18;296(15):1885–99. doi: 10.1001/jama.296.15.1885. Erratum in: JAMA. 2007 Feb 14;297(6):590.

[55] NHANES has not continued to collect hair-mercury data in subsequent years since the NHANES dataset referenced here. While NHANES has continued with total blood-mercury monitoring, hair mercury is a better biomarker for characterizing methylmercury exposure over time. Given that the CR functions based on the KIHD study (as well as observations presented in Roman *et al.* 2011 regarding cardio-modeling) were all based on hair-mercury, this was chosen as the anchoring analytical biometric. The potential for bias due to the use of the 1999–2000 NHANES data is further discussed in the 2021 Risk TSD.

[56] A detailed discussion of the Mercury Maps approach (establishing a proportional relationship between mercury deposition and methylmercury concentrations in fish at the watershed level) is presented in section 1.4.6.1 of the 2011 Final Mercury TSD which in turn references: *Mercury Maps—A Quantitative Spatial Link Between Air Deposition and Fish Tissue Peer Reviewed Final Report.* U.S. EPA, Office of Water, EPA–823–R–01–009, September, 2001.

[57] Note that while the 2011 Final Mercury TSD, in utilizing an RfD-based approach reflecting neurodevelopmental effects, focused on female subsistence fishers; the analysis focused on MI-mortality risk covers all adult subsistence fishers, and we use our cutpoint bounding analysis because there is not an RfD focused specifically on cardiovascular effects for methylmercury.

watershed to generate equivalent hair-mercury exposure estimates for that subsistence fisher scenario in each watershed (*see* 2021 Risk TSD for additional detail on the conversion of daily methylmercury intake rates into hair-mercury levels). We then compare those hair-mercury levels to the confidence cutpoints developed for the MI mortality screening-level risk assessment described above in section III.A.3.a. If the hair-mercury level for a particular watershed is above either the EURAMIC or KIHD confidence cutpoint (*i.e.,* above 0.66 and 1.9 µg/g hair-mercury, respectively), then we consider that watershed to be at increased risk for MI mortality exclusively due to that U.S. EGU-attributable methylmercury exposure.[58] Note, that this is not to suggest that exposures at watersheds where U.S. EGU-attributable contributions are below these cutpoints are without risk, but rather that when exposure levels exceed these cutpoints, we have increased confidence in concluding there is an increased risk of MI mortality for subsistence fishers active within that watershed. It is also important to note that in many cases, total methylmercury exposure (*i.e.,* EGU contribution plus contributions from other sources) may exceed these confidence cutpoints such that subsistence fishers active at those watersheds would be at increased risk of MI mortality at least in part due to EGU emissions. *See White Stallion,* 748 F.3d at 1242–43 (finding reasonable the EPA's decision to consider cumulative impacts of HAP from EGUs and other sources in determining whether HAP emissions from EGUs pose a hazard to public health under CAA section 112(n)(1)(A)); *see also* CAA section 112(n)(1)(B) (directing the EPA to study the cumulative impacts of mercury emissions from EGUs and other domestic stationary sources of mercury).

Table 3 of the 2021 Risk TSD presents the results of the analysis of risk for MI-mortality for the subsistence fisher scenarios. As with the original RfD-based risk estimates, these results are dimensioned on two key parameters (*self-caught fish consumption rate* and *the watershed percentile exposure level—hair-mercury* µg/g). Those watershed percentile hair-mercury values that exceed the EURAMIC-based MI mortality confidence cutpoints (0.66 µg/g hair-mercury) are shaded in the table and those cells that also exceed the KIHD-based MI mortality confidence cutpoint (1.9 µg/g hair-mercury) are bolded. Once again, these thresholds identify levels of methylmercury exposure (hair-mercury) associated with a clear association with MI-related health effects (*i.e.,* increased risk). Unlike the RfD-based risk estimates, for MI-mortality estimates we only focus on U.S. EGU-attributable methylmercury (*i.e.,* whether U.S. EGU-attributable hair-mercury exceeds the cutpoints of interest).

Results for the typical subsistence fisher, representing high-end self-caught fish consumption in the U.S. population, suggest that up to 10 percent of the watersheds modeled are associated with hair-mercury levels (due to U.S. EGU mercury emissions alone) that exceed the lower EURAMIC cutpoint for MI-mortality risk, with 1 percent of modeled watersheds also exceeding the KIHD cutpoint (due to U.S. EGU-mercury emissions alone). For low-income Black subsistence fishers active in the Southeast, up to 25 percent of the watersheds exceed the lower EURAMIC confidence threshold (assuming the highest rate of fish consumption), with only the upper 1 percent of watersheds exceeding the KIHD threshold (again based only on U.S. EGU-sourced mercury exposure).

c. Characterization of MI-Mortality Risk for the General U.S. Population Resulting From the Consumption of Commercially-Sourced Fish

The second of the three new screening-level risk analyses estimates the incidence of MI mortality in the general U.S. population resulting from consumption of commercially-sourced fish containing methylmercury emitted from U.S. EGUs.[59] This is accomplished by first estimating the total burden of methylmercury-related MI mortality in the U.S. population and then estimating the fraction of that total increment attributable to U.S. EGUs. The task of modeling this health endpoint can involve complex mechanistic modeling of the multi-step process leading from U.S. EGU mercury emissions to mercury deposition over global/regional fisheries to bioaccumulation of methylmercury in fisheries stocks to exposure of U.S. fish consumers through consumption of those commercially-sourced fish (*e.g.,* Giang and Selin, 2016). However, in recognition of the uncertainty associated with attempting to model this more complex multi-step process, we have instead developed a simpler screening analysis approach intended to generate a range of risk estimates that reflects the impact of critical sources of uncertainty associated with this exposure scenario. Rather than attempting to generate a single high-confidence estimate of risk, which in our estimation is challenging given overall uncertainty associated with this exposure pathway, the goal with the bounding approach is simply to generate a range of risk estimates for MI mortality that furthers our understanding of the significant public health burden associated with EGU HAP emissions.

The bounding approach developed for this particular scenario is based on the assumption that fish sourced from global commercial fisheries are loaded by mercury deposited to those fisheries and that the fraction of that deposited mercury originating from U.S. EGUs will eventually be reflected as a fraction of methylmercury in those fish and subsequently as a fraction of MI mortality risk associated with those U.S. EGUs. One of the challenges associated with this screening analysis is how to attribute domestic EGU contributions to global fisheries and how that might vary from location to location. For simplicity, the bounding analysis includes two assumptions: (1) A potential lower-bound reflecting the assumption that U.S. fish consumption is largely sourced from global fisheries and consequently the U.S. EGU contribution to total global mercury emissions (anthropogenic and natural) can be used to approximate the U.S. EGU fractional contribution to MI mortality and (2) a potential upper-bound where we assume that fisheries closer to U.S. EGUs (*e.g.,* within the continental U.S. or just offshore and/or along the U.S. Atlantic and Pacific coastlines) supply most of the fish and seafood consumed within the U.S., and therefore U.S. EGU average deposition over the U.S. (as a fraction of total mercury deposition) can be used to approximate the U.S. EGU fractional contribution to MI mortality (*see* 2021 Risk TSD for more detail).[60] The EPA is

[58] Although we have used the MI-mortality CR function described in section III.A.3.a of this preamble to generate mortality incidence estimates for the general fish consuming population (*see* section III.A.3.c), this is not possible for subsistence fishers since we are not able at this point to enumerate them. Consequently, we use the confidence cutpoints associated with that CR function to identify exposures associated with MI mortality risk as described here.

[59] Although the analysis presented here focuses on methylmercury exposure associated with fish consumption which, as noted earlier, is the primary source of methylmercury exposure for the U.S. population, EGU mercury deposited to land can also impact other food sources including those associated with agricultural production (*e.g.,* rice). In the context of fish consumption, commercially-sourced fish refers to fish consumed in restaurants or from food stores.

[60] Another way of stating this is that the lower-bound estimate reflects an assumption that U.S. EGU mercury is diluted as part of a global pool and impacts commercial fish sourced from across the globe (with lower levels of methylmercury contribution) while the upper-bound estimate

Continued

continuing to review the literature (including consideration of research by FDA) to better define the relative contributions for sources of fish consumed within the U.S. Note that the bounding analysis also includes consideration for another key source of uncertainty, namely, the specification of the CR function linking methylmercury exposure to increased MI mortality and, in particular, efforts to account for increased confidence in specifying the CR function for higher levels of methylmercury exposure through the use of confidence cutpoints (section III.A.3.a). Additional detail on the stepwise process used to first generate the total U.S. burden of MI-mortality related to total methylmercury exposure and then apportion that total risk estimate to the fraction contributed by U.S. EGUs is presented the 2021 Risk TSD. Based on the 29 tons of mercury emitted by U.S. EGUs prior to implementation of MATS, the bounding estimates from the fraction of total mercury deposition attributable to U.S. EGUs at the global scale is 0.48 percent (lower bound) and 1.8 percent (upper bound). These estimated bounding percentages are important since they have a significant impact on the overall incidence of MI mortality ultimately attributable to U.S. EGU-sourced mercury.

Reflecting both the spread in the apportionment of U.S. EGU-sourced mercury (as described above) and application of the three possible applications of the CR function for MI mortality (no confidence-cutpoint, KIHD cutpoint, EURAMIC cutpoint), the estimated MI-mortality attributable to U.S. EGU-sourced mercury for the general U.S. population associated primarily with consumption of commercially-sourced fish ranges from 5 to 91 excess deaths each year.[61] For those Americans with high levels of methylmercury in their body (*i.e.,* above certain cutpoints), the science suggests that any additional increase in methylmercury exposure will raise the risk of fatal heart attacks. Based on this screening analysis, even after imposition of the ARP and other CAA criteria pollutant requirements that also reduce HAP emissions from domestic EGU sources, we find that mercury emissions from EGUs pose a risk of premature mortality due to MI.

d. Characterization of IQ Loss for Children Born to Mothers in the General U.S. Population Resulting From the Consumption of Commercially Sourced Fish (and Other Food Items Containing Methylmercury)

The third new screening-level risk analysis estimates the incidence of IQ loss in children in the general U.S. population resulting from maternal consumption of commercially sourced fish containing methylmercury attributable to U.S. EGUs (resulting in subsequent prenatal exposure to methylmercury). The approach used in estimating incidence of this adverse health effect shares several elements with the approach described above for modeling MI mortality in the general U.S. population, including in particular, the method used to apportion the total methylmercury-related health burden to the fraction associated with U.S. EGU mercury emissions (*e.g.,* use of lower and upper bound estimates of the fractional contribution of domestic EGU sources). Other elements of the modeling approach, including the specification of the number of children born annually in the U.S., the specification of maternal baseline hair-mercury levels (utilizing NHANES data) and the characterization of the linkage between methylmercury exposure (*in utero*) and IQ loss, are based on methods used in the original 2011 benefits analysis completed for MATS (USEPA, 2011) and are documented in the 2021 Risk TSD.

As with the MI-mortality estimates described earlier, the two bounding estimates for the fraction of total mercury deposition attributable to U.S. EGUs at the global and regional scales (0.48 percent and 1.8 percent, respectively) have a significant impact on the overall magnitude of IQ points lost (for children born to the general U.S. population) which are ultimately attributable to U.S. EGUs. However, the EPA has relatively high confidence in modeling this endpoint due to greater confidence in the IQ loss CR function. The range in IQ points lost annually due to U.S. EGU-sourced mercury is estimated at 1,600 to 6,000 points, which is distributed across the population of U.S. children covered by this analysis.[62] Given variation in key factors related to maternal methylmercury exposure, it is likely that modeled IQ loss will not be uniformly distributed across the population of exposed children and may instead, display considerable heterogeneity.[63] The bounding analysis described here was not designed to characterize these complex patterns of heterogeneity in IQ loss across the population of children simulated and we note that such efforts would be subject to considerable uncertainty. However, it does provide evidence of specific adverse outcomes with real implications to those affected. Even small degradations in IQ in the early stages of life are associated with diminished future outcomes in education and earnings potential.

4. Most HAP Benefits Cannot Be Quantified or Monetized

Despite the array of adverse health and environmental risks associated with HAP emissions from U.S. coal- and oil-fired EGUs documented above, as the above discussion demonstrates, it can be technically challenging to estimate the extent to which EGU HAP emissions will result in adverse effects quantitively across the U.S. population absent regulation. In fact, the vast majority of the post-control benefits of reducing HAP cannot be quantified or monetized with sufficient quality to inform regulatory decisions due to data gaps, particularly with respect to sensitive populations. But that does not mean that these benefits are small, insignificant, or nonexistent. There are numerous unmonetized effects that contribute to additional benefits realized from emissions reductions. These include additional reductions in neurodevelopmental and cardiovascular effects from exposure to methylmercury, adverse ecosystem effects including mercury-related impacts on recreational and commercial fishing, health risks from exposure to non-mercury HAP, and health risks in EJ subpopulations that face disproportionally high exposure to EGU HAP.

Congress well understood the challenges in monetizing risks. As discussed in section II.B above, the statutory language in CAA section 112 clearly supports a conclusion that the intended benefit of HAP regulation is a reduction in the volume of HAP emissions to reduce assumed and

reflects a focus on more near-field regional impacts by U.S. EGU mercury to fish sourced either within the continental U.S. or along its coastline (with greater relative contribution to methylmercury levels).

[61] Inclusion of 95th percentile confidence intervals for the effect estimate used in modeling MI mortality extends this range to from 3 to 143 deaths (reflecting the 5th percentile associated with the 5 lower bound estimate to the 95th percentile for the upper bound estimate of 91).

[62] Inclusion of 95th percentile confidence intervals for the effect estimate used in modeling this endpoint extends this range to from 80 to 12,600 IQ points lost (reflecting the 5th and 95th percentiles).

[63] Maternal exposure (and hence IQ impacts to children) from U.S. EGU-sourced mercury can display considerable variation due to (a) spatial patterns of U.S. EGU mercury fate and transport (including deposition and methylation) which affects impacts on fish methylmercury and (b) variations in fish consumption by mothers (including differences in daily intake, types of fish consumed and geographical origins of that fish).

identified risks from HAP with the goal of protecting even the most exposed and most sensitive members of the population. The statute requires the EPA to move aggressively to quickly reduce and eliminate HAP, placing high value on doing so in the face of uncertainty regarding the full extent of harm posed by hazardous pollutants on human health and welfare. The statute also clearly places great value on protecting even the most vulnerable members of the population, by instructing the EPA, when evaluating risk in the context of a determination of whether regulation is warranted, to focus on risk to the most exposed and most sensitive members of the population. *See, e.g.,* CAA sections 112(c)(9)(B), 112(f)(2)(B), and 112(n)(1)(C). For example, in evaluating the potential for cancer effects associated with emissions from a particular source category under CAA section 112(f)(2), the EPA is directed by Congress to base its determinations on the maximum individual risk (MIR) to the most highly exposed individual living near a source. Similarly, in calculating the potential for non-cancer effects to occur, the EPA evaluates the impact of HAP to the most exposed individual and accounts for sensitive subpopulations.

Notably, Congress in CAA section 112 did not require the EPA to quantify risk across the entire population, or to calculate average or ''typical'' risks. The statutory design focusing on maximum risk to individuals living near sources acknowledges the inherent difficulty in enumerating HAP effects, given the large number of pollutants and the uncertainties associated with those pollutants, as well as the large number of sources emitting HAP. However, this does not mean that these effects do not exist or that society would not highly value these reductions, despite the fact that the post-control effects of the reductions generally cannot be quantified. The EPA has long acknowledged the difficulty of quantifying and monetizing HAP benefits. In March 2011, the EPA issued a report on the post-control benefits and costs of the CAA. This Second Prospective Report [64] is the latest in a series of EPA studies that estimate and compare the post-control benefits and costs of the CAA and related programs over time. Notably, it was the first of these reports to include any attempt to quantify and monetize the impacts of reductions in HAP, and it concentrated on a small case study for a single pollutant, entitled ''Air Toxics Case Study—Health Benefits of Benzene Reductions in Houston, 1990–2020.'' As the EPA summarized in the Second Prospective Report, ''[t]he purpose of the case study was to demonstrate a methodology that could be used to generate human health benefits from CAAA controls on a single HAP in an urban setting, while highlighting key limitations and uncertainties in the process. . . . Benzene was selected for the case study due to the availability of human epidemiological studies linking its exposure with adverse health effects.'' (pg. 5–29). In describing the approach, the EPA noted: ''[b]oth the Retrospective analysis and the First Prospective analysis omitted a quantitative estimation of the benefits of reduced concentrations of air toxics, citing gaps in the toxicological database, difficulty in designing population-based epidemiological studies with sufficient power to detect health effects, limited ambient and personal exposure monitoring data, limited data to estimate exposures in some critical microenvironments, and insufficient economic research to support valuation of the types of health impacts often associated with exposure to individual air toxics.'' (pg. 5–29). These difficulties have long hindered the Agency's ability to quantify post-control HAP impacts and estimate the monetary benefits of HAP reductions.

In preparing the benzene case study for inclusion in the Second Prospective Report, the Agency asked the Advisory Council on Clean Air Compliance Analysis (the Council) to review the approach. In its 2008 consensus advice to the EPA after reviewing the benzene case study,[65] the Council noted that ''Benzene . . . has a large epidemiological database which OAR used to estimate the health benefits of benzene reductions due to CAAA controls. The Council was asked to consider whether this case study provides a basis for determining the value of such an exercise for HAP benefits characterization nationwide.'' They concluded:

> As recognized by OAR, the challenges for assessing progress in health improvement as a result of reductions in emissions of hazardous air pollutants (HAPs) are daunting. Accordingly, EPA has been unable to adequately assess the economic benefits associated with health improvements from HAP reductions due to a lack of exposure-response functions, uncertainties in emissions inventories and background levels, the difficulty of extrapolating risk estimates to low doses and the challenges of tracking health progress for diseases, such as cancer, that have long latency periods. . . .
>
> The benzene case study successfully synthesized best practices and implemented the standard damage function approach to estimating the benefits of reduced benzene, however the Council is not optimistic that the approach can be repeated on a national scale or extended to many of the other 187 air toxics due to insufficient epidemiological data. With some exceptions, it is not likely that the other 187 HAPs will have the quantitative exposure-response data needed for such analysis. Given EPA's limited resources to evaluate a large number of HAPs individually, the Council urges EPA to consider alternative approaches to estimate the benefits of air toxics regulations.

In addition to the difficulties noted by the Council, there are other challenges that affect the EPA's ability to fully characterize post-control impacts of HAP on populations of concern, including sensitive groups such as children or those who may have underlying conditions that increase their risk of adverse effects following exposure to HAP. Unlike for criteria pollutants such as ozone and PM, the EPA lacks information from controlled human exposure studies conducted in clinical settings which enable us to better characterize dose-response relationships and identify subclinical outcomes. Also, as noted by the Council and by the EPA itself in preparing the benzene case study, the almost universal lack of HAP-focused epidemiological studies is a significant limitation. Estimated risks reported in epidemiologic studies of fine PM ($PM_{2.5}$) and ozone enable the EPA to estimate health impacts across large segments of the U.S. population and quantify the economic value of these impacts. Epidemiologic studies are particularly well suited to supporting air pollution health impact assessments because they report measures of population-level risk that can be readily used in a risk assessment.

However, such studies are infrequently performed for HAP. Exposure to HAP is typically more uneven and more highly concentrated among a smaller number of individuals than exposure to criteria pollutants. Hence, conducting an epidemiologic study for HAP is inherently more challenging; for starters, the small population size means such studies often lack sufficient statistical power to detect effects. For example, in the case of mercury, the most exposed and most sensitive members of the population

[64] U.S. EPA Office of Air and Radiation, April 2011. *The Benefits and Costs of the Clean Air Act from 1990 to 2020,* Final Report—Rev. A. Available at *https://www.epa.gov/sites/production/files/2015-07/documents/fullreport_rev_a.pdf.*

[65] U.S. EPA Advisory Council on Clean Air Act Compliance Analysis, Review of the Benzene Air Toxics Health Benefits Case Study. July 11, 2008. Available at *https://nepis.epa.gov/Exe/ZyPDF.cgi/P1000ZYP.PDF?Dockey=P1000ZYP.PDF.*

may be both small and highly concentrated, such as the subsistence fishers that the EPA has identified as likely to suffer deleterious effects from U.S. EGU HAP emissions. While it is possible to estimate the potential risks confronting this population in a case-study approach (an analysis that plays an important role in supporting the public health hazard determination for mercury as discussed above in sections III.A.2 and III.A.3), it is not possible to translate these risk estimates into post-control quantitative population-level impact estimates for the reasons described above.

Further, for many HAP-related health endpoints, the Agency lacks economic data that would support monetizing HAP impacts, such as willingness to pay studies that can be used to estimate the social value of avoided outcomes like heart attacks, IQ loss, and renal or reproductive failure. In addition, the absence of socio-demographic data such as the number of affected individuals comprising sensitive subgroups further limits the ability to monetize HAP-impacted effects. All of these deficiencies impede the EPA's ability to quantify and monetize post-control HAP-related impacts even though those impacts may be severe and/or impact significant numbers of people.

Though it may be difficult to quantify and monetize most post-control HAP-related health and environmental benefits, this does not mean such benefits are small. The nature and severity of effects associated with HAP exposure, ranging from lifelong cognitive impairment to cancer to adverse reproductive effects, implies that the economic value of reducing these impacts would be substantial if they were to be quantified completely. By extension, it is reasonable to expect both that reducing HAP-related incidence affecting individual endpoints would yield substantial benefits if fully quantified, and moreover that the total societal impact of reducing HAP would be quite large when evaluated across the full range of endpoints. In judging it appropriate to regulate based on the risks associated with HAP emissions from U.S. EGUs, the EPA is placing weight on the likelihood that these effects are significant and substantial, as supported by the health evidence. The EPA's new screening-level analyses laid out in the Risk TSD for this proposal illustrate this point. Specifically, in exploring the potential for MI-related mortality risk attributable to mercury emissions from U.S. EGUs, the EPA's upper bound estimate is that these emissions may contribute to as many as 91 additional premature deaths each year. The value society places on avoiding such severe effects is very high; as the EPA illustrates in the valuation discussion in the 2021 Risk TSD, the benefit of avoiding such effects could approach $720 million per year. Similarly, for IQ loss in children exposed *in utero* to U.S. EGU-sourced mercury, our upper bound estimate approaches 6,000 IQ points lost which could translate into a benefit approaching $50 million per year.

These estimates are intended to illustrate the point that the HAP impacts are large and societally meaningful, but not to suggest that they are even close to the full benefits of reducing HAP. There are many other unquantified effects of reducing EGU HAP that would also have substantial value to society. As described above, mercury alone is associated with a host of adverse health and environmental effects. The statute clearly identifies this basket of effects as a significant concern in directing the EPA to study them specifically. If the EPA were able to account for all of these post-control effects in our quantitative estimates, the true benefits of MATS would be far clearer. However, available data and methods currently preclude a full quantitative accounting of the post-control impacts of reducing HAP emissions from U.S. EGUs and a monetization of these impacts.

There are other aspects of social willingness to pay that are not accounted for in the EPA's quantitative estimate of benefits either. For example, in previous MATS-related rulemakings and analysis, the EPA has not estimated what individuals would be willing to pay in order to reduce the exposure of *others* who are exposed (even if they are not experiencing high levels of HAP exposure themselves). These may be considered and quantified as benefits depending on whether it is the health risks to others in particular that is motivating them.[66] For example, Cropper *et al.* (2016) found that focus group participants indicated a preference for more equitable distribution of health risks than for income, which indicates that it is specifically the risks others face that was important to the participants.[67] This result is particularly important as exposure to HAP is often disproportionately borne by underserved and underrepresented communities (Bell and Ebisu, 2012).[68] Unfortunately, studies to quantify the willingness to pay for a more equitable distribution of HAP exposures are limited, so quantification of this benefit likely cannot be performed until new research is conducted.

The HAP-related legislative history for the 1990 Amendments includes little discussion of the monetized benefits of HAP, perhaps due to these attendant difficulties. When such monetized benefits were estimated in several outside reports submitted to Congress before passage of the 1990 Amendments, the estimates were based on reduced cancer deaths and the value of the benefits that are quantified were estimated to be small as compared to the estimated costs of regulating HAP emissions under CAA section 112. *See, e.g., A Legislative History of the Clean Air Act Amendments of 1990,* Vol. I at 1366–67 (November 1993) (estimating the total annual cost of CAA section 112 to be between $6 billion and $10 billion per year and the estimated annual benefits to be between $0 and $4 billion per year); *id.* at 1372–73 (estimating the total annual cost of CAA section 112 to be between $14 billion and $62 billion per year and the estimated annual benefits to be between $0 and $4 billion per year). Despite the apparent disparity of estimated costs and monetized benefits, Congress still enacted the revisions to CAA section 112. Thus, it is reasonable to conclude that Congress found HAP emissions to be worth regulating even without evidence that the monetized benefits of doing so were greater than the costs. The EPA believes this stems from the value that the statute places on reducing HAP regardless of whether the post-control benefits of doing so can be quantified or monetized, and the statute's purpose of protecting even the most exposed and most sensitive members of the population.

5. Characterization of HAP Risk Relevant to Consideration of Environmental Justice

In assessing the adverse human health effects of HAP pollution from EGUs, we note that these effects are not borne equally across the population, and that some of the most exposed individuals and subpopulations—protection of whom is, as noted, of particular concern under CAA section 112—are minority and/or low-income populations. Executive Order 12898 (59 FR 7629;

[66] Jones-Lee, M.W. *Paternalistic Altruism and the Value of Statistical Life.* The Economic Journal, vol. 102, no. 410, 1992, pp. 80–90.

[67] Cropper M., Krupnick A., and W. Raich, *Preferences for Equality in Environmental Outcomes,* Working Paper 22644 *http://www.nber.org/papers/w22644* National Bureau of Economic Research, September 2016.

[68] Bell, Michelle L., and Keita Ebisu. *Environmental inequality in exposures to airborne particulate matter components in the United States.* Environmental Health Perspectives 120.12 (2012): 1699–1704.

February 16, 1994) establishes Federal executive policy on EJ issues. That Executive Order's main provision directs Federal agencies, to the greatest extent practicable and permitted by law, to make EJ part of their mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority populations and low-income populations. Executive Order 14008 (86 FR 7619; February 1, 2021) also calls on Federal agencies to make achieving EJ part of their missions ''by developing programs, policies, and activities to address the disproportionately high and adverse human health, environmental, climate-related and other cumulative impacts on disadvantaged communities, as well as the accompanying economic challenges of such impacts.'' That Executive Order also declares a policy ''to secure environmental justice and spur economic opportunity for disadvantaged communities that have been historically marginalized and overburdened by pollution and under-investment in housing, transportation, water and wastewater infrastructure, and health care.'' Under Executive Order 13563, Federal agencies may consider equity, human dignity, fairness, and distributional considerations, where appropriate and permitted by law.

In the context of MATS, exposure scenarios of clear relevance from an EJ perspective include the full set of subsistence fisher scenarios included in the watershed-level risk assessments completed for the rule. Subsistence fisher populations are potentially exposed to elevated levels of methylmercury due to their elevated levels of self-caught fish consumption which, in turn, are often driven either by economic need (*i.e.,* poverty) and/or cultural practices. In the context of MATS, we completed watershed-level assessments of risks for a broad set of subsistence fisher populations covering two health endpoints of clear public health significance including: (a) Neurodevelopmental effects in children exposed prenatally to methylmercury (the methylmercury-based RfD analysis described in the 2011 Final Mercury TSD) and (b) potential for increased MI-mortality risk in adults due to methylmercury exposure (section III.A.3.b above).

The general subsistence fisher population that was evaluated nationally for both analyses was not subdivided by socioeconomic status, race, or cultural practices.[69] Therefore, the risk estimates derived do not fully inform our consideration of EJ impacts, although the significantly elevated risks generated for this general population are clearly relevant from a public health standpoint. However, the other, more differentiated subsistence fisher populations, which are subdivided into smaller targeted communities, are relevant in the EJ context and in some instances were shown to have experienced levels of risk significantly exceeding those of the general subsistence fisher population, as noted earlier in section III.A.3.b.

In particular, for the watershed analysis focusing on the methylmercury RfD-based analysis (*i.e.,* neurodevelopmental risk for children exposed prenatally), while the general female fisher scenario suggested that modeled exposures (from U.S. EGU-sourced mercury alone) exceeded the methylmercury RfD in approximately 10 percent of the watersheds modeled (2011 Final Mercury TSD, Table 2–6), for low-income Black subsistence fisher females in the Southeast, modeled exposures exceeded the RfD in approximately 25 percent of the watersheds. These results suggest a greater potential for adverse effects in low-income Black populations in the Southeast. Similarly, while the general subsistence fisher had exposure levels suggesting an increased risk for MI-mortality risk in 10 percent of the watersheds modeled, two sub-populations were shown to be even further disadvantaged. Low-income Black and white populations in the Southeast and tribal fishers active near the Great Lakes had the potential for increased risk in 25 percent of the watersheds modeled.[70] Both of these results (the neurodevelopmental RfD-based analysis and the analysis of increased MI-mortality risk) suggest that subsistence fisher populations that are racially or culturally, geographically, and income-differentiated could experience elevated risks relative to not only the general population but also the population of subsistence fishers generally. We think these results are relevant in considering the benefits of regulating EGU HAP.

6. Overview of Health and Environmental Effects Associated With Non-HAP Emissions From EGUs

Alongside the HAP emissions enumerated above, U.S. EGUs also emit a substantial quantity of criteria pollutants, including direct $PM_{2.5}$, nitrogen oxides (NO_X) (including NO_2), and SO_2, even after implementation of the ARP and numerous other CAA requirements designed to control criteria pollutants. In the 2011 RIA, for example, the EPA estimated that U.S. EGUs would emit 3.4 million tons of SO_2 and 1.9 million tons of NO_X in 2015 prior to implementation of any controls under MATS (*see* Table ES–2). These EGU SO_2 emissions were approximately twice as much as all other sectors combined (EPA SO_2 Integrated Science Assessment, 2017).[71] These pollutants contribute to the formation of $PM_{2.5}$ and ozone criteria pollutants in the atmosphere, the exposure to which is causally linked with a range of adverse public health effects. SO_2 both directly affects human health and is a precursor to $PM_{2.5.}$ Short-term exposure to SO_2 causes respiratory effects, particularly among adults with asthma. SO_2 serves as a precursor to $PM_{2.5}$, the exposure to which increases the risk of premature mortality among adults, lung cancer, new onset asthma, exacerbated asthma, and other respiratory and cardiovascular diseases. Likewise, EGU-related emissions of NO_X will adversely affect human health in the form of respiratory effects including exacerbated asthma. NO_X is a precursor pollutant to both $PM_{2.5}$ and ground-level ozone. Exposure to ozone increases the risk of respiratory-related premature death, new onset asthma, exacerbated asthma, and other outcomes. Fully accounting for the human health impacts of reduced EGU emissions under MATS entails quantifying both the direct impacts of HAP as well as the avoided premature deaths and illnesses associated with reducing these co-emitted criteria pollutants. Similarly,

[69] Note that the RfD-based analysis described in the 2011 Final Mercury TSD and referenced here addressed the potential for neurodevelopmental effects in children and therefore focused on the ingestion of methylmercury by female subsistence fishers. By contrast, the analysis focusing on increased MI-mortality risk for subsistence fishers described in the 2021 Risk TSD and referenced here was broader in scope and encompassed all adult subsistence fishers.

[70] Recognizing challenges in obtaining high-end consumption rates for tribal populations active in areas of high U.S. EGU impact (*e.g.,* Ohio River valley, areas of the central Southeast such as northern Georgia, northern South Carolina, North Carolina and Tennessee) there is the potential for our analysis of tribal-associated risk to have missed areas of elevated U.S. EGU-sourced mercury exposure and risk. In that case, estimates simulated for other subsistence populations active in those areas (*e.g.,* low-income whites and Blacks in the Southeast as reported here and in Table 3 of the 2021 Risk TSD) could be representative of the ranges of risk experienced by tribal populations to the extent that cultural practices result in similar levels of increased fish consumption.

[71] U.S. EPA. *Integrated Science Assessment for Sulfur Oxides—Health Criteria* (Final Report). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R–17–451, December 2017.

U.S. EGUs emit substantial quantities of CO_2, a powerful greenhouse gas (GHG): The EPA estimated these emissions at 2.23 million metric tpy in 2015 (2011 RIA, Table ES–2). The environmental impacts of GHG emissions are accounted for through the social cost of carbon,[72] which can be used to estimate the benefits of emissions reductions due to regulation.

Not all of the non-HAP benefits of MATS were quantified or monetized in the 2011 RIA. However, the EPA thoroughly documented these potential effects and identified those for which quantification and/or monetization was possible. Specifically, the EPA calculated the number and value of avoided $PM_{2.5}$-related impacts, including 4,200 to 11,000 premature deaths, 4,700 nonfatal heart attacks, 2,600 hospitalizations for respiratory and cardiovascular diseases, 540,000 lost work days, and 3.2 million days when adults restrict normal activities because of respiratory symptoms exacerbated by $PM_{2.5}$ (2011 RIA, p. ES–3). We also estimated substantial additional health improvements for children from reductions in upper and lower respiratory illnesses, acute bronchitis, and asthma attacks. In addition, we included in our monetized co-benefits estimates the effect from the reduction in CO_2 emissions resulting from this rule, based on the interagency SC–CO_2 estimates. These benefits stemmed from imposition of MATS and would be coincidentally realized alongside the HAP benefits.

7. Summary of Public Health Hazards Associated With Emissions From EGUs

The EPA is proposing to find that the evidence provided in this section of the preamble, informed where possible with new scientific evidence available since the publication of the 2016 Supplemental Finding, once again demonstrates that HAP released from U.S. EGUs represent a significant public health hazard absent regulation under CAA section 112. As noted earlier, the EPA found that even after imposition of the other requirements of the CAA, EGUs were the largest domestic source of mercury, HF, HCl, and selenium and among the largest domestic contributors of arsenic, chromium, cobalt, nickel, hydrogen cyanide, beryllium, and cadmium. The EPA has documented a wide range of adverse health effects in children and adults associated with mercury including, in particular, neurodevelopmental effects in children exposed prenatally (*e.g.,* IQ, attention, fine motor-function, language, and visual spatial ability) and a range of cardiovascular effects in adults including fatal MI and non-fatal IHD. Non-mercury HAP have also been associated with a wide range of chronic health disorders (*e.g.,* irritation of the lung; decreased pulmonary function, pneumonia, or lung damage; detrimental effects on the central nervous system; and damage to the kidneys). Furthermore, three of the key metal HAP emitted by EGUs (arsenic, chromium, and nickel) have been classified as human carcinogens and there is evidence to suggest that, prior to MATS, emissions from these sources had the potential to result in cancer risks greater than 1-in-1 million.

Further, this section describes the results from several new screening-level risk assessments considering mercury from domestic EGU sources. These risk assessments focused on two broad populations of exposure: (a) Subsistence fishers exposed to mercury through self-caught fish consumption within the continental U.S. and (b) the general U.S. population exposed to mercury through the consumption of commercially-sourced fish (*i.e.,* purchased from restaurants and food stores). The results of these screening-level risk assessments are useful for informing our understanding about the potential scope and public health importance of these impacts, but remaining uncertainties prohibit precise estimates of the size of these impacts currently. For example, numerous studies considering multiple, large cohorts have shown that people exposed to high amounts of mercury are at higher risk of fatal and non-fatal CVD. While U.S. EGUs are only one of multiple global sources that contribute to this mercury exposure, the EPA's screening analysis suggests the potential for U.S. EGU emissions of mercury to contribute to premature mortality in the general U.S. population.

Furthermore, as part of the subsistence fisher analyses, we included scenario modeling for a number of EJ-relevant populations showing that several populations (including low-income Blacks and whites in the Southeast and tribal populations near the Great Lakes) had risk levels that were significantly above the general subsistence fisher population modeled for the entire U.S. As noted earlier, the EPA believes that Congress intended in CAA section 112 to address risks to the most exposed and most sensitive members of the public. These additional risk assessments suggest that there are populations that are particularly vulnerable to EGU HAP emissions, including populations of concern from an EJ standpoint.

MATS plays a critical role in reducing the significant volume and risks associated with EGU HAP emissions discussed above. Mercury emissions have declined by 86 percent, acid gas HAP by 96 percent, and non-mercury metal HAP by 81 percent since 2010 (pre-MATS). *See* Table 4 at 84 FR 2689 (February 7, 2019). MATS is the only Federal requirement that guarantees this level of HAP control from EGUs. At the same time, the concomitant reductions in CO_2, NO_X, and SO_2, also provide substantial public health and environmental benefits. Given the numerous and important public health and environmental risks associated with EGU emissions, the EPA again concludes that the advantages of regulating HAP emissions from this sector are significant. Acknowledging the difficulties associated with characterizing risks from HAP emissions discussed earlier in this section, we solicit comments about the health and environmental hazards of EGU HAP emissions discussed in this section and the appropriate approaches for quantifying such risks, as well any information about additional risks and hazards not discussed in this proposal.

B. Consideration of Cost of Regulating EGUs for HAP

1. Introduction

In evaluating the costs and disadvantages of MATS, we begin with the costs to the power industry of complying with MATS. This assessment uses a sector-level (or system-level) accounting perspective to estimate the cost of MATS, looking beyond just pollution control costs for directly affected EGUs to include incremental costs associated with changes in fuel supply, construction of new capacity, and costs to non-MATS units that were also projected to adjust operating decisions as the power system adjusted to meet MATS requirements. Such an approach is warranted due to the nature of the power sector, which is a large, complex, and interconnected industry.

[72] *See https://19january2017snapshot.epa.gov/climatechange/social-cost-carbon_.html:* "EPA and other federal agencies use estimates of the social cost of carbon (SC–CO_2) to value the climate impacts of rulemakings. The SC–CO_2 is a measure, in dollars, of the long-term damage done by a ton of carbon dioxide (CO_2) emissions in a given year. This dollar figure also represents the value of damages avoided for a small emission reduction (*i.e.,* the benefit of a CO_2 reduction). The SC–CO_2 is meant to be a comprehensive estimate of climate change damages and includes changes in net agricultural productivity, human health, property damages from increased flood risk, and changes in energy system costs, such as reduced costs for heating and increased costs for air conditioning. However, given current modeling and data limitations, it does not include all important damages."

This means that while the MATS requirements are directed at a subset of EGUs in the power sector, the compliance actions of the MATS-regulated EGUs can affect production costs and revenues of other units due to generation shifting and fuel and electricity price changes. Thus, the EPA's projected compliance cost estimate represents the incremental costs to the entire power sector to generate electricity, not just the compliance costs projected to be incurred by the coal- and oil-fired EGUs that are regulated under MATS. Limiting the cost estimate to only those expenditures incurred by EGUs directly regulated by MATS would provide an incomplete estimate of the costs of the rule.

Using this broad view, in the 2011 RIA we projected that the compliance cost of MATS would be $9.6 billion per year in 2015.[73] This estimate of compliance cost was based on the change in electric power generation costs between a base case without MATS and a policy case where the sector complies with the HAP emissions limits in the final MATS. The EPA generated this cost estimate using the Integrated Planning Model (IPM).[74] This model is designed to reflect electricity markets as accurately as possible using the best available information from utilities, industry experts, natural gas and coal market experts, financial institutions, and government statistics. Notably, the model includes cost and performance estimates for state-of-the-art air pollution control technologies with respect to mercury and other HAP controls. But there are inherent limits to what can be predicted *ex ante.* And because the estimate was made 5 years prior to full compliance with MATS, stakeholders, including a leading power sector trade association, have indicated that our initial cost projection significantly overestimated actual costs expended by industry. There are significant challenges to producing an *ex post* cost estimate that provides an apples-to-apples comparison to our initial cost projections, due to the complex and interconnected nature of the industry. However, independent analyses provided to the EPA indicate that we may have overestimated the cost of MATS by billions of dollars per year. Moreover, there have been significant changes in the power sector in the time since MATS was promulgated that were not anticipated in either EPA or U.S. Energy Information Administration (EIA) projections at the time.[75] Entirely outside of the realm of EPA regulation, there were dramatic shifts in the cost of natural gas and renewables, state policies, and Federal tax incentives, which have also further encouraged construction of new renewables. These have led to significantly faster and greater than anticipated retirement of coal capacity and coal-fired generation.

While there are significant limitations to producing an *ex post* cost estimate, we have endeavored, where possible, to approximate the extent of our overestimate. The unexpected shifts in the power sector, including the rapid increase in natural gas supplies that occurred after promulgation of MATS, resulted in our projected estimates of natural gas prices to be approximately double what they were in actuality. Incremental natural gas expenditures accounted for approximately 25 percent of the $9.6 billion compliance cost estimate for 2015 in the 2011 RIA. The market trends of the power sector also had major impacts on the number of controls installed and operated on coal-fired EGUs in the years following promulgation of MATS. With respect to just pollution control installation and operation, we project that we overestimated annual compliance costs by at least $2.2 to 4.4 billion per year, simply as a result of fewer pollution controls being installed than were estimated in the 2011 RIA. Though this range of an overestimate is limited to costs associated with pollution controls and operation, those costs made up 70 percent of the projected $9.6 billion figure.

We additionally find that the controls that were installed at MATS-regulated EGUs were likely both less expensive and more effective in reducing pollution than originally projected, resulting in our estimate likely being too high for these reasons as well. Lastly, since completing the 2011 RIA, we have updated several assumptions in our modeling that would also have resulted in a lower cost estimate had they been incorporated into our modeling at the time of the rule. Taking into account the above considerations, we believe we overestimated the cost of MATS by billions of dollars.

We next examine the projected cost of MATS—both total cost and specific types of costs—using sector-level metrics that put those cost estimates in context with the economics of the power sector. The reason we examine these metrics is to better understand the disadvantages that expending these costs had on the EGU industry and the public more broadly, just as on the benefits side we look beyond the volume of pollution reductions to the health and environmental advantages conferred by the reductions.

For purposes of these analyses, we use the 2011 RIA projections, keeping in mind our newer analyses, which indicated that those projections were almost certainly overestimated. Specific to the power sector, we evaluate the projected costs of the rule to revenues from electricity sales across nearly 20 years, and we compare the projected expenditures required under the rule with historic expenditures by the industry over the same time period. We additionally evaluate broader impacts on the American public by looking at projected effects of MATS on retail electricity prices and our analyses of whether the power sector could continue to provide adequate and reliable electricity after imposition of the rule. We find that, when viewed in context, the projected costs of MATS to both the power sector and the public were small relative to these metrics and well within the range of historical variability. Moreover, experience has borne out our projection that the EGU sector could continue to provide adequate, reliable, and affordable electricity to the American public after the imposition of the rule.

Section III.B.2 contains our discussion of the ways in which the compliance costs for MATS were likely overestimated. Section III.B.3 expands upon and re-evaluates the cost metrics used in the 2016 Supplemental Finding by adding post-promulgation information to our analysis, and we discuss impacts on power sector generating capacity. In section III.B.4, we propose to reaffirm additional cost considerations regarding the availability and cost of control technologies discussed in earlier rulemakings, and in section III.B.5, we provide our proposed conclusions regarding the costs, or disadvantages, of regulating HAP from EGUs.

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[73] All costs were reported in 2007 dollars.

[74] IPM, developed by ICF International, is a state-of-the-art, peer-reviewed, dynamic, deterministic linear programming model of the contiguous U.S. electric power sector. IPM provides forecasts of least-cost capacity expansion, electricity dispatch, and emission control strategies while meeting electricity demand and various environmental, transmission, dispatch, and reliability constraints. The EPA has used IPM for over 2 decades to understand power sector behavior under future business-as-usual conditions and to evaluate the economic and emission impacts of prospective environmental policies.

[75] In 2009, coal-fired generation was by far the most important source of utility scale generation, providing more power than the next two sources (natural gas and nuclear) combined. By 2016, natural gas had passed coal-fired generation as the leading source of generation in the U.S. While natural gas-fired generation, nuclear generation and renewable generation have all increased since 2009, coal-fired generation has significantly declined.

2. Compliance Cost Projections in the 2011 RIA Were Likely Significantly Overestimated

In issuing this proposal, the EPA finds itself in a position Congress was not likely to have contemplated when it promulgated the 1990 Amendments. The statute contemplated that the EPA would have completed the required studies and presumably made its determination more than 20 years ago. Due to litigation and multiple changes of administration following *Michigan,* we are, at this point, nearly 10 years after promulgation of the regulation about which we are making a threshold determination, and 5 years after full implementation of that regulation. The vast majority of MATS-affected sources were required to be in compliance with the rule's requirements by April 2016, and installation of new controls–or upgrades to existing controls–were in place by 2017.[76] This means we now have on hand unit-level data regarding installations, a clearer picture about market trends, and updated, more accurate assumptions that, taken together, produce a very different picture of the actual costs of MATS than what we projected when we reaffirmed the appropriate and necessary determination and promulgated the rule in 2012. Therefore, while the Agency considers that the information that was available at the time of MATS promulgation provided a valid analytical basis for the threshold appropriate and necessary determination, because many years have elapsed since then, the EPA believes it is reasonable to examine how the power sector has evolved since MATS was finalized and, with the benefit of hindsight, compare important aspects of the 2011 RIA projections with what actually happened since MATS was promulgated. Because our obligation under CAA section 112(n)(1)(A) is to fully consider the advantages and disadvantages of regulating a large, critically important industry, whose role impacts the lives of every American, we think it is important to evaluate and consider the best, currently available information, even if, as discussed in sections III.B.3 and 4, the pre-existing record supports the same conclusion. This *ex post* examination demonstrates that the EPA almost certainly significantly overestimated compliance costs in the 2011 RIA, which further supports the determination that regulation is appropriate and necessary after considering cost. We also do not view this updated, post-hoc evaluation of what happened post-promulgation as undermining the record we established in 2012. Models are not invalidated ''solely because there might be discrepancies between those predictions and the real world. That possibility is inherent in the enterprise of prediction.'' *EME Homer City Generation, L.P.* v. *EPA,* 795 F.3d 118, 135–36 (D.C. Cir. 2015).

In an ideal world, with perfect information, we would be able to generate an *ex post* analysis of regulatory costs that could be compared to our *ex ante* cost estimate prepared at the time MATS was issued. However, it is extremely challenging to produce rigorous retrospective estimates of regulatory costs. A literature review and series of case studies performed by EPA staff provides insights on how analysts can perform retrospective cost analysis.[77] Kopits *et al.* (2015) identifies several challenges associated with *ex post* cost assessments, including data limitations with respect to how facilities chose to comply with regulations and comprehensive facility-level pollution abatement costs. A key component to a rigorous retrospective analysis noted by the authors that can be particularly difficult to achieve is an accurate definition of the counterfactual, that is, what would have occurred absent the rule. It is this counterfactual that provides the baseline against which the incremental costs of regulation are estimated.

In the case of MATS, to construct an estimate of *ex post* implementation costs that is directly comparable to the *ex ante* 2011 RIA cost estimate, we would first need to accurately attribute changes in the power sector that were due to MATS requirements rather than to market and technological changes, other regulations, or, importantly, combinations of these factors (*i.e.,* properly specify the counterfactual). Second, we would need actual information of the incremental costs that had been associated with facility-level operational changes due to MATS, such as observed changes in dispatch, actual fuel consumption, and how controls in MATS-affected units were actually operated. Even the operation of non-MATS affected units would be relevant to such an analysis, because operational decisions are interconnected on the grid via dispatch decisions as well as through fuel markets. While there may be approaches such as econometric analysis, simulation modeling, and event study analysis that could capture and estimate components of the problem identified above and derive an estimate of *ex post* MATS costs, the approach would very likely require different methods and assumptions than the 2011 RIA estimates which were based on the comparison of two forward-looking sets of projections. Even if we undertook such additional analysis or modeling, ultimately we would still only be able to provide a new *estimate* of regulatory costs, not an *actual* cost. Given how challenging it is to produce rigorous retrospective estimates of regulatory costs, particularly at a system-level, an *ex post* analysis is better suited to comparing particular aspects of the analysis, which can help us understand whether costs in the 2011 RIA were over- or under-estimated and can yield a general sense of how much reality diverged from the projection, than to attempting to generate a new and precise ''actual'' total compliance cost estimate for MATS.

Estimating retrospective costs for a rule of the magnitude of MATS is an especially significant challenge because the rule regulates hundreds of units within a complex, interdependent, and dynamic economic sector. Units within the power sector are also subject to many regulatory requirements and other economic drivers. While we can observe the decisions of the sector and individual units in terms of decisions on controls, fuels, and retirement, we cannot pinpoint the reason(s) behind each unit-level decision. With respect to identifying the counterfactual against which to evaluate retrospective compliance costs, several unforeseen factors since MATS promulgation have driven changes in the power sector that have led to the composition of the current fleet being different than the fleet projected in the 2011 RIA. For example, dramatic increases in the supply of natural gas, along with advances in cost and performance of renewable generation technologies and low electricity demand growth, none of which were fully anticipated in the 2011 RIA, have made strong contributions to shifts away from coal-fired generation.[78] [79] Additionally, other

[76] Affected sources were required to be in compliance with the requirements in MATS within 3 years after the effective date of the rule (*i.e.,* by April 2015). However, sources were allowed to request an additional year to comply with the rule and the vast majority of sources were required to be in compliance with the rule's requirements by April 2016. We therefore think 2017 is a reasonable year in which to analyze installed controls on the EGU fleet.

[77] Kopits, E., A. McGartland, C. Morgan, C. Pasurka, R. Shadbegian, N. B. Simon, D. Simpson and A. Wolverton (2015). *Retrospective cost analyses of EPA regulations: a case study approach.* Journal of Benefit-Cost Analysis 5(2): 173–193.

[78] Linn, J. and K. McCormack (2019). *The Roles of Energy Markets and Environmental Regulation in Reducing Coal-Fired Plant Profits and Electricity*

EPA regulations such as the Disposal of Coal Combustion Residuals from Electric Utilities final rule, the Steam Electric Power Generating Effluent Guidelines—2015 Final Rule, and the 2020 Steam Electric Reconsideration Rule, were promulgated after MATS.[80] While the compliance periods of these rules all postdate the MATS compliance date, utilities are likely to consider multiple regulations simultaneously when making planning decisions, a likelihood that also complicates the identification of the counterfactual scenario of a world without MATS that is needed to generate an *ex post* incremental cost estimate of MATS that would be directly comparable to the *ex ante* 2011 RIA cost estimate.

Even though it is extremely challenging to produce the type of *ex post* incremental cost estimate discussed above, several stakeholders have conducted analyses, focusing on different components of the regulation's cost, to assess actual costs of compliance. While none of these estimates can be precisely compared against the EPA *ex ante* estimates because they use different methods than the power sector modeling the EPA used in the 2011 RIA, all of the independent analyses suggested that the actual compliance costs expenditures were significantly lower—by billions of dollars—than the EPA estimated in the 2011 RIA.

First, a 2015 analysis by Andover Technology Partners focused on the capital and operating costs associated with the actual installation and operation of pollution control equipment at MATS-regulated units and made two key findings: the number of installed controls was significantly lower than the number of controls that was projected in the 2011 RIA and the cost of the installed controls was generally lower than the control costs that the EPA assumed in the 2011 RIA modeling. Based on these findings, the study estimated that the EPA's projected cost of compliance was over-estimated by approximately $7 billion.[81] [82] In other words, the Andover Technology Partners estimated that the EPA's projected cost was approximately four times higher than their retrospective estimate of cost, which they estimated to be approximately $2 billion per year.

Second, a 2017 study performed by M.J. Bradley & Associates (MJB&A) used information from the EIA and estimated that owners and operators of coal-fired EGUs incurred total capital expenditures on environmental retrofits of $4.45 billion from December 2014 to April 2016.[83] To the EPA's understanding, the MJB&A cost estimate represents total upfront capital costs (not ongoing operating and maintenance expenditures), and is not annualized as was the capital expenditure in the 2011 RIA-based projected cost estimate. For comparison, the estimated total upfront (not annualized) capital expenditures underpinning the 2011 RIA annual compliance cost estimate is about $36.5 billion, which is more than eight times higher than the MJB&A estimates. This result suggests that the capital cost component of the 2011 RIA cost projections was significantly overestimated, potentially by a factor of more than eight.

Third, the Edison Electric Institute (EEI), the association that represents all U.S. investor-owned electric companies, estimated that by April 2019, owners and operators of coal- and oil-based EGUs incurred *cumulative* (not annual) compliance costs of more than $18 billion to comply with MATS, including both capital and operations and maintenance costs since MATS became effective in April 2012.[84] In order to provide a simple comparison between the EEI figure, which was incurred over 7 years, and the annualized amount presented in the 2011 RIA ($9.6 billion), we can divide the EEI figure by 7 to estimate an average annual amount of approximately $2.6 billion, which is similar to the Andover Technology Partners estimate of approximately $2 billion. Also in line with the Andover Technology Partners estimate, EEI's estimate suggests that the annual costs related to MATS compliance were overestimated in the 2011 RIA by approximately $7 billion. While there is some uncertainty in the amount of time over which those costs were incurred, as well as the exact nature of those expenditures, it is clear that the information provided by EEI supports a conclusion that the costs of compliance with MATS were significantly lower than the Agency's projections.

In summary, it is the EPA's understanding that two of these studies indicate that the 2011 RIA may have overestimated annual compliance costs by approximately $7 billion, and the third study finds that the projected total upfront capital costs may have been overestimated by a factor of more than eight. While each of these retrospective cost estimates is developed from bases that are dissimilar from one another and, in particular, from how the EPA developed the prospective cost estimates in the 2011 RIA, each of the independent analyses indicate that the costs of MATS are likely significantly less than the EPA estimated in the 2011 RIA.

For this proposal, the EPA has evaluated whether the *ex ante* estimates in the 2011 RIA were likely accurate, overestimated, or underestimated, and the details of the EPA's new analysis are contained in the docketed TSD (referred to herein as the "Cost TSD").[85] Consistent with our systems-level approach, we begin our analysis with an evaluation of natural gas expenditures during the relevant time period. The rapid decrease in the price of natural gas during this time period affected U.S. power generation profoundly, including U.S. EGU fuel expenditures; this has significant implications for our *ex post* analysis because natural gas expenditures constituted approximately 25 percent of the projected 2015 compliance costs in the 2011 RIA.[86] These market shifts in the industry also impacted expenditures associated with the installation and operation of pollution control equipment at MATS-affected facilities. Those costs constituted a majority—about 70 percent—of the projected annual compliance costs in 2015. The following

Sector Emissions. RAND Journal of Economics 50: 733–767.

[79] Coglianese, J., *et al.* (2020). *The Effects of Fuel Prices, Environmental Regulations, and Other Factors on U.S. Coal Production, 2008–2016.* The Energy Journal 41(1): 55–82.

[80] 85 FR 53516 (August 28, 2020), 80 FR 67838 (November 3, 2015), and 85 FR 64650 (October 13, 2020), respectively.

[81] Declaration of James E. Staudt, Ph.D., CFA, at 3, *White Stallion Energy Center* v. *EPA,* No. 12–1100 (DC Cir., December 24, 2015). Also available at Docket ID Item No. EPA–HQ–OAR–2009–0234–20549.

[82] In addition to the 2015 study, Andover Technology Partners produced two other analyses in 2017 and 2019, respectively, that estimated the ongoing costs of MATS. The 2017 report estimated that the total annual operating cost for MATS-related environmental controls was about $620 million, an estimate that does not include ongoing payments for installed environmental capital. The 2019 report estimates the total annual ongoing incremental costs of MATS to be about $200 million; again, this estimate does not include ongoing MATS-related capital payment. The 2017 report is available in Docket ID Item No. EPA–HQ–OAR–2018–0794–0794. The 2019 report is available in Docket ID Item No. EPA–HQ–OAR–2018–0794–1175.

[83] Available in Docket ID Item No. EPA–HQ–OAR–2018–0794–1145.

[84] Available in Docket ID Item No. EPA–HQ–OAR–2018–0794–2267.

[85] U.S. EPA. 2021. *Supplemental Data and Analysis for the National Emission Standards for Hazardous Air Pollutants: Coal- and Oil-Fired Electric Utility Steam Generating Units—Revocation of the 2020 Reconsideration, and Affirmation of the Appropriate and Necessary Supplemental Finding; Notice of Proposed Rulemaking ("Cost TSD").*

[86] We projected that regulation of coal- and oil-fired EGUs under MATS would induce units to switch to natural gas, which in turn would increase the price of natural gas and the cost of those expenditures.

sections closely examine these two components of the compliance cost and use available information to evaluate whether the projected compliance costs reported in the 2011 RIA were likely higher or lower than actual costs. We also review important cost assumptions used in the 2011 RIA. Taken together, this suite of quantitative and qualitative evaluations indicates that the projected costs in the 2011 RIA were almost certainly significantly overestimated. We find that the 2011 RIA's estimate of the number of installations alone led to an overestimate of about $2.2 to $4.4 billion, and that if recent updates to the cost and performance assumption for pollution controls had been reflected in the 2011 RIA modeling, the projected compliance costs would likely have been even lower (suggesting the overestimate could be greater than $4.4 billion).

a. Natural Gas Supply

The natural gas industry has undergone significant change in recent years. Starting in the mid-2000s, technological changes in natural gas drilling and extraction initiated major market changes that resulted in significant increases to domestic supplies of natural gas. As these technologies have continued to advance, they have had a lasting impact on natural gas markets, resulting in major shifts in the economics of electric sector operations given the abundant supply of natural gas at relatively low costs. This section summarizes these changes and the implications for the cost projection presented in the 2011 RIA.

In 2005, the EIA estimated that proved reserves of natural gas were 213 trillion cubic feet (tcf).[87] In 2019, the estimate of proved reserves was 495 tcf, an increase of 132 percent. The market effects of this major supply shift were profound across the economy, but especially for the power sector. By the end of 2019, aided by advances in drilling and hydraulic fracturing techniques, natural gas production from tight and shale gas formations was the major source of domestic production (*see* Table 1 below) and had increased three-fold from 2005 production levels.

TABLE 1—U.S. NATURAL GAS PRODUCTION, BY SOURCE

[Trillion cubic feet]

Year	Tight/shale gas	Other lower 48 onshore	Lower 48 offshore	Other
2005	7.2	5.1	3.4	2.3
2006	8.0	5.1	3.2	2.3
2007	9.0	4.9	3.1	2.3
2008	10.3	4.9	2.6	2.4
2009	11.1	4.5	2.7	2.4
2010	12.4	4.2	2.5	2.2
2011	14.8	4.0	2.0	2.1
2012	16.7	3.7	1.6	2.0
2013	17.6	3.5	1.4	1.7
2014	19.5	3.4	1.3	1.6
2015	21.0	3.2	1.4	1.5
2016	21.1	2.8	1.3	1.4
2017	22.2	2.7	1.1	1.3
2018	25.7	2.7	1.0	1.3
2019	29.3	2.4	1.0	1.2
2020	29.2	2.3	1.2	1.2

Source: U.S. EIA, *https://www.eia.gov/energyexplained/natural-gas/where-our-natural-gas-comes-from.php,* accessed July 25, 2021.

Note: ''Other'' includes production from Alaska and Coalbed Methane sources.

As a result, the natural gas market underwent a long period of sustained low prices (*see* Table 2 below). These market shifts were not fully anticipated or predicted by observers, as indicated by natural gas futures prices at the time of MATS promulgation. Although these changes took root in the mid-2000s, the lasting market disruption would take more time to cement itself. From 2010 through 2019, the U.S became one of the world's leading producers of natural gas, breaking domestic production records year-on-year through the decade, while maintaining record-low prices. During this timeframe, the U.S. shifted from a *total* net energy importer to an exporter,[88] while maintaining some of the lowest relative natural gas prices globally.[89]

TABLE 2—NATURAL GAS PRICES

Year	NYMEX natural gas Henry Hub natural gas futures ($/MMBtu), annual average, as of: 2011–03–16	NYMEX natural gas Henry Hub natural gas futures ($/MMBtu), annual average, as of: 2011–12–21	Henry Hub spot natural gas index annual average price ($/MMBtu)
2005			8.63
2006			6.74
2007			6.96

[87] *U.S. Crude Oil and Natural Gas Proved Reserves, Year-end 2019* (Table 9: U.S. proved reserves of natural gas). EIA, January 11, 2021 release available at *https://www.eia.gov/naturalgas/crudeoilreserves.* Accessed July 23, 2021.

[88] *Monthly Energy Review,* EIA (June 24, 2021) and *Today in Energy* (''U.S. total energy exports exceed imports in 2019 for the first time in 67 years''), EIA (April 20, 2020) available at *https://www.eia.gov/todayinenergy/detail.php?id=43395.* Accessed July 23, 2021.

[89] BP, *Statistical Review of World Energy 2021* available at *https://www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy.html.* Accessed July 23, 2021.

TABLE 2—NATURAL GAS PRICES—Continued

Year	NYMEX natural gas Henry Hub natural gas futures ($/MMBtu), annual average, as of: 2011–03–16	NYMEX natural gas Henry Hub natural gas futures ($/MMBtu), annual average, as of: 2011–12–21	Henry Hub spot natural gas index annual average price ($/MMBtu)
2008			8.90
2009			3.94
2010			4.37
2011	4.24		4.00
2012	4.91	3.43	2.75
2013	5.31	4.07	3.73
2014	5.67	4.43	4.37
2015	6.04	4.66	2.63
2016	6.36	4.90	2.51
2017	6.67	5.16	2.98
2018	6.97	5.43	3.16
2019	7.25	5.70	2.56
2020	7.50	5.96	2.03
2021	7.76	6.23	
2022	8.02	6.50	
2023	8.28	6.78	
2024		7.06	

Source: Annual Average Henry Hub Price, EIA. NYMEX price, from S&P Global data. 2015 data from 2011 RIA, Chapter 3.

The EPA projected a 2015 natural gas price of roughly $5/MMBtu when MATS was finalized in December 2011, which was a reasonable expectation based on prevailing market conditions at that time. However, natural gas prices post-MATS promulgation ended up being considerably lower than anticipated, which resulted in major shifts in the economics of fossil fuel-fired electric generating technologies (*see* Table 2 above and Chart A–1 in the Cost TSD). From 2005 through 2010, annual average natural gas prices (at Henry Hub) averaged about $6.60/MMBtu. Several years later, as MATS compliance began, prices averaged roughly $2.75/MMBtu for the years 2015 through 2019. This market shift greatly changed the economics of power plant operation for fossil fuel-fired facilities, with the electric sector surpassing the industrial sector to become the largest consumer of natural gas (38 percent of the total in 2020),[90] and gas-fired generators becoming the leading source of electric generation in the electric sector, representing 40 percent of total generation in 2020.[91]

The modeling supporting the 2011 RIA did not anticipate this major change in natural gas supply, which has clearly had a significant impact on the electric power sector and those sources covered by MATS. While we do not quantify the impact this change would have on the projected compliance costs associated with incremental changes in natural gas use and price (about 25 percent of the total projected compliance cost in the 2011 RIA), we note that any closures of covered units that occurred as a result of the changed relative economics of fuel prices would decrease the MATS-related compliance costs for the sector. These closures reduced the amount of control capacity necessary for compliance with MATS, and we estimate below a range of costs associated with the overestimation of control installations in the 2011 RIA.

Several researchers have investigated the role of relative fuel prices as a factor in decisions that were made regarding closures of coal-fired units around 2015. Generally, these studies attribute closures primarily to the decrease in natural gas prices, and they also note smaller factors such as advances in the cost and performance of renewable generating sources, lower-than-anticipated growth in electricity demand, and environmental regulations.

For example, Linn and McCormack (2019) developed a simulation model of the U.S. Eastern Interconnection that reproduced unit operation, emissions, and retirements over the 2005–2015 period. The authors use this model to explain the relative contributions of demand, natural gas prices, wind generation, and environmental regulations, including MATS, to the changes in the share of coal in electricity generation. The results showed that lower electricity consumption and natural gas prices account for a large majority of the declines in coal plant profitability and resulting retirements. The authors found that the environmental regulations they modeled, NO_X emissions caps and MATS, played a relatively minor role in declines of coal plant profitability and retirements.

Additionally, Coglianese *et al.* (2020) developed a statistical modeling approach to enable the decomposition of changes in U.S. coal production from 2008–2016 into changes due to a variety of factors, including changes in electricity demand, natural gas prices relative to coal, renewable portfolio standards, and environmental regulations that affect coal-fired plants. The results indicated that declines in natural gas prices explained about 92 percent of the decrease in coal production between 2008 and 2016. Air regulations, including MATS, explained about 6 percent of the drop in coal production. The study attributed about 5.2 GW of coal-fired EGU retirements to MATS.

These studies both demonstrate that the decrease in natural gas prices played a significant role in closures of coal-fired EGUs. While we do not quantify the impact this change had on the projected costs included in the 2011 RIA, we note that any closures of covered units that occurred as a result of the dramatically changed relative economics of fuel prices would decrease the MATS-related compliance costs for the sector.

[90] Table 4.3, *Monthly Energy Review,* EIA, April 2021, available at *https://www.eia.gov/totalenergy/data/monthly/archive/00352104.pdf.*

[91] EIA, Electricity Data Browser, Net generation, United States, all sectors, annual, available at *https://www.eia.gov/electricity/data/browser/.*

b. Projected Versus Observed Pollution Control Installations

The 2011 RIA reported a sector-level compliance cost of $9.6 billion annually in 2015. The majority of those costs—about 70 percent—represented the incremental annualized capital and annual operation and maintenance (O&M) costs associated with installation and operation of pollution controls for compliance with MATS at coal steam units. Given the time that has passed, we can now compare the incremental projected pollution control capacity reported in the 2011 RIA with available information regarding actual (observed) control installations. For this proposal, therefore, the EPA has compared observed installations and costs over 2013–2016 to unit-level estimates of the control installation capacity and associated costs presented in the 2011 RIA. This analysis demonstrates, subject to the caveats and uncertainty discussed below, that the 2011 RIA likely overestimated total pollution control retrofit capacity that would occur in response to MATS and, thus, likely overestimated MATS compliance costs. For example, the analysis that follows demonstrates that fabric filter (FF) systems—which are an expensive and capital-intensive control technology—were only installed on less than one-third of the capacity anticipated in the 2011 RIA analysis.

This comparison of projected to observed control capacity installations relies on the simplifying assumption that all dry scrubbers (*e.g.,* dry FGD systems), dry sorbent injection (DSI) systems, activated carbon injection (ACI) systems, and FF systems installed during the 2013–2016 period were installed for compliance with the MATS emissions limits. This assumption is necessitated by the absence of comprehensive data on the specific reasons EGUs installed pollution control equipment. While assuming pollution controls of these types that were installed in this period are singularly attributable to MATS requirements is a reasonable assumption for this analysis, it is a highly conservative assumption given that some of the observed installations likely occurred in response to other regulations to control criteria air pollutants (*e.g.,* Cross-State Air Pollution Rule, Regional Haze, Federal implementation plans, or state implementation plans) or enforcement actions (*e.g.,* consent decrees). Because some of the observed installations in this analysis likely resulted from non-MATS requirements, the approach potentially over-attributes the amount of pollution controls built specifically for MATS compliance, thereby leading to an overestimate of the control costs associated with MATS.

Table 3 presents the findings of this analysis in capacity terms. The total capacity projected to retrofit with each control in the 2011 RIA is reported for the base case (*i.e.,* projected future conditions absent MATS) and under MATS. The difference is presented in the 'Projected Incremental Controls' column. So, for example, in the 2011 RIA the EPA projected that there would be an incremental 20.3 GW of capacity retrofitting with dry FGD that is attributable to MATS. We compare the projected incremental controls capacity value to the observed installations capacity value. Note that we are unable to estimate the total capacity of observed upgrades to electrostatic precipitators (ESP) and scrubbers due to a lack of available data regarding such upgrades. For additional information, *see* the docketed Cost TSD.

TABLE 3—PROJECTED VS. OBSERVED CAPACITY

[Gigawatts (GW)]

Pollution control retrofit	Base case	MATS	Projected incremental controls	Observed installations (2013–2016)	Difference: Observed minus projected (2013–2016)	Percent difference: Observed minus projected (2013–2016)
Dry FGD	4.6	24.8	20.3	16.0	−4.3	−21
DSI	8.6	52.5	43.9	15.8	−28.1	−64
ACI	0	99.3	99.3	96.1	−3.2	−3
FF	12.7	114.7	102	31.4	−70.6	−69
ESP Upgrade	0	33.9	33.9	N/A	N/A	N/A
Scrubber Upgrade	0	63.1	63.1	N/A	N/A	N/A

Source: Projected Controls: 2011 RIA; Observed Installations: NEEDS v.5.16.

Note: FF installations include installations specifically related to PM control, as well as installations included with dry scrubber, DSI, and some ACI retrofits in the modeling. Totals may not sum due to rounding.

This analysis demonstrates that projected incremental capacity of dry FGD, DSI, ACI, and FF was likely significantly overestimated in the 2011 RIA. The capacities of actual installed control technologies are lower, often significantly lower, than projected (and again, this analysis attributes *all* control installations of certain types during this time period to MATS, even though some portion of those installations were likely made in whole or in part due to other regulations). For example, the installed DSI capacity is about two-thirds lower than was projected. The difference between observed installed control capacities and what we projected those incremental control capacities would be translates directly into significantly lower costs than estimated. Because the vast majority of compliance costs in the 2011 RIA were related to the installation and operation of pollution controls, and because significant deployment of any higher-cost compliance strategies did not occur, the large differences observed in Table 3 suggest that the projected compliance costs were likely significantly overestimated as well. For example, approximately $2 billion was estimated to be attributable to the installation and operation of DSI controls (21 percent of the total annual projected costs of MATS), when in actuality, only one-third of those installations occurred (and some were likely attributable to regulations other than MATS).

We also conduct an analysis of the approximate costs related to the overestimate of projected incremental pollution controls. This analysis is discussed in detail in the Cost TSD. Specifically, we compared observed installations over 2013–2016 to unit-level estimates of the control installation capacity and associated costs presented in the 2011 RIA to develop a range of the potential overestimate of compliance costs related to projected control installations that did not occur.

As result of this analysis, we find that based on this one variable—the number of control technology installations—the 2011 RIA overestimated control costs by about $2.2 to $4.4 billion (or 2.7 times). If recent updates to the cost and performance assumptions for pollution controls had been reflected in the 2011 RIA modeling, the projected compliance costs would likely have been even lower (suggesting the overestimate could be greater than $4.4 billion). The EPA did not quantify advances in cost and performance of control technology between the time of the EPA's modeling and implementation of the rule due to uncertainty. We note that this may be one reason that the Andover Technology Partners' overestimate for control costs of $7 billion exceeds the EPA's range of overestimates ($2.2–4.4 billion) for the same control and operation costs. The next section helps explain some of the difference quantified above, and provides further qualitative evidence supporting the EPA's conclusion that the 2011 RIA likely significantly overestimated the compliance costs associated with meeting MATS requirements.

c. 2011 RIA Modeling Assumptions

Since promulgation of MATS, the EPA has found it necessary to update some of the modeling assumptions used in the IPM modeling that informed the RIA cost estimate, in order to capture the most recently available information and best reflect the current state of the power sector. Several of these recent updates are directly related to pollution control retrofits that were projected to be installed for MATS in the 2011 RIA. Had these updates been reflected in our modeling, it likely would have projected fewer controls needing to be installed and therefore a lower cost estimate overall.

The full suite of assumptions utilized in the IPM modeling are reported in the model documentation, which provides additional information on the assumptions discussed here as well as all other assumptions and inputs to the model.[92] Updates specific to MATS modeling are also in the IPM 4.10 Supplemental Documentation for MATS.[93] As was included in the 2011 RIA discussion regarding uncertainty and limitations of the power sector modeling analysis (Section 3.15), the cost and emissions impact projections did not take into account the potential for advances in the capabilities of pollution control technologies or reductions in their costs over time. EPA modeling cannot anticipate in advance the full spectrum of compliance strategies that the power sector may innovate to achieve required emission reductions, and experience has shown that regulated industry often is able to comply at lower costs through innovation or efficiencies. Where possible, the EPA designs regulations to assure environmental performance while preserving flexibility for affected sources to design their own solutions for compliance. Industry will employ an array of responses, some of which regulators may not fully anticipate and will generally lead to lower costs associated with the rule than modeled in *ex ante* analysis. *See, e.g.,* section III.D of this preamble, discussing how the actual cost of the ARP was up to 70 percent less than what had been estimated.

A first example regards the assumptions of HCl removal for certain types of coal. When lignite and subbituminous coals are combusted, the chemistry of coal ash alkalinity removes HCl emissions. The 2011 RIA modeling assumed a 75 percent reduction of HCl emissions from lignite and subbituminous coals.[94] Upon subsequent review of available data, the EPA updated this assumption to 95 percent HCl removal.[95] This revised assumption regarding improved HCl removal from coal ash alkalinity effectively lowers uncontrolled HCl emissions rates in the projections and is a better reflection of actual removal rates observed by EGUs combusting subbituminous and/or lignite coal. This updated assumption, had it been used in the 2011 RIA modeling, would have significantly decreased the incremental capacity of acid gas controls (*e.g.,* DSI, dry FGD) that the model projected to be needed for compliance with the MATS acid gas limits.[96] The lower projection for controls would in turn have resulted in a lower cost estimate.

For a second example, the EPA updated the DSI retrofit cost methodology used in our power sector modeling. The 2011 RIA compliance cost projections assumed an SO_2 removal rate of 70 percent and a corresponding HCl removal effect of 90 percent[97] based on a technical report, developed by Sargent and Lundy in August 2010.[98] These assumptions have been updated to reflect an SO_2 removal rate of 50 percent and a corresponding HCl removal effect of 98 percent for units with FF in the EPA's recent modeling,[99] based on an updated technical report from Sargent and Lundy.[100]

These revised assumptions, which better reflect the actual cost and performance of DSI, would reduce the variable costs significantly, by about one-third at a representative plant,[101] because less sorbent is required to achieve the same amount of HCl reduction. If the EPA had been able to use this new information in the 2011 RIA modeling, the projected compliance costs would have been lower, reflecting the reduced sorbent necessary to achieve the MATS emission limits. Furthermore, we note that while these modeling assumptions are based on a single sorbent (trona), alternative sorbents are available, potentially at a lower cost for some units.

A third example relates to the assumed cost of ESP upgrades. In the 2011 RIA modeling, the EPA assumed that a range of upgrades would be necessary at units with existing ESP controls in order to meet the MATS PM standard. The EPA assumed the cost of these upgrades ranged from $55/kilowatt (kW) to $100/kW (in 2009 dollars). However, new evidence suggests that many ESP upgrades were installed and are available at less than $50/kW.[102]

These examples highlight the uncertainty inherent in *ex ante* compliance cost projections, and contribute additional evidence that the projected compliance costs presented in

[92] *See https://www.epa.gov/airmarkets/ipm-analysis-proposed-mercury-and-air-toxics-standards-mats.* Accessed July 23, 2021.

[93] *See https://www.epa.gov/airmarkets/documentation-supplement-base-case-v410mats.* Accessed July 23, 2021.

[94] *Id.*

[95] *See https://www.epa.gov/sites/default/files/2019-03/documents/chapter_5.pdf.* Accessed July 23, 2021.

[96] While we are unable to quantify precisely the impact that updating this assumption would have on the projected compliance costs, we can observe that most incremental DSI capacity (about 40 GW) would not require DSI controls in the 2011 RIA modeling, holding all else constant.

[97] *See https://www.epa.gov/sites/production/files/2015-07/documents/updates_to_epa_base_case_v4.10_ptox.pdf.* Accessed July 23, 2021.

[98] *See Dry Sorbent Injection Cost Development Methodology* at *https://www.epa.gov/sites/production/files/2015-07/documents/append5_4.pdf.* Accessed July 23, 2021.

[99] *See https://www.epa.gov/airmarkets/documentation-epa-platform-v6-november-2018-reference-case-chapter-5-emission-control.* Accessed July 23, 2021.

[100] *See Dry Sorbent Injection for SO_2/HCl Control Cost Development Methodology* at *https://www.epa.gov/sites/production/files/2018-05/documents/attachment_5-5_dsi_cost_development_methodology.pdf.* Accessed July 23, 2021.

[101] Based on a 500 MW plant with a heat rate of 9,500 Btu/kWh burning bituminous coal.

[102] *Analysis of PM and Hg Emissions and Controls from Coal-Fired Power Plants.* Andover Technology Partners (August 19, 2021), available in the rulemaking docket.

the 2011 RIA were likely overestimated and that actual compliance costs for MATS in 2015 were likely significantly less than the $9.6 billion estimate.

d. Conclusion That the 2011 RIA Costs Were Overestimated

After reviewing this suite of quantitative and qualitative updates and considering studies that were performed by outside entities, the EPA concludes that the available *ex post* evidence points to significantly lower costs of compliance for the power sector under MATS than suggested by the *ex ante* projections in the 2011 RIA. There are numerous reasons for this, and chief among them is the fact that the natural gas industry has undergone profound change in recent years. Following the promulgation of MATS, natural gas supply increased substantially, leading to dramatic price decreases that resulted in major shifts in the economics of fossil fuel-fired electric generating technologies. The 2011 RIA modeling did not fully anticipate this historic change in natural gas supply and the related decrease in natural gas prices. As a result of this and other fundamental changes in the industry, we see a very different pattern of control installations than was projected: [103]

- 21 percent less capacity of dry FGD than projected;
- 64 percent less capacity of DSI than projected;
- 3 percent less capacity of ACI than projected;
- 69 percent less capacity of FF than projected; and
- Likely fewer ESP and scrubber control upgrades than projected.

These controls were responsible for approximately 70 percent of the projected annual compliance costs in the 2011 RIA. Because so many projected controls were not installed, we know that the control-related costs were almost certainly significantly overestimated. By simply comparing between projected and installed controls, we now find that the projected control-related costs for 2015 of about $7 billion were likely overestimated by $2.2 to $4.4 billion, and possibly more.

In addition, we have updated some of the modeling assumptions that supported the 2011 RIA. Specifically:

- HCl emissions for EGUs burning subbituminous and lignite coals are much lower than originally modeled, reducing the number of controls necessary for compliance in the model;
- DSI controls require less sorbent than originally assumed, lower the operating cost of these controls, and other lower-cost sorbents are likely available; and
- The assumed cost of ESP upgrades in the modeling was likely much higher than the actual cost of these upgrades.

While not quantified here, the advances in cost and performance of control technology between the time of the EPA's modeling and implementation of the rule would, if quantified, likely add to the $2.2 to $4.4 billion overestimate.

Furthermore, the three studies submitted to the EPA during earlier rulemakings support this finding that the 2011 RIA cost projection was significantly overestimated:

- Andover Technology Partners estimated that the actual costs of compliance with MATS were approximately $2 billion, and that the 2011 RIA may have overestimated compliance costs by approximately $7 billion.
- MJB&A estimated that the total upfront capital expenditures of pollution controls installed for compliance with the rule were overestimated in the 2011 RIA by a factor of more than eight.
- EEI, the association that represents all U.S. investor-owned electric companies, estimated cumulative costs incurred by the industry in response to MATS, and that estimate suggests an annual amount about $7 billion less than the 2011 RIA projected.

Taken together, this information indicates that the projected costs in the 2011 RIA were almost certainly significantly overestimated. We solicit comment on data resource and methods such as econometric, simulation, and event study approaches that may aid the EPA in better characterizing the *ex post* regulatory costs of MATS for consideration before we issue the final rule.

3. Evaluation of Metrics Related to MATS Compliance

In the next four sections, we place the costs that we estimated in 2011, and which, as just explained, were likely significantly overestimated, in the context of the EGU industry and the services the EGU industry provides to society. The purpose of these comparisons is to better understand the disadvantages conferred by expending this money, both in terms of their scale and distribution, in order to weigh cost as a factor in our preferred methodology for making the appropriate determination. While we recognize the projected cost estimate from the 2011 RIA in absolute terms is perceived as a large number, our findings demonstrate that, for example, the (overestimated) projected cost estimate is less than 3 percent of the power sector's revenues from electricity sales, even when compared against data from 2019 (which had the lowest electricity sale revenues in a nearly 20 year period). As we did in 2016, we first contextualize the costs of MATS against power sector data for the years 2000 to 2011, *i.e.,* the information that was available to the Agency when we were promulgating MATS in 2012 and reaffirming the appropriate and necessary determination. For purposes of this proposal, we also expand our assessment to compare the 2011 cost estimates to the most recent years of data available regarding, for example, industry revenue and electricity prices. The intent of expanding the years of analysis is to update our assessments from the 2016 Supplemental Finding considering power sector trends with the newest information. We continue to use projections developed for the 2011 RIA for purposes of these evaluations, because as discussed in section III.B.2, we are unable to generate new, bottom-line actual cost projections. However, in section III.D, we consider these evaluations in light of the EPA's finding that the projected costs were almost certainly significantly overestimated.

a. Compliance Costs as a Percent of Power Sector Sales

The first metric examined here (as in 2016) is a comparison of the annual compliance costs of MATS to electricity sales at the power sector-level (*i.e.,* revenues), often called a sales test. The sales test is a frequently used indicator of potential impacts from compliance costs on regulated industries.[104] Incorporating updated information from the EIA, Section 2.a and Table A–4 of the Cost TSD present the value of retail electricity sales from 2000 to 2019, as well as net generation totals for the electric power sector for the same period.

This information indicates that the $9.6 billion in annual compliance costs of MATS projected for 2015 would have represented about 2.7 percent of 2008 power sector revenues from retail electricity sales, the peak year during

[103] As discussed above, although we attributed all controls of these types to MATS in this analysis, even those controls that were installed were likely due in part or in whole for reasons other than MATS.

[104] For example, the sales test is often used by the EPA when evaluating potential economic impacts of regulatory actions on small entities. In the context of a small entity analysis, an evaluation of the change in profits to owners is likely the best approach to assessing the economic burden to owners from a regulatory action. Data limitations prevent solely analyzing profit changes to EGU owners as a result of MATS in this proposal.

the 2000 to 2019 period. The $9.6 billion in projected compliance costs would constitute about 2.9 percent of 2019 sales, which was the lowest sales level observed in the post-2011 period. These projected compliance costs are a very small percentage of total EGU revenues from electricity sales in both robust or lean years, and newer data confirms the findings of the 2016 record. Moreover, if we account for the fact that the $9.6 billion figure likely significantly overestimated the actual cost of compliance, the percentage of compliance costs to revenues would be even smaller.

b. Compliance Expenditures Compared to the Power Sector's Annual Expenditures

The next metrics we examine are a comparison of the annual capital expenditures projected in the 2011 RIA to be needed for MATS compliance to historical power sector-level overall capital expenditures, followed by a comparison of projected annual capital and production expenditures related to MATS compliance to historical power sector-level overall capital and production expenditures.

First, we evaluate capital expenditures. Capital costs represent largely irreversible investments for firms that must be paid off regardless of future economic conditions, as opposed to other important variable costs, such as fuel costs, that may vary according to economic conditions and generation needs. Section 2.b and Table A–5 of the Cost TSD present two sets of estimates for trends in annual capital expenditures by the electric power sector through 2019. The first set of information is based on data compiled by S&P Global, a private sector firm that provides data and analytical services. The second set of information is from the U.S. Census Bureau's Annual Capital Expenditures Survey. While each dataset has limitations, the estimates from each correspond to one another reasonably well.

The 2011 RIA modeling estimated the incremental capital expenditures associated with MATS compliance to be $4.2 billion for 2015. As discussed in section III.B.2, the 2011 RIA likely significantly overestimated compliance costs. This conclusion also applies to the capital cost component of the overall cost because, as detailed earlier, fewer pollution controls were installed during the 2013–2016 timeframe than were projected in the 2011 RIA. While the EPA is not able to produce an alternative capital cost estimate directly comparable to the estimates from the 2011 RIA, the analysis discussed in section III.B.2 and the Cost TSD indicated the annualized capital expenditures at units that installed controls under MATS might be as low as $0.7 billion ($3.5 billion lower than projected in 2011 RIA, or less than one-fifth).

Even using the significantly overestimated figure of $4.2 billion in our comparison shows that the projected capital expenditures associated with MATS represent a small fraction of the power sector's overall capital expenditures in recent years. Specifically, the $4.2 billion estimate represents about 3.6 or 3.7 percent of 2019 (*i.e.,* most recent) power sector level capital expenditures based on the S&P Global and U.S. Census information, respectively. Compared against 2004 power sector level capital expenditures (*i.e.,* the 20-year low), the $4.2 billion figure represents 10.4 or 9.3 percent of sector level capital expenditures (using the two respective data sets). Additionally, the projected $4.2 billion in incremental capital costs is well within the range of annual variability associated with capital expenditures for the sector over the 2000–2019 period. During this period, based on the Census information, for example, the largest year-to-year decrease in power sector-level capital expenditures was $19.5 billion (from 2001 to 2002) and the largest year-to-year increase in power sector-level capital expenditures was $23.4 billion (from 2000 to 2001). This wide range (−$19.5 to +$23.4 billion) indicates substantial year-to-year variability in industry capital expenditures, and the projected $4.2 billion increase in capital expenditures in 2015 projected under MATS falls well within this variability. Similar results are found using the S&P Global information. If a $4.2 billion increase in capital expenditures in 2015 projected under MATS falls well within the variability of historical trends, then a capital expenditure of less than $4.2 billion would also fall within this variability.

Next, in order to provide additional perspective to the projected cost information, we look at a broader set of costs faced by industry, including both capital and production expenditures together. Section 2.b and Table A–6 of the Cost TSD present two sets of estimates through 2019 for trends in annual total (capital and production) expenditures by the electric power sector using the same two data sets as above, which we then compare with the projected annual total expenditures required by MATS.

We find that even the overestimated $9.6 billion compliance cost projection from the 2011 RIA represents a small fraction of the power sector's annual capital and production expenditures compared to historical data, and is well within annual variability in total costs over the 2000 to 2011 and the 2012 to 2019 periods. Compared to 2008 data (*i.e.,* the historic high for total industry expenditures), the projected $9.6 billion estimate represents about 4.2 to 4.3 percent of total expenditures. The MATS projected compliance cost represents 6.2 to 6.6 percent of total expenditures in 2003 (which was the lowest year for total industry expenditures during the studied time period). Additionally, the EPA notes that, similar to the capital expenditures analysis set forth in the 2015 Proposal, the projected $9.6 billion in incremental capital plus production costs is well within the range of annual variability in costs in general over the 2000 to 2019 period. For example, during this period, the largest year-to-year decrease in power sector-level capital and production expenditures ranged from $30.5 billion to $32.8 billion. The largest year-to-year increase in power sector-level capital and production expenditures in this period ranged from $27.5 billion to $28.7 billion. If a $9.6 billion increase in expenditures falls well within the variability of historical trends, then an expenditure substantially less than $9.6 billion would also fall within this variability.

c. Impact on Retail Price of Electricity

We are cognizant that, for an industry like the power sector, costs and disadvantages to regulation are not solely absorbed by regulated sources. Many firms in the industry are assured cost-recovery for expenditures, so there is considerable potential for EGUs to pass through the costs of compliance to consumers via increases in retail electricity prices. This is especially true given that the demand for electricity is not particularly price-responsive. That is, because people are dependent on electricity for daily living, they are not likely to reduce their consumption of electricity even when the price goes up but will instead pay the higher price, thus absorbing the costs of compliance incurred by the industry. Notably, average retail electricity prices have fallen since the promulgation of MATS.

While we analyze these aspects of cost separately, control costs and electricity prices are not separate economic indicators. Electricity price increases are generally related to increases in the capital and operating expenditures by the power sector. Therefore, the electricity price impacts and the associated increase in electricity bills by consumers are not costs that are additional to the compliance costs described earlier in this section. In fact, to the extent the compliance costs are passed on to electricity consumers, the costs to the EGU owners in the power sector are reduced. Therefore, in order to further assess the disadvantages to regulation, in this case to consumers of electricity in all sectors (residential, commercial, industrial, transportation, and other sectors), we evaluate as we did in 2016 the projected effect MATS was anticipated to have on retail electricity prices, as measured against the variations in electricity prices from year to year. For this proposal, we expanded that analysis using updated data from the EIA, as presented in section 2.c and Table A–7 of the Cost TSD.

Looking at 2000–2019 data, we find that the projected 0.3 cents per kilowatt-hour projected increase in national average retail electricity price under MATS is well within the range of annual variability over the 2000–2019 period. During that time period, the largest year-to-year decrease in national average retail electricity price was −0.2 cents per kilowatt-hour (from 2001 to 2002) and the largest year-to-year increase was 0.5 cents per kilowatt-hour (from 2005 to 2006). For the newer data analyzed, we also found that average retail electricity prices have generally decreased since 2011, from 9.33 cents per kilowatt-hour in 2011 to 8.68 cents per kilowatt-hour in 2019, or by nearly 7 percent.

After considering the potential impacts of MATS on retail electricity prices, the EPA concludes that the projected increase in electricity prices is within the historical range. In addition, any increase in electricity prices would not be additive to the overall compliance costs of MATS. Rather, such price impacts would in part reflect the ability of many EGUs to pass their costs on to consumers, thereby reducing the share of MATS compliance costs borne by owners of EGUs. Given the relationship between compliance costs and electricity prices, we would also therefore expect the significant overestimate of compliance costs reflected in the $9.6 billion figure to translate into overestimates in our projections for electricity price increases. Therefore, incorporating this newer data into our analysis, we find that MATS did not result in increases in electricity prices for American consumers that were outside the range of normal year-to-year variability, and during the period when MATS was implemented, electricity prices generally decreased.

d. Impact on Power Sector Generating Capacity

We recognize that the power sector plays a role of critical importance to the American public. A potential disadvantage to regulation that we consider to be a relevant factor in our consideration under CAA section 112(n)(1)(A) is how such regulation would impact the provision of adequate and reliable electricity throughout the country.[105] Therefore, we analyzed, as part of the 2012 record, projected net changes in generation capacity under MATS, as compared to the base case, that is, what expected generation capacity would have been absent the rule.[106] We also conducted an analysis of the impacts of projected retirements on electric reliability. *Id.* And finally, in parallel with finalizing MATS, the EPA's Office of Enforcement and Compliance Assurance issued a policy memorandum describing an approach for units that were reliability critical that could demonstrate a need to operate in noncompliance with MATS for up to a year.[107]

Our analysis indicated that the vast majority of the generation capacity in the power sector directly affected by the requirements of MATS would remain operational following MATS. Specifically, our model projected that operational capacity with MATS in place would be reduced by less than 1 percent nationwide. *See* Resource Adequacy and Reliability TSD at 2. With respect to reliability, our modeling indicated that coal retirements would be distributed throughout the power grid, and that there would only be small impacts at the regional level, and that in those regions, we anticipated small decreases in overall adequacy of resources and robust remaining reserve margins. *Id.* These analyses therefore found that the power sector would be able to continue to provide adequate and reliable electricity even with regulation of the EGU sector for HAP.

[105] The EPA generally uses the term ''reliability'' to refer to the ability to deliver the resources to the projected electricity loads so the overall power grid remains stable, and the term ''resource adequacy'' generally refers to the provision of adequate generating resources to meet projected load and generating reserve requirements in each region.

[106] U.S. EPA. 2011. *Resource Adequacy and Reliability in the Integrated Planning Model Projections for the MATS Rule* (Resource Adequacy and Reliability TSD), *http://www3.epa.gov/ttn/atw/utility/revised_resource_adequacy_tsd.pdf,* Docket ID Item No. EPA–HQ–OAR–2009–0234–19997.

[107] U.S. EPA. 2011. *The Environmental Protection Agency's Enforcement Response Policy For Use of Clean Air Act Section 113(a) Administrative Orders In Relation To Electric Reliability And The Mercury and Air Toxics Standard, https://www.epa.gov/sites/default/files/documents/mats-erp.pdf,* Docket ID Item No. EPA–HQ–OAR–2009–0234–20577.

Additionally, since MATS was promulgated, the EPA has not been made aware of reliability or resource adequacy problems attributable to MATS. As noted, the EPA's enforcement office concurrently issued a policy memorandum to work with sources that faced demonstrated reliability concerns, and five administrative orders were issued in connection with the policy.[108] We think this small number of sources obtaining relief due to their reliability critical status provides some confirmation of the EPA's projections that regulation would not cause widespread resource and reliability problems.

4. Other Cost Considerations

We also propose to reaffirm our previous findings regarding the costs of mercury controls, consistent with the instruction from the statute to study the availability and cost of such controls in CAA section 112(n)(1)(B). 80 FR 75036–37 (December 1, 2015). We similarly propose to reaffirm our previous records and findings regarding the cost of controls for other HAP emissions from EGUs, and the cost of implementing the utility-specific ARP, which Congress wrote into the 1990 CAA Amendments and implementation of which Congress anticipated could result in reductions in HAP emissions. *Id.* With respect to the costs of technology for control of mercury and non-mercury HAP, the record evidence shows that in 2012 controls were available and routinely used and that control costs had declined considerably over time. *Id.* at 75037–38. With regard to the ARP, industry largely complied with that rule by switching to lower-sulfur coal, and subsequently the actual costs of compliance were substantially lower than projected. Though the reasons for discrepancies between projected and actual costs are different for MATS, as discussed in section III.B.2, the newer information examined as part of this proposal demonstrates that the projected cost estimates for MATS were also likely significantly overestimated.

5. Summary of Consideration of Cost of Regulating EGUs for HAP

In this section, the EPA noted several studies performed by outside entities suggesting that costs of MATS may have been overestimated in the 2011 RIA. We discussed the dramatic impacts to the power sector over the last 10 years due to increasing supplies and decreasing price of natural gas and renewables, and

[108] *https://www.epa.gov/enforcement/enforcement-response-policy-mercury-and-air-toxics-standard-mats.*

we conducted a suite of quantitative and qualitative updates to the information available in the 2011 RIA. Based on this information, we propose to conclude that the available *ex post* evidence points to a power sector that incurred significantly lower costs of compliance obligations under MATS than anticipated based on the *ex ante* projections when the rule was finalized in 2012. This overestimate was significant—for just one part of the original compliance cost estimate, the EPA was able to quantify a range of at least $2.2 to $4.4 billion in projected costs related to the installation, operation, and maintenance of controls which were not expended by industry. This projected overestimation is limited to these costs; it does not account for other ways in which the rule's costs were likely overestimated, such as advances in control technologies that made control applications less expensive or more efficient at reducing emissions. The other studies conducted by stakeholders asserted there were even greater differences between projected and actual costs of MATS.

We next examined the 2011 projected costs, which were almost certainly significantly overestimated, in the context of the EGU industry and the services the EGU industry provides to society. The purpose of these comparisons was to better understand the disadvantages imposed by these costs, in order to weigh cost as a factor in our preferred methodology for making the appropriate determination. Even though the cost estimates we used in this analysis were almost certainly significantly overestimated, we noted they were relatively small when placed in the context of the industry's revenues and expenditures, and well within historical variations.

Based on the 2011 RIA, the total projected cost of the MATS rule to the power sector in 2015 represented between 2.7 and 3.0 percent of annual electricity sales when compared to years from 2000 to 2019, a small fraction of the value of overall sales (and even smaller when one takes into account that the 2011 RIA projections were likely significantly overestimated). Looking at capital expenditures, the EPA demonstrated that the projected MATS capital expenditures in 2015 represented between 3.6 and 10.4 percent of total annual power sector capital expenditures when compared to years surrounding the finalization of the MATS rule. Such an investment by the power sector would comprise a small percentage of the sector's historical annual capital expenditures on an absolute basis and also would fall within the range of historical variability in such capital expenditures. Similarly, the EPA demonstrated that the projected capital and operating expenditures in 2015 represented between 4.3 and 6.2 percent of total annual power sector capital and operating expenditures over 2000 to 2019, and is well within the substantial range of annual variability. This proposal's analysis indicating that the far fewer controls were installed than the EPA had projected would be required is particularly relevant to considering our findings as to this metric; with the overestimation of capital expenditures in mind, actual investments by the power sector to comply with MATS would have comprised an even smaller percentage of historical annual capital expenditures.

With respect to impacts on the wider American public, the EPA examined impacts on average retail electricity prices and found the modest increases—which, like overall compliance costs, are also likely to have been significantly overestimated—to be within the range of historical variability. Experience has also shown that national average retail electricity prices in years after MATS promulgation have declined. Finally, previous analysis indicated that the vast majority of the generation capacity in the power sector would remain operational and that the power sector would be able to continue to provide adequate and reliable electricity after implementation of the rule, and we have seen no evidence to contradict those findings.

The EPA proposes that each of these analyses are appropriate bases for evaluating the disadvantages to society conferred by the MATS-related projected compliance expenditures. As we note above, even though the projected costs we use in this analysis are almost certainly significantly overestimated, we find that they are still relatively small when placed in the context of the economics of the industry, and well within historical variations. We solicit comments on all aspects of this proposed consideration of costs.

C. Revocation of the 2020 Final Action

We are proposing to revoke the 2020 Final Action because we find that the framework used to consider cost in 2020, which centered the Agency's mandated determination under CAA section 112(n)(1)(A) on a comparison of costs to monetized HAP benefits, was an approach ill-suited to making the appropriate and necessary determination in the context of CAA section 112(n)(1)(A) specifically and the CAA section 112 program generally. Moreover, the statutory text and legislative history do not support a conclusion that the 2020 framework is required under CAA section 112(n)(1)(A), and we exercise our discretion to adopt a different approach. We also disagree with the conclusions presented in the 2020 Final Action as to the 2016 Supplemental Finding's two approaches.

The 2020 Final Action established the following framework for making the appropriate and necessary determination. It stated:

''The Administrator has concluded that the following procedure provides the appropriate method under which the EPA should proceed to determine whether it is appropriate and necessary to regulate EGUs under CAA section 112(n)(1)(A). First, the EPA compares the monetized costs of regulation against the subset of HAP benefits that could be monetized. . . . Second, the EPA considers whether unquantified HAP benefits may alter that outcome. . . . Third, the EPA considers whether it is appropriate, notwithstanding the above, to determine that it is ''appropriate and necessary'' to regulate EGUs under CAA section 112(n)(1)(A) out of consideration for the PM co-benefits that result from such regulation.'' 85 FR 31302 (May 22, 2020).

Applying the first part of the framework, the Agency noted that the costs of regulation estimated in the 2011 RIA were disproportionately higher—by three orders of magnitude—than the monetized HAP benefits, and concluded ''[t]hat does not demonstrate 'appropriate and necessary.' '' *Id.* Under the framework's second inquiry, the EPA determined that the unquantified HAP benefits, even if monetized, were unlikely to alter its conclusion under the first part of the framework. *Id.; see also* 85 FR 31304 (noting that ''valuing HAP-related morbidity outcomes would not likely result in estimated economic values similar to those attributed to avoiding premature deaths''). Finally, applying the third part of its framework, the EPA noted that nearly all of the monetized benefits of MATS as reflected in the 2011 RIA were derived from PM benefits. *See* 85 FR 31302–03 (May 22, 2020). The EPA then posited that, ''[h]ad the HAP-specific benefits of MATS been closer to the costs of regulation, a different question might have arisen as to whether the Administrator could find that co-benefits legally form part of the justification for determination that regulation of EGUs under CAA section 112(d) is appropriate and necessary.'' *See* 85 FR 31303 (May 22, 2020). However, because of the factual scenario presented in the record, the Agency in the 2020 Final Action stated that ''[t]he

EPA does not need to, and does not, determine whether that additional step would be appropriate . . . given that the monetized and unquantified HAP-specific benefits do not come close to a level that would support the prior determination.'' *Id.* In conclusion, the EPA stated that ''[u]nder the interpretation of CAA section 112(n)(1)(A) that the EPA adopts in this action, HAP benefits, as compared to costs, must be the primary question in making the 'appropriate and necessary' determination.'' *Id.*

We note that the three-step framework employed by the 2020 Final Action is not a BCA conforming to recognized principles (*see, e.g.,* OMB Circular A–4, EPA Economic Guidelines). BCA is a specific tool developed by economists to assess total society-wide benefits and costs, to determine the economic efficiency of a given action. Instead of conforming to this comprehensive approach, the three-step framework focused primarily on comparing the rule's total costs to a very small subset of HAP benefits that could be monetized. The Agency gave secondary weight to the vast majority of the benefits of regulating HAP emissions from stationary sources that cannot be quantified, and completely ignored the non-HAP monetized benefits directly attributable to the MATS rule.

We propose to find that this three-step framework is an unsuitable approach to making the appropriate and necessary determination under CAA section 112(n)(1)(A) because it places undue primacy on those HAP benefits that have been monetized, and fails to consider critical aspects of the inquiry posed to the EPA by Congress in CAA section 112(n)(1). The 2020 three-step framework also did not in any meaningful way grapple with the bases upon which the EPA had relied to design the 2016 preferred approach, as discussed above, including the broad statutory purpose of CAA section 112 to reduce the volume of HAP emissions with the goal of reducing the risk from HAP emissions to a level that is protective of even the most exposed and most sensitive subpopulations; the fact that we rarely can fully characterize or quantify risks, much less benefits, at a nationwide level; and the fact that except for one of the many health endpoints for only one of the many HAP emitted from EGUs, the EPA lacked the information necessary to monetize any post-control benefit of reductions in HAP emissions. The sole rationale provided in the 2020 Final Action for rejecting the relevance of the statute's clear purpose as evinced in the broader CAA section 112 program and reflected in the provisions of CAA section 112(n)(1) was that CAA section 112(n)(1)(A) is a separate provision and threshold determination. *See* 85 FR 31293–94 (May 22, 2020). But we do not think it is sensible to view the statute's direction to the EPA to make a separate determination as to EGUs as an invitation to disregard the statutory factors of CAA section 112(n)(1) and the greater statutory context in which that determination exists, and we do not think that the 2020 Final Action provided an adequately reasoned basis for abandoning the interpretation and assessment provided in the 2016 Supplemental Finding. And in any event, we believe the methodology we propose today is better suited to making the statutory finding than the 2020 framework.

In the 2020 rulemaking, the EPA did not explain its rationale for its decision to anchor the appropriate and necessary determination at step one as a comparison between the monetized costs of regulation and *monetized* HAP specific benefits. Rather, the proposed and final rules repeatedly state that the ''primary'' inquiry in the determination should be a comparison of costs and HAP benefits, but did not explain why only *monetized* HAP benefits should be given primacy. *See, e.g.,* 85 FR 31286, 31288, 31303 (May 22, 2020). Given the Agency's recognition of the broad grant of discretion inherent in the phrase ''appropriate and necessary,'' *see* 81 FR 24430–31 (April 25, 2016), its acknowledgement of Congress' ''particularized focus on reducing HAP emissions and addressing public health and environmental risks from those emissions'' in CAA section 112, *see* 85 FR 31299 (May 22, 2020), and its knowledge and recognition that the dollar value of one of its points of comparison represented but a small subset of the advantages of regulation, *see* 85 FR 31302 (May 22, 2020), we now believe it was inappropriate to adopt a framework that first and foremost compared dollar value to dollar value. Nothing in the CAA required the Agency's decision in 2020 to hinge its framework on monetized HAP benefits. The consideration of the non-monetized benefits of MATS *(i.e.,* dozens of endpoints, including virtually all of the HAP benefits associated with this rule) occurred only at step two, where the Agency considered whether the unquantified benefits, if monetized, were ''likely to overcome the imbalance between the monetized HAP benefits and compliance costs in the record.'' *See* 85 FR 31296 (May 22, 2020). This approach discounts the vast array of adverse health and environmental impacts associated with HAP emissions from coal- and oil-fired EGUs that have been enumerated by the EPA [109] and discounts the social value (benefit) of avoiding those impacts through regulation, simply because the Agency cannot assign a dollar value to those impacts. Further, the three-step framework gave no consideration to the important statutory objective of protecting the most at-risk subpopulations. As noted above, in CAA section 112(n)(1)(C) Congress directed the EPA to establish threshold levels of exposure under which no adverse effect to human health would be expected to occur, even considering exposures of sensitive populations, and throughout CAA section 112, Congress placed special emphasis on regulating HAP from sources to levels that would be protective of those individuals most exposed to HAP emissions and most sensitive to those exposures. The rigid and narrow approach to making the appropriate and necessary determination in the 2020 Final Action is at odds with the text and purpose of CAA section 112, and is certainly not required under the express terms of CAA section 112 or CAA section 112(n)(1)(A).

Commenters on the 2019 Proposal objected strenuously to the Agency's revised framework for making the appropriate and necessary determination, arguing that the 2019 Proposal's interpretation ''fails to meaningfully address factors that are 'centrally relevant' to the inquiry of whether it is appropriate and necessary to regulate HAP from EGUs,'' and that the Agency's new interpretation must fall because the EPA failed to provide a reasoned explanation for its change in policy, as required by *Motor Vehicle Mfrs. Ass'n of United States, Inc.* v. *State Farm Mut. Automobile Ins. Co.,* 463 U.S. 29 (1983), and *FCC* v. *Fox Television Stations, Inc.,* 556 U.S. 502 (2009). *See* 85 FR 31294 (May 22, 2020). Among the factors that commenters argued had been inadequately addressed under the new framework were the ''hazards to public health reasonably anticipated to occur'' that had not been monetized; the non-monetizable benefits of HAP regulation such as preservation of tribal social practices; the latency, persistence in the environment, and toxicity of HAP as recognized by Congress; and the distributional impacts on particular communities and individuals most

[109] *See, e.g.,* 65 FR 79829–30 (December 20, 2000); 76 FR 24983–85, 24993–97, 24999–25001, 25003–14, 25015–19 (May 3, 2011).

impacted by HAP emitted from power plants. In responses to these comments, the EPA claimed that it was not ''disregarding'' or ''dismissing'' the concerns raised by the commenters, but rather simply weighing them differently, and explained that the Administration's changed priorities provided the ''reasoned basis'' for its changed interpretation. *See* 85 FR 31296–97 (May 22, 2020).

Agencies do have broad discretion to re-evaluate policies and change their ''view of what is in the public interest,'' *State Farm,* 463 U.S. at 57, but such re-evaluations must still adhere to principles of reasoned decision-making. The 2020 Final Action did not aver that the concerns identified by commenters were factors that the statute does not instruct the Agency to consider in making its appropriate and necessary determination. Instead, the EPA stated that it was permitted to pick its decisional framework and admitted that its decisional framework might undervalue certain factors. For example, with respect to commenters' concerns that the revised appropriate and necessary framework did not adequately account for adverse impacts on tribal culture or undue concentration of public health risks on certain population subgroups or individuals, the EPA stated,

> ''In a cost-benefit comparison, the overall amount of the benefits stays the same no matter what the distribution of those benefits is. The EPA, therefore, believes it is reasonable to conclude that those factors to which the EPA previously gave significant weight–including qualitative benefits, and distributional concerns and impacts on minorities–will not be given the same weight in a comparison of benefits and costs for this action under CAA section 112(n)(1)(A).'' 85 FR 31297 (May 22, 2020).

The decisional framework in the 2020 Final Action, however, did not give ''less weight'' to these factors—it gave them none. In both the selection and application of its framework, the EPA in the 2020 Final Action effectively ignored these factors altogether, and we do not agree that the inability to monetize a factor should render it unimportant. *Cf. Am. Trucking Ass'ns, Inc.* v. *EPA,* 175 F.3d 1027, 1052–53 (D.C. Cir. 1999), reversed in part on other grounds in *Whitman* v. *Am. Trucking Ass'ns,* 531 U.S. 457 (2001) (holding that the EPA was not permitted to ignore information ''because the . . . benefits are difficult, if not impossible, to quantify reliably and because there is 'no convincing basis for concluding that any such effects . . . would be significant' ''); *Pub. Citizen* v. *Fed. Motor Carrier Safety Admin.,* 374 F.3d 1209, 1219 (D.C. Cir. 2004) (''The mere fact that the magnitude of . . . effects is *uncertain* is no justification for *disregarding* the effect entirely.'') (emphasis in original). The mere mention and summary dismissal of factors does not constitute meaningful consideration of those factors.

In the 2020 Final Action, like the 2016 Supplemental Finding before it, the EPA maintained that there is more than one permissible way to interpret the Agency's obligation to consider cost in the appropriate and necessary determination. Given the Agency's knowledge of the significant risks and often irreversible impacts of HAP exposure on vulnerable populations like developing fetuses, the disproportionate impact of EGU HAP emissions on communities who subsist on freshwater fish due to cultural practices and/or economic necessity, and the record of data demonstrating risks to public health amassed over decades, and, perhaps more importantly, the overwhelming quantity of advantages to regulation that could not be monetized, we do not think that selecting a framework that compared first and foremost monetized HAP benefits with costs was appropriate. And even if the framework ultimately addressed the statutorily relevant factors because at the second step the EPA stated that it was considering non-monetized HAP benefits, we think that the application of that second step fell short. The secondary consideration of non-monetized HAP benefits in the three-step framework only considered post-control HAP-related impacts of regulation insofar as the EPA speculated about what the monetized value of those benefits might be (*see* 85 FR 31296 (May 22, 2020), asserting that monetized value of avoiding morbidity effects such as neurobehavioral impacts is ''small'' compared to monetized value associated with avoided deaths). The Agency did not, at this second step, grapple with the existing risk analyses, including those stemming from the statutorily mandated studies in CAA section 112(n)(1). Those analyses demonstrated substantial public health and environmental hazards, even if the hazards were not translated into post-control monetized benefits. *See White Stallion,* 748 F.3d at 1245. The Agency also did not explain why other attributes of risk—such as impacts on vulnerable populations and the reality that HAP pollution from EGUs is not distributed equally across the population but disproportionately impacts some individuals and communities far more than others—were unimportant, stating only that the selected framework did not accommodate consideration of those factors.

As noted, the Agency did not point to anything in the CAA as supporting the use of its three-step framework. This is in stark contrast to the 2016 Supplemental Finding rulemaking, in which the EPA examined CAA section 112(n)(1)(A) and the other section 112(n)(1) provisions, and the rest of CAA section 112 generally, and D.C. Circuit case law on CAA cost considerations to inform the EPA's interpretation of CAA section 112(n)(1)(A). *See* 80 FR 75030 (December 1, 2015); 2015 Legal Memorandum. In the 2020 Final Action, the EPA merely asserted that a comparison of benefits to costs is ''a traditional and commonplace way to assess costs'' and claimed that the Supreme Court's holding in *Entergy Corp.* v. *Riverkeeper,* 556 U.S. 208 (2009) supported the EPA's 2020 position that, absent an unambiguous prohibition to use a BCA, an agency may generally rely on a BCA as a reasonable way to consider cost. *See* 85 FR 31293 (May 22, 2020). The 2020 Final Action also pointed out ''many references comparing'' costs and benefits from the *Michigan* decision, including: ''EPA refused to consider whether the costs of its decision outweighed the benefits'' (576 U.S. at 743); ''[o]ne would not say that it is rational, never mind 'appropriate,' to impose billions of dollars in economic costs in return for a few dollars in health or environmental benefits'' (*Id.* at 752); and ''[n]o regulation is 'appropriate' if it does more harm than good'' (*Id.*).

But while we agree that a comparison of benefits to costs is a traditional way to assess costs, the 2020 framework was *not* a BCA. There is no economic theory or guidance of which we are aware that endorses the version of BCA presented in the 2020 Final Action, in which total costs are compared against a small subset of total benefits. *See* section III.E for further discussion. Moreover, general support for weighing costs and benefits does not justify placing undue weight on monetized HAP benefits, with secondary consideration for all other benefits, and only valuing those other benefits to the extent of their speculative monetized effects. As noted in Justice Breyer's concurrence in *Entergy Corp.,* the EPA has the ability ''to describe environmental benefits in non-monetized terms and to evaluate both costs and benefits in accordance with its expert judgment and scientific knowledge,'' and to engage in this balancing outside of ''formal cost-benefit proceedings and futile attempts at comprehensive monetization.'' 556 U.S. at 235 (Breyer, J., concurring). Benefits—the advantages of regulation—can encompass outcomes that are not or cannot be expressed in terms of dollars and cents, just as the Court found that '' 'cost' includes more than the expense of complying with regulations; any disadvantage could be termed a cost.'' *Michigan,* 576 U.S. at 752. And the Court faulted the EPA's interpretation for ''preclud[ing] the Agency from considering *any* type of cost—including, for instance, harms that regulation might do to human health or the environment. . . . No regulation is 'appropriate' if it does significantly more harm than good.'' *Id.* The constricted view of benefits that the Agency adopted in 2020 was ill-suited to the statutory inquiry as interpreted in *Michigan.*

The primary basis in the 2020 action upon which the EPA relied to find that the 2016 preferred approach was flawed was that the preferred approach failed to ''satisf[y] the Agency's obligation under CAA section 112(n)(1)(A) as interpreted by the Supreme Court in *Michigan.*'' *See* 84 FR 2674 (February 7, 2019). The 2019 Proposal claimed that the chief flaw of the preferred approach was the Agency's failure to ''meaningfully consider cost within the context of a regulation's benefits,'' asserting that the *Michigan* Court contemplated that a proper consideration of cost would be relative to benefits. *See* 84 FR 2675 (February 7, 2019). But that is not an accurate characterization of the 2016 preferred approach, wherein the Agency weighed the existing record from 2012 demonstrating that HAP emissions from EGUs pose a number of identified hazards to both public health and the environment remaining after imposition of the ARP and other CAA requirements against the cost of MATS. *See* 81 FR 24420 (April 25, 2016) (''After evaluating cost reasonableness using several different metrics, the Administrator has, in accordance with her statutory duty under CAA section 112(n)(1)(A), weighed cost against the previously identified advantages of regulating HAP emissions from EGUs—including the agency's prior conclusions about the significant hazards to public health and the environment associated with such emissions and the volume of HAP that would be reduced by regulation of EGUs under CAA section 112.''). The 2020 Final Action further stated that the preferred approach was an ''unreasonable'' interpretation of CAA section 112(n)(1)(A) and impermissibly de-emphasized the importance of the cost consideration in the appropriate and necessary determination. *See* 85 FR 31292 (May 22, 2020). It is a decisional framework which rests primarily upon a comparison of the costs of a regulation and the small subset of HAP benefits which could be monetized that does not ''meaningfully consider[s] cost within the context of a regulation's benefits,'' because such a narrow approach relegates as secondary (and in application appeared to ignore altogether) the vast majority of that rule's HAP benefits and other advantages. We therefore propose to revoke the 2020 three-step approach and determination because we do not think it is a suitable way to assess the advantages and disadvantages of regulation under CAA section 112(n)(1)(A) and in applying it, the Agency failed to meaningfully address key facts in the existing record. Even if the Agency's selection of the 2020 framework could be considered a permissible interpretation of the broad ''appropriate and necessary'' determination in CAA section 112(n)(1)(A), we exercise our discretion under the statute and as described in *Michigan,* to approach the determination differently.

D. The Administrator's Proposed Preferred Framework and Proposed Conclusion

The EPA is proposing a preferred, totality-of-the-circumstances approach as a reasonable way to ''pay attention to the advantages *and* disadvantages of [our] decision,'' *Michigan,* 576 U.S. at 753, in determining whether it is appropriate to regulate coal- and oil-fired EGUs under section 112 of the CAA. This approach, including which factors we consider and how much weight we give them, is informed by Congress' design of CAA section 112(n)(1) specifically, and CAA section 112 generally.

Specifically, under this approach we first consider and weigh the advantages of reducing EGU HAP via regulation. We focus on the public health advantages of reducing HAP emissions because in CAA section 112(n)(1)(A), Congress specifically directed the EPA to regulate EGUs under CAA section 112 after considering the results of the ''study of hazards to public health reasonably anticipated to occur as a result of emissions'' by EGUs. We also consider the other studies commissioned by Congress in CAA sections 112(n)(1)(B) and (C) and the types of information the statute directed the EPA to examine under those provisions—the rate and mass of EGU mercury emissions, the health and environmental effects of such emissions, and the threshold level of mercury concentrations in fish tissue which may be consumed (even by sensitive populations) without adverse effects to public health.[110] We place considerable weight on the factors addressed in the studies required in the other provisions of CAA section 112(n)(1) because that provision is titled ''Electric utility steam generating units,'' so it is reasonable to conclude that the information in those studies is important and relevant to a determination of whether HAP emissions from EGUs should be regulated under CAA section 112.[111] *See Michigan,* 576 U.S. at 753–54 (citing CAA sections 112(n)(1)(B) and (C), its caption, and the additional studies required under those subparagraphs as relevant statutory context for the appropriate and necessary determination).

Notably, the studies of CAA section 112(n)(1) place importance on the same considerations that are expressed in the terms and overall structure of CAA section 112. For example, CAA section 112(n)(1)(A) and section 112(n)(1)(B) both show interest in the amount of HAP emissions from EGUs—section 112(n)(1)(A) by requiring the EPA to estimate the risk remaining after imposition of the ARP and other CAA requirements and section 112(n)(1)(B) by requiring the EPA to study the rate and mass of mercury emissions; therefore, we believe it is reasonable to conclude that we should consider and weigh the volume of toxic pollution EGUs contributed to our air, water, and land absent regulation under CAA section 112, in total and relative to other domestic anthropogenic sources, and the potential to reduce that pollution, thus reducing its grave harms. In addition, the clear goal in CAA section 112(n)(1)(C) and elsewhere to consider risks to the most exposed and susceptible populations supports our decision to place significant weight on reducing the risks of HAP emissions from EGUs to the most sensitive members of the population (*e.g.,* developing fetuses and children), and communities that are reliant on self-

[110] CAA section 112(n)(1)(B) also directs the EPA to study available technologies for controlling mercury and the cost of such controls, and we consider those in our assessment of cost.

[111] The statute directed the EPA to complete all three CAA section 112(n)(1) studies within 4 years of the 1990 Amendments, expressing a sense of urgency with regard to HAP emissions from EGUs on par with addressing HAP emissions from other stationary sources. *See* CAA section 112(e) (establishing schedules for setting standards on listed source categories as expeditiously as practicable, but no later than between 2–10 years).

caught local fish for their survival. Finally, we also consider the identified risks to the environment posed by mercury and acid-gas HAP, consistent with CAA section 112(n)(1)(B) and the general goal of CAA section 112 to address adverse environmental effects posed by HAP emissions. *See* CAA section 112(a)(7) (defining ''adverse environmental effect'').

We next examine the disadvantages of regulation, principally in the form of the costs incurred to capture HAP before they enter the environment. As with the advantages side of the equation, where we consider the consequences of reducing HAP emissions to human health and the environment, we consider the consequences of these expenditures for the electricity generating sector and society. We therefore consider compliance costs comprehensively, placing them in the context of the effect those expenditures have on the economics of power generation more broadly, the reliability of electricity, and the cost of electricity to consumers. These metrics are relevant to our weighing exercise because they give us a more complete picture of the disadvantages to society imposed by this regulation, and because our conclusion might change depending on how this burden affects the ability of the industry to thrive and provide reliable, affordable electricity to the benefit of all Americans. Consistent with CAA section 112(n)(1)(B), we further consider relevant control costs for EGUs and the relationship of control costs expected and experienced under the ARP and MATS.

Below, consistent with this framework, we consider and weigh the advantages to regulation against the costs of doing so, giving particular weight to our examination of the public health hazards we reasonably anticipate to occur as a result of HAP emissions from EGUs, and the risks posed by those emissions to exposed and vulnerable populations. We note as well that had we found regulation under CAA section 112 to impose significant barriers to provision of affordable and reliable electricity to the American public, this would have weighed heavily in our decision.

We acknowledge, as we recognized in the 2016 preferred approach, that this approach to making the appropriate and necessary determination is an exercise in judgment, and that ''[r]easonable people, and different decision-makers, can arrive at different conclusions under the same statutory provision,'' (81 FR 24431; April 25, 2016), but this type of weighing of factors and circumstances is an inherent part of regulatory decision-making. As noted in then-Judge Kavanaugh's dissent in *White Stallion,* ''All regulations involve tradeoffs, and . . . Congress has assigned EPA, not the courts, to make many discretionary calls to protect both our country's environment and its productive capacity.'' 748 F.3d at 1266 (noting as well that ''if EPA had decided, in an exercise of its judgment, that it was 'appropriate' to regulate electric utilities under the MACT program because the benefits outweigh the costs, that decision would be reviewed under a deferential arbitrary and capricious standard of review''). Bright-line tests and thresholds are not required under the CAA's instruction to determine whether regulation is ''appropriate and necessary,'' nor have courts interpreted broad provisions similar to CAA section 112(n)(1)(A) in such manner. In *Catawba Cty.* v. *EPA,* the D.C. Circuit held that ''[a]n agency is free to adopt a totality-of-the-circumstances test to implement a statute that confers broad authority, even if that test lacks a definite 'threshold' or 'clear line of demarcation to define an open-ended term.' '' 571 F.3d 20, 37 (D.C. Cir. 2009).

In undertaking this analysis, we are cognizant that, while the Agency has been studying the science underlying this determination for decades, the understanding of risks, health, and environmental impacts associated with toxic air pollution continues to evolve. In this notice, we explained the additional information that has become available to the Agency since we performed our national risk assessments, and explained why, despite the certainty of the science demonstrating substantial health risks, we are unable at this time to quantify or monetize many of the effects associated with reducing HAP emissions from EGUs.[112] We continue to think it is appropriate to give substantial weight to these public health impacts, even where we lack information to precisely quantify or monetize those impacts. As the D.C. Circuit stated in *Ethyl Corp.* v. *EPA,*

> ''Where a statute is precautionary in nature, the evidence difficult to come by, uncertain, or conflicting because it is on the frontiers of scientific knowledge, the regulations designed to protect public health, and the decision that of an expert administrator, we will not demand rigorous step-by-step proof of cause and effect. . . . [I]n such cases, the Administrator may assess risks. . . . The Administrator may apply his expertise to draw conclusions from suspected, but not completely substantiated, relationships between facts, from trends among facts, from theoretical projections from imperfect data, from probative preliminary data not yet certifiable as 'fact,' and the like.''

541 F.2d 1, 28 (D.C. Cir. 1976). *See also Lead Industries Ass'n* v. *EPA,* 647 F.2d 1130, 1155 (D.C. Cir. 1980) (''[R]equiring EPA to wait until it can conclusively demonstrate that a particular effect is adverse to health before it acts is inconsistent with both the [Clean Air] Act's precautionary and preventive orientation and the nature of the Administrator's statutory responsibilities.'').

The EPA is not alone in needing to make difficult judgments about whether a regulation that has a substantial economic impact is ''worth it,'' in the face of uncertainty such as when the advantages of the regulation are hard to quantify in monetary terms. The Transportation Security Administration (TSA), when determining whether to require Advanced Imaging Technology at certain domestic airports, faced assertions that the high cost of widespread deployment of this type of screening was ''not worth the cost.'' TSA acknowledged that it did not ''provide monetized benefits'' or ''degree of benefits'' to justify the use of the screening, but noted that the agency ''uses a risk-based approach . . . in order to try to minimize risk to commercial air travel.'' *See* 81 FR 11364, 11394 (March 3, 2016). The agency pointed out that it could not consider ''only the most easily quantifiable impacts of a terrorist attack, such as the direct cost of an airplane crashing,'' but rather that it had an obligation to ''pursue the most effective security measures reasonably available so that the vulnerability of commercial air travel to terrorist attacks is reduced,'' noting that some commenters were failing to consider the more difficult to quantify aspects of the benefits of avoiding terrorist attacks, such as ''substantial indirect effects and social costs (such as fear) that are harder to measure but which must also be considered by TSA when deciding whether an investment in security is cost-beneficial.'' *Id.*

In reviewing Agency decisions like these, courts do ''not to substitute [their] judgment[s] for that of the agenc[ies],'' *State Farm,* 463 U.S. at 43 (1983), and ''[t]his is especially true when the agency is called upon to weigh the costs and benefits of alternative policies,'' *Center for Auto Safety* v. *Peck,* 751 F.2d 1336, 1342 (D.C. Cir. 1985). *See also*

[112] Unquantified effects include additional neurodevelopmental and cardiovascular effects from exposure to methylmercury, ecosystem effects, health risks from exposure to non-mercury HAP, and effects in EJ relevant subpopulations that face disproportionally high risks.

United Church of Christ v. *FCC,* 707 F.2d 1413, 1440 (D.C. Cir. 1983) (''[C]ost benefit analyses epitomize the types of decisions that are most appropriately entrusted to the expertise of an agency.''). Agencies are entitled to this deference even where, or perhaps particularly where, costs or benefits can be difficult to quantify. For example, in *Consumer Elecs. Ass'n* v. *FCC,* the D.C. Circuit upheld the FCC's mandate to require digital tuners, finding reasonable the Commission's identification of benefits, that is, ''principally speeding the congressionally-mandated conversion to DTV and reclaiming the analog spectrum,'' coupled with the FCC's ''adequate[ ] estimate[of] the long-range costs of the digital tuner mandate within a range sufficient for the task at hand . . . and [its finding of] the estimated costs to consumers to be 'within an acceptable range.''' 347 F.3d 291, 303–04 (D.C. Cir. 2003) (''We will not here second-guess the Commission's weighing of costs and benefits.'').

Similarly, the Food and Drug Administration, in weighing the costs and benefits of deeming electronic cigarettes to be ''tobacco products,'' described the benefits qualitatively, '' 'potentially coming from' . . . premarket review [*i.e.,* the statutory consequence of deeming], which will result in fewer harmful or additive products from reaching the market than would be the case in the absence of the rule; youth access restrictions and prohibitions on free samples, which can be expected to constrain youth access to tobacco products and curb rising uptake; health warning statements, which will help consumers understand and appreciate the risks of using tobacco products; prohibitions against false or misleading claims and unsubstantiated modified risk claims; and other changes [such as monitoring and ingredient listings].'' *Nicopure Labs, LLC* v. *FDA,* 266 F. Supp. 3d 360, 403–404 (D.D.C. 2017), *aff'd,* 944 F.3d 267 (D.C. Cir. 2019). Plaintiffs challenging the rule claimed that because the FDA had not quantified the benefits of the rule, it ''cannot realistically determine that a rule's benefits justify its costs,'' because ''it does not have . . . a general grasp of the rule's benefits.'' *Id.* at 406. The court disagreed, finding the agency's statement of benefits to have ''provided substantial detail on the benefits of the rule, and the reasons why quantification was not possible'' and in any case agreeing with the agency that there was no obligation to quantify benefits in any particular way. *Id.*

We think the inquiry posed to the Agency by CAA section 112(n)(1)(A) has similarities to these other decisions, in which agencies tasked with protecting and serving the American public elected to take actions that would impose significant costs in order to achieve important benefits that could not be precisely quantified or were in some cases uncertain—protection from terrorist attacks, speeding the advancement of digital technology, and subjecting a new product to marketing and safety regulation. In those cases, the framework for decision-making was to make a judgment after a weighing of advantages against disadvantages, considering qualitative factors as well as quantified metrics. Here, we employ a similar totality-of-the-circumstances approach to the CAA section 112(n)(1)(A) inquiry as to whether it is appropriate to regulate HAP emissions from EGUs.

Earlier sections of this preamble (sections III.A. and III.B.) discuss in detail the EPA's evaluation of the public health and environmental advantages of regulating HAP from U.S. EGUs and the reasons it is not possible to quantify or monetize most of those advantages, as well as the EPA's comprehensive assessment of the costs of doing so. We will not in this section repeat every detail and data point, but we incorporate all of that analysis here and highlight only a few of the considerations that weighed heavily in our application of the preferred totality-of-the-circumstances approach.

Under our preferred approach, we first consider the public health advantages to reducing HAP from EGUs, and the other focuses for study identified by Congress in CAA section 112(n)(1). As noted, we give particular weight in our determination to the information related to the statutory factors identified for the EPA's consideration by the studies—namely, the hazards to public health reasonably anticipated to occur as a result of EGU HAP emissions (112(n)(1)(A)), the rate and mass of mercury emissions from EGUs (112(n)(1)(B)), the health and environmental effects of such emissions (112(n)(1)(B)), and the levels of mercury exposure below which adverse human health effects are not expected to occur as well as the mercury concentrations in the tissue of fish which may be consumed (including by sensitive populations) without adverse effects to public health (112(n)(1)(C)).

The statutorily mandated studies are the foundation for the Agency's finding that HAP emissions from U.S. EGUs represent a clear hazard to public health and the environment, but as documented in section III.A., the EPA has continued to amass an extensive body of evidence related to the original study topics that only furthers the conclusions drawn in the earlier studies. As discussed in section III.A, the EPA completed a national-scale risk assessment focused on mercury emissions from U.S. EGUs as part of the 2011 Final Mercury TSD. That assessment specifically examined risk associated with mercury released from U.S. EGUs that deposits to watersheds within the continental U.S., bioaccumulates in fish as methylmercury, and is consumed when fish are eaten by female subsistence fishers of child-bearing age and other freshwater self-caught fish consumers. We focused on the female subsistence fisher subpopulation because there is increased risk for *in utero* exposure and adverse outcomes in children born to female subsistence fishers with elevated exposure to methylmercury.[113] Our analysis estimated that 29 percent of the watersheds studied would lead to exposures exceeding the methylmercury RfD for this population, based on *in utero* effects, due in part to the contribution of domestic EGU emissions of mercury. We also found that deposition of mercury emissions from U.S. EGUs alone led to potential exposures that exceed the RfD in up to 10 percent of modeled watersheds.

We have also examined impacts of prenatal methylmercury exposure on unborn children of recreational anglers consuming self-caught fish from inland freshwater lakes, streams, and rivers, and found significant IQ loss in the affected population of children. Our analysis, which we recognized did not cover consumption of recreationally caught seafood from estuaries, coastal waters, and the deep ocean, nevertheless indicated significant health harm from methylmercury exposure. Methylmercury exposure also leads to adverse neurodevelopmental effects such as performance on neurobehavioral tests, particularly on tests of attention, fine motor function, language, and visual spatial ability. *See* section III.A.2.a.

The population that has been of greatest concern with respect to methylmercury exposure is women of childbearing age because the developing fetus is the most sensitive to the effects of methylmercury. *See* 85 FR 24995 (May 3, 2011). In the Mercury Study, the EPA estimated that, at the time of the study, 7 percent of women of childbearing age in the continental U.S.

[113] The NAS Study had also highlighted this population as one of particular concern due to the regular and frequent consumption of relatively large quantities of fish. *See* 65 FR 79830 (December 20, 2000).

(or about 4 million women) were exposed to methylmercury at levels that exceeded the RfD and that about 1 percent of women of childbearing age (or about 580,000 women) had methylmercury exposures three to four times the RfD. *See* 65 FR 79827 (December 20, 2000). We also performed a new bounding analysis for this proposal that focuses on the potential for IQ points lost in children exposed *in utero* through maternal fish consumption by the population of general U.S. fish consumers (section III.A.3.d).

Another important human health impact documented by the EPA over the last 2 decades includes cardiovascular impacts of exposure to methylmercury—including altered blood-pressure and heart-rate variability in children as a result of infant exposure in the womb and higher risk of acute MI, coronary heart disease, and cardiovascular heart disease in adults, due to dietary exposure. Studies that have become available more recently led the EPA to perform new quantitative screening analyses (as described in section III.A.3) to estimate the incidence of MI (heart attack) mortality that may be linked to U.S. EGU mercury emissions. The new analyses performed include an extension of the original watershed-level subsistence fisher methylmercury risk assessment to evaluate the potential for elevated MI-mortality risk among subsistence fishers (section III.A.3.b; 2021 Risk TSD) and a separate risk assessment examining elevated MI mortality among all adults that explores potential risks associated with exposure of the general U.S. population to methylmercury from domestic EGUs through commercially-sourced fish consumption (section III.A.3.c; 2021 Risk TSD). The updated subsistence fisher analysis estimated that up to 10 percent of modeled watersheds are associated with exposures linked to increased risk of MI mortality, but for some populations such as low-income Black subsistence fishers active in the Southeast, that number is approximately 25 percent of the watersheds modeled. The bounding analysis results estimating MI-mortality attributable to U.S. EGU-sourced mercury for the general U.S. population range from 5 to 91 excess deaths annually. As noted, we give significant weight to these findings and analyses examining public health impacts associated with methylmercury, given the statutory focus in CAA section 112(n)(1)(B) and 112(n)(1)(C) on adverse effects to public health from EGU mercury emissions and the directive to develop an RfD (''threshold level of mercury exposure below which adverse human health effects are not expected to occur''), and in particular one that is designed to assess ''mercury concentrations in the tissue of fish which may be consumed (including consumption by sensitive populations).'' *See* CAA section 112(n)(1)(C).

Because of CAA section 112(n)(1)(A)'s broader focus on hazards to public health from all HAP, not just mercury, we also give considerable weight to health effects associated with non-mercury HAP exposure (*see* section III.A.2.b for further detail), including chronic health disorders such as irritation of the lung, skin, and mucus membranes; decreased pulmonary function, pneumonia, or lung damage; detrimental effects on the central nervous system; damage to the kidneys; and alimentary effects such as nausea and vomiting). The 2011 Non-Hg HAP Assessment, performed as part of the EPA's 2012 reaffirmation of the appropriate and necessary determination, expanded on the original CAA section 112(n)(1)(A) Utility Study by examining further public health hazards reasonably anticipated to occur from EGU HAP emissions after imposition of other CAA requirements. This study included a refined chronic inhalation risk assessment that was designed to assess how many coal- and oil-fired EGUs had cancer and non-cancer risks associated with them, and indicated that absent regulation, a number of EGUs posed cancer risks to the American public (*see* section III.A.2.b).

As discussed in section II.B, the statutory design of CAA section 112 quickly secured dramatic reductions in the volume of HAP emissions from stationary sources. CAA section 112(n)(1)(B) also directs the EPA to study, in the context of the Mercury Study, the ''rate and mass'' of mercury emissions. We therefore think it is reasonable to consider, in assessing the advantages to regulating HAP emissions from EGUs, what the volume of emissions was from that sector prior to regulation—as an absolute number and relative to other sources—and what the expected volume of emissions would be with CAA section 112(d) standards in place. Prior to the EPA's promulgation of MATS in 2012, the EPA estimated that in 2016, without MATS, coal-fired U.S. EGUs above 25 MW would emit 29 tons of mercury per year. While these mercury emissions from U.S. EGUs represented a decrease from 1990 and 2005 levels (46 tons and 53 tons, respectively), they still represented nearly half of all anthropogenic mercury emissions in 2011 (29 out of 64 tons total). Considered on a proportional basis, the relative contribution of U.S. EGUs to all domestic anthropogenic mercury emissions was also stark. The EGU sector emitted more than six times as much mercury as any other sector (the next highest being 4.6 tons). *See* Table 3 at 76 FR 25002 (May 3, 2011). Prior to MATS, U.S. EGUs were estimated to emit the majority of HCl and HF nationally, and were the predominant source of emissions nationally for many metal HAP as well, including antimony, arsenic, chromium, cobalt, and selenium. *Id.* at 25005–06. In 2012, the EPA projected that MATS would result in an 88 percent reduction in hydrogen chloride emissions, a 75 percent reduction in mercury emissions, and a 19 percent reduction in PM emissions (a surrogate for non-mercury metal HAP) from coal-fired units greater than 25 MW in 2015 alone. *See* 77 FR 9424 (February 16, 2012). In fact, actual emission reductions since MATS implementation have been even more substantial. In 2017, by which point all sources were required to have complied with MATS, the EPA estimated that acid gas HAP emissions from EGUs had been reduced by 96 percent, mercury emissions had been reduced by 86 percent, and non-mercury metal HAP emissions had been reduced by 81 percent compared to 2010 levels. *See* 84 FR 2689 (February 7, 2019). Retaining the substantial reductions in the volume of toxic pollution entering our air, water, and land, from this large fleet of domestic sources reduces the substantial risk associated with this pollution faced by all Americans.

Even though reducing HAP from EGUs would benefit all Americans by reducing risk and hazards associated with toxic air pollution, it is worth noting that the impacts of EGU HAP pollution in the U.S. have not been borne equally nationwide. Certain communities and individuals have historically borne greater risk from exposure to HAP emissions from EGUs prior to MATS, as demonstrated by the EPA's risk analyses. The individuals and communities that have been most impacted have shouldered a disproportionate burden for the energy produced by the power sector, which in turn benefits everyone—*i.e.,* these communities are subject to a greater share of the externalities of HAP pollution that is generated by EGUs producing power for everyone. A clear example of these disproportionately impacted populations are subsistence fishers who live near U.S. EGUs experiencing increased risk due to U.S. EGU mercury deposition at the watersheds where they are active (2011 Final Mercury TSD). CAA section 112(n)(1)(C) directed the EPA to examine risks to public health experienced by sensitive populations as a result of the consumption of mercury concentrations in fish tissue, which we think includes fetuses and communities that are reliant on local fish for their survival, and CAA section 112 more generally is drafted in order to be protective of small cohorts of highly exposed and susceptible populations. We therefore weigh heavily the importance of reducing risks to particularly impacted populations, including those who consume large amounts of self-caught fish reflecting cultural practice and/or economic necessity, including tribal populations, specific ethnic communities and low-income populations including Black persons living in the southeastern U.S.

Consistent with CAA section 112(n)(1)(B) and the general goal of CAA section 112 to reduce risks posed by HAP to the environment, we also consider the ecological effects of methylmercury and acid gas HAP (*see* section III.A.2.c). Scientific studies have consistently found evidence of adverse impacts of methylmercury on fish-eating birds and mammals, and insect-eating birds. These harmful effects can include slower growth and development, reduced reproduction, and premature mortality. Adverse environmental impacts of emissions of acid gas HAP, in particular HCl, include acidification of terrestrial and aquatic ecosystems. In the EPA's recent *Integrated Science Assessment for Oxides of Nitrogen, Oxides of Sulfur and Particulate Matter—Ecological Criteria* (2020), we concluded that the body of evidence is sufficient to infer a causal relationship between acidifying deposition and adverse changes in freshwater biota like plankton, invertebrates, fish, and other organisms. Adverse effects on those animals can include physiological impairment, loss of species, changes in community composition, and biodiversity. Because EGUs contribute to mercury deposition in the U.S., we conclude that EGUs are contributing to the identified adverse environmental effects, and consider the beneficial impacts of mitigating those effects by regulating EGUs.

We turn next in our application of the preferred approach to the consideration of the disadvantages of regulation, which in this case we measure primarily in terms of the costs of that regulation. As discussed in section III.B, for purposes of this preferred totality-of-the-circumstances approach, we start with the sector-level estimate developed in the 2011 RIA. Given the complex, interconnected nature of the power sector, we think it is appropriate to consider this estimate, which represents the incremental costs to the entire power sector to generate electricity, not just the compliance costs projected to be borne by regulated EGUs. We explain in section III.B that while a precise *ex post* estimate of this sector-level figure is not possible, we update those aspects of the cost estimate where we can credibly do so (*see* section III.B.2), and our consideration of the cost of regulation therefore takes into account the fact that new analyses performed as part of this proposal demonstrate that the 2011 RIA cost estimate was almost certainly significantly overestimated. We propose to conclude that regulation is appropriate and necessary under either cost estimate.

As with the benefits side of the ledger, where we look comprehensively at the effects of reducing the volume of HAP, we also comprehensively assess costs in an attempt to evaluate the economic impacts of the regulation as a whole. We situate the cost of the regulation in the context of the economics of power generation, as we did in 2016, because we think examining the costs of the rule relative to three sector-wide metrics provides a useful way to evaluate the disadvantages of expending these compliance costs to this sector beyond a single monetary value. For each of these metrics, we use our 2011 estimate of compliance costs, which, as is discussed in section III.B.2 and the Cost TSD, was likely to have been significantly overestimated by a figure in the billions of dollars. We first evaluate the 2011 projected annual compliance costs of MATS as a percent of annual power sector sales, also known as a ''sales test.'' A sales test is a frequently used indicator of potential impacts from compliance costs on regulated industries, and the EPA's analysis showed that projected 2015 compliance costs, based on the 2011 estimate, represented between 2.7–3.5 percent of power sector revenues from historical annual retail electricity sales. *See* section III.B.3; Cost TSD; 80 FR 75033 (December 1, 2015). We also examine the annual capital expenditures that were expected for MATS compliance as compared to the power sector's historical annual capital expenditures. We conclude that projected incremental annual capital expenditures of MATS would be a small percentage of 2011 power sector-level capital expenditures, and well within the range of historical year-to-year variability on industry capital expenditures. *Id.* Finally, we consider the annual operating or production expenses in addition to capital expenditures because we were encouraged during the 2016 rulemaking to use this broader metric of power industry costs to provide perspective on the cost of MATS relative to total capital and operational expenditures by the industry historically. Consistent with our other findings, we conclude that, even when using the likely overestimated cost of MATS based on the 2011 RIA, the total capital and operational expenditures required by MATS are in the range of about 5 percent of total historical capital and operational expenditures by the power sector during the period of 2000–2011. *See* section III.B.3; Cost TSD; 81 FR 24425 (April 25, 2016). In this proposal, we re-analyze all of these metrics using updated data to reflect more recent information (as of 2019), and took into consideration the fact that the 2011 RIA cost estimate was almost certainly significantly overestimated. All of this new analysis further supports our findings as to the cost of MATS relative to other power sector economics based on the record available to the Agency at the time we were making the threshold determination (*i.e.,* the 2012 record).

Consistent with the *Michigan* Court's instruction to consider all advantages and disadvantages of regulation, we also assess, as we did in 2016, disadvantages to regulation that would flow to the greater American public. Specifically, we examine whether regulation of EGUs would adversely impact the provision of reliable, affordable electricity to the American public, because had regulation been anticipated to have such an effect, it would have weighed heavily on our decision as to whether it was appropriate to require such regulation. The CAA tasks the EPA with the purpose of protecting and enhancing air quality in the U.S., but directs that in doing so we promote public health and welfare *and* the productive capacity of the U.S. population. CAA section 101(b)(1). As noted, we also think examining these potential impacts is consistent with the ''broad and all-encompassing'' nature of the term ''appropriate,'' as characterized by the Supreme Court. *Michigan,* 576 U.S. at 752. We were particularly interested in examining the expected impact of MATS implementation on the retail price of electricity, because in electricity markets, utility expenditures can be fully or partially passed to consumers. It was therefore reasonable to assume that the cost of MATS could result in increased retail electricity prices for consumers, although we emphasize, as we did in 2016, that the electricity price impacts examined under this metric do not reflect *additional* compliance costs on top of the estimate produced in the 2011 RIA but rather reflect the passing on of a share of those costs to consumers (and ultimately reducing the costs EGU owners would otherwise bear). However, even though the impacts on electricity prices are reflected in the total cost estimate to the sector as a whole, we think, for the reasons stated above, that electricity price impacts are worthy of special attention because of the potential effect on the American public.

We therefore estimate the percent increase in retail electricity prices projected to result from MATS compared to historical levels of variation in electricity prices. *See* section III.B.3; 80 FR 75035 (December 1, 2015). We estimate that retail electricity prices for 2015 would increase by about 0.3 cents per kilowatt-hour, or 3.1 percent with MATS in place. Between 2000 and 2011, the largest annual year-to-year decrease in retail electricity price was –0.2 cents per kilowatt-hour and the largest year-to-year increase during that period was +0.5 cents per kilowatt-hour. The projected 0.3 cents increase due to MATS was therefore well within normal historical fluctuations. *Id.* As with the other metrics examined, as the increase in retail electricity prices due to MATS was within the normal range of historical variability, a substantially lower estimate for impacts on electricity prices would only further support the EPA's determination. We also note in section III.B.3 that the year-to-year retail electricity price changes in the new information we examined (*i.e.,* years 2011–2019) were within the same ranges observed during the 2000–2011 period, and that in fact, during that period when MATS was implemented, retail electricity prices have generally decreased (9.3 cents per kilowatt-hour in 2011 to 8.7 cents per kilowatt-hour in 2019). Consistent with these observed trends in retail electricity prices, as discussed in section III.B.2 and further below, our *ex post* analysis of MATS indicates that the projected compliance costs in the 2011 RIA—and, as a corollary, the projected increases in retail electricity prices—were likely significantly overestimated. Certainly, we have observed nothing in the data that suggests the regulation of HAP from EGUs resulted in increases in retail electricity prices for the American public that would warrant substantial concern in our weighing of this factor.

Similar to our reasoning for examining impacts on electricity prices for American consumers, in assessing the potential disadvantages to regulation, we elected to also look at whether the power sector would be able to continue to provide reliable electricity to all Americans after the imposition of MATS. We think this examination naturally fits into our assessment of whether regulation is ''appropriate,'' because had MATS interfered with the provision of reliable electricity to the American public, that would be a significant disadvantage to regulation to weigh in our analysis. In examining this factor, we looked at both resource adequacy and reliability—that is, the provision of generating resources to meet projected load and the maintenance of adequate reserve requirements for each region (resource adequacy) and the sector's ability to deliver the resources to the projected electricity loads so that the overall power grid remains stable (reliability). *See* section III.B.3; U.S. EPA 2011, Resource Adequacy and Reliability TSD; 80 FR 75036 (December 1, 2015). Our analysis indicated that the power sector would have adequate and reliable generating capacity, while maintaining reserve margins over a 3-year MATS compliance period. *Id.* We did not in this proposal update the Resource Adequacy and Reliability Study conducted in 2011, but we note that the EPA, as a primary regulator of EGUs, is keenly aware of adequacy and reliability concerns in the power sector and in particular the relationship of those concerns to environmental regulation. We have not seen evidence in the last decade to suggest that the implementation of MATS caused power sector adequacy and reliability problems, and only a handful of sources obtained administrative orders under the enforcement policy issued with MATS to provide relief to reliability critical units that could not comply with the rule by 2016.

In addition to the cost analyses described above, the EPA revisited its prior records examining the costs of mercury controls consistent with the requirement in CAA section 112(n)(1)(B), the cost of controls for other HAP emissions from EGUs, and the cost of implementing the utility-specific ARP, which Congress wrote into the 1990 CAA Amendments and implementation of which Congress anticipated could result in reductions in HAP emissions. 80 FR 75036–37 (December 1, 2015). The ARP, like MATS, was expected to have a significant financial impact on the power sector, with projections of its cost between $6 billion to $9 billion per year (in 2000 dollars), based on the expectation that many utilities would elect to install FGD scrubbers in order to comply with the ARP. *Id.* at 75037. The actual costs of compliance were much less (up to 70 percent lower than initial estimates), in large part because of the utilities' choice to comply with the ARP by switching to low sulfur coal instead of installing scrubbers.[114] This choice also resulted in far fewer reductions in HAP emissions than would have occurred if more EGUs had installed SO_2 scrubbers. We believe the considerable reduction in the implementation cost of the ARP is important because of the economic benefit that accrued from delaying the large capital costs of controls by almost 25 years. With respect to the costs of technology for control of mercury and non-mercury HAP, the record evidence shows that in 2012 controls were available and routinely used and that control costs had declined considerably over time. *Id.* at 75037–38. We also note that, as explained at length in section III.B.2, the actual compliance costs of MATS, with respect to capital and operating expenditures associated with installing and operating controls, were significantly lower than what we projected at the time of the rule. In addition, the newer information examined as part of this proposal demonstrates that actual control costs were much lower than we projected, which weighs further in favor of a conclusion that it is appropriate to impose those costs in order to garner the advantages of regulation.

Our review of the record and application of the preferred totality-of-the-circumstances approach has demonstrated that we have, over the last 2 decades, amassed a voluminous and scientifically rigorous body of evidence documenting the significant hazards to public health associated with HAP emissions from EGUs, particularly to certain vulnerable populations that bear greater risk from these emissions than the general public. We have looked at the volume of emissions coming from these sources and what the impact of regulation would be on that volume. We examined the cost of regulation to industry (even using an estimate of cost that we know to be higher than what was expended), and the potential

[114] U.S. EPA Clean Air Markets Div., 2011, *National Acid Precipitation Assessment Program Report to Congress 2011: An Integrated Assessment,* National Science and Technology Council, Washington, DC.

adverse impacts that could be felt by the American public via increased electricity prices and access to reliable electricity. And, consistent with the statute, we have also considered adverse impacts of EGU pollution on the environment as well as availability of controls and the costs of those controls.

Even based solely on the record available to us at the time we issued the regulation and made the threshold determination in 2012, we find that the benefits of regulation are manifold, and they address serious risks to vulnerable populations that remained after the implementation of the ARP and other controls imposed upon the power sector that were required under the CAA. We have placed considerable weight on these benefits, given the statutory directive to do so in CAA section 112(n)(1)(A) and Congress' clear purpose in amending CAA section 112 in 1990. In contrast, the costs, while large in absolute terms, were shown in our analyses to be within the range of other expenditures and commensurate with revenues generated by the sector, and our analysis demonstrated that these expenditures would not and did not have any significant impacts on electricity prices or reliability. After considering and weighing all of these facts and circumstances, in an exercise of his discretion under the Act, the Administrator proposes to conclude that the substantial benefits of reducing HAP from EGUs, which accrue in particular to the most vulnerable members of society, are worth the costs. Consequently, we propose to find after weighing the totality of the circumstances, that regulation of HAP from EGUs is appropriate after considering cost.

The newer information examined as part of this proposal regarding both benefits and costs is directionally consistent with all of the findings the EPA has made in the 2016 administrative record. The robust and long-standing scientific foundation regarding the adverse health and environmental risks from mercury and other HAP is fundamentally unchanged since the comprehensive studies that Congress mandated in the CAA were completed decades ago. But in this proposal, we completed screening level risk assessments, informed by newer meta-analyses of the dose-response relationship between methylmercury and cardiovascular disease, which indicate that a segment of the American public is at increased risk of prematurely dying by heart attack due to methylmercury exposure with as many as 91 deaths per year (and possibly more) being attributable to mercury emissions from EGUs.[115] Further, analyses show that some populations (*e.g.,* low-income Blacks in the Southeast and certain tribal communities engaging in subsistence fishing activity) likely bear a disproportionately higher risk from EGU HAP emissions than the general populace.

The new cost information analyzed by the EPA, discussed in section III.B, indicates that the cost projection used in the 2016 Supplemental Finding (*i.e.,* the 2011 RIA cost estimate) likely significantly overestimated the actual costs of compliance of MATS. Specifically, the EGU sector installed far fewer controls to comply with the HAP emissions standards than projected; certain modeling assumptions, if updated with newer information, would have resulted in a lower cost estimate; unexpected advancements in technology occurred; and the country experienced a dramatic increase in the availability of comparatively inexpensive natural gas. All of these factors likely resulted in a lower actual cost of compliance than the EPA's projected estimates in 2011. We therefore find that when we consider information available to the Agency after implementation of the rule, our conclusion that it was appropriate to regulate this sector for HAP is further strengthened. The costs projected in the 2011 RIA were almost certainly overestimated by an amount in the billions of dollars.

We note as well that during prior rulemaking processes related to the appropriate and necessary determination, stakeholders suggested that undermining the threshold finding in order to pave the way to rescinding MATS would have grave economic and health consequences. Utilities reported that they rely upon the mandated status of MATS in order to recoup expenditures already made to comply with the rule before Public Utility Commission proceedings.[116] States asserted that they rely upon the Federal protections achieved by the rule in state implementation planning and other regulatory efforts.[117] And other industries, such as pollution control companies, have made business decisions based on the existence of MATS.[118] We think these reliance interests, nearly all of which are aligned, also weigh in favor of retaining the appropriate and necessary determination, particularly given the fact that a significant portion of compliance costs have already been spent.

Finally, while we focus on the HAP benefits, we note that the *Michigan* court directed that ''any disadvantage could be termed a cost.'' *Michigan,* at 752. The corollary is that any advantage could be termed a benefit. And so, while it is not necessary to our conclusion that regulation is appropriate, we also consider, under our totality-of-the-circumstances approach, whether there are additional advantages or disadvantages to the specific controls imposed under MATS. Specifically, we note that because the controls required to reduce HAP from U.S. EGUs resulted in substantial reductions in co-emitted pollutants, including direct $PM_{2.5}$ as well as SO_2 and NO_X, which are both precursors to ozone and fine particle formation, the Administrator's proposed conclusion is further supported by the ramifications of the regulatory requirements in MATS for these pollutants. We propose that the benefits associated with such reductions may be appropriate to consider where the framework for making the CAA section 112(n)(1)(A) determination is a totality-of-the-circumstances approach, and we take comment on that approach. Therefore, while we conclude that the benefits associated with regulating HAP alone outweigh the costs without consideration of non-HAP benefits, we also propose that, to the extent we consider benefits attributable to reductions in co-emitted pollutants as a concomitant advantage, these benefits act to confirm that regulation is

[115] This estimate of premature mortality is for the EGU sector after imposition of the ARP and other CAA requirements, but before MATS implementation.

[116] *See, e.g.,* Comment Letter from Edison Electric Institute, Docket ID Item No. EPA–HQ–OAR–2018–0794–2267; Comment Letter from Edison Electric Institute, NRECA, American Public Power Association, The Clean Energy Group, Class of '85 Regulatory Response Group, Large Public Power Council, Global Energy Institute, International Brotherhood of Electrical Workers, International Brotherhood of Boilermakers, Iron Ship Builders, Blacksmiths, Forgers & Helpers, and the Laborers' International Union of North America, Docket ID Item No. EPA–HQ–OAR–2018–0794–0577.

[117] *See, e.g.,* Comment Letter from Attorneys General of Massachusetts, California, Connecticut, Delaware, Illinois, Iowa, Maine, Maryland, Michigan, Minnesota, Nevada, New Jersey, New Mexico, New York, North Carolina, Oregon, Rhode Island, Vermont, Virginia, Washington, and the District of Columbia, the Maryland Department of the Environment, the City Solicitor of Baltimore, the Corporation Counsels of Chicago and New York City, the County Attorney of the County of Erie, NY, and the County Counsel for the County of Santa Clara, CA, Docket ID Item No. EPA–HQ–OAR–2018–0794–1175.

[118] *See, e.g.,* Comment Letter from ADA Carbon Solutions, LLC, Docket ID Item No. EPA–HQ–OAR–2018–0794–0794; Comment Letter from Advanced Emissions Solutions, Inc., Docket ID Item No. EPA–HQ–OAR–2018–0794–1181; Comment Letter from Exelon Corporation, Docket ID Item No. EPA–HQ–OAR–2018–0794–1158.

appropriate under a totality-of-the-circumstances approach. Specifically, we note that reductions in co-emissions of direct $PM_{2.5}$, SO_2 and NO_X will have substantial health benefits in the form of decreased risk of premature mortality among adults, and reduced incidence of lung cancer, new onset asthma, exacerbated asthma, and other respiratory and cardiovascular diseases. In the 2011 RIA, the EPA estimated the number and value of avoided $PM_{2.5}$-related impacts, including 4,200 to 11,000 premature deaths, 4,700 nonfatal heart attacks, 2,600 hospitalizations for respiratory and cardiovascular diseases, 540,000 lost work days, and 3.2 million days when adults restrict normal activities because of respiratory symptoms exacerbated by $PM_{2.5}$. We also estimated substantial additional health improvements for children from reductions in upper and lower respiratory illnesses, acute bronchitis, and asthma attacks. In addition, we estimated the benefit of reductions in CO_2 emissions under MATS. Although the EPA only partially monetized the benefits associated with these reductions in co-emitted pollutants in the 2011 RIA, the Agency estimated that—due in particular to the strong causal relationship between $PM_{2.5}$ and premature mortality—these reductions could result in as much as $90 billion (in 2016 dollars) in additional public health benefits annually. Therefore, if these non-HAP benefits are considered in the totality-of-the-circumstances approach, we take note of the fact that regulating EGUs for HAP emissions results in substantial other health benefits accruing to the American public by virtue of regulating HAP from EGUs.

E. The Administrator's Proposed Benefit-Cost Analysis Approach and Proposed Conclusion

In addition to the preferred approach, we separately put forward an alternative approach, as we did in 2016, to support a determination that it is appropriate and necessary to regulate HAP from EGUs when looking at the results of a formal BCA. The formal BCA we conducted for purposes of meeting Executive Order 12866 using established BCA practices also demonstrates that the benefits estimated for MATS far exceed the estimated costs, as reported in the 2011 RIA.[119] In its net benefits projection, the 2011 RIA monetized only one post control benefit from regulating HAP emissions from EGUs because the Agency did not and does not have the information necessary to monetize the many other benefits associated with reducing HAP emissions from EGUs. *See* section III.A.4. However, the 2011 RIA properly accounted for all benefits by discussing qualitatively those that could not be quantified and/or monetized. While some of the impacts on particularly impacted populations—such as the children of recreational anglers experiencing IQ loss—were reflected in the net benefits calculation, that accounting does not really grapple with the equitable question of whether a subset of Americans should continue to bear disproportionate health risks in order to avoid the increased cost of controlling HAP from EGUs. We continue to prefer a totality-of-the-circumstances approach to making the determination under CAA section 112(n)(1)(A), but we think that if a BCA is to be used, it should, consistent with economic theory and principles, account for all costs and all benefits.

BCA has been part of executive branch rulemaking for decades. Over the last 50 years, Presidents have issued Executive Orders directing agencies to conduct these analyses as part of the rulemaking development process. Executive Order 12866, currently in effect, requires a quantification of benefits and costs to the extent feasible for any regulatory action that is likely to result in a rule that may have an annual effect on the economy of $100 million or more or adversely affect in a material way certain facets of society. Executive Order 12866, at section 3(f)(1).

The EPA performed a formal BCA to comport with Executive Order 12866 as part of the 2012 MATS rulemaking process (referred to herein as the 2011 RIA). In the 2016 Supplemental Finding, the EPA relied on the BCA it had performed for Executive Order 12866 purposes as an alternative basis upon which to make the appropriate and necessary determination. That BCA, which reflected in its net benefits calculation only certain categories of benefits that could be confidently monetized, estimated that the final MATS would yield annual *net* monetized benefits (in 2007 dollars) of between $37 billion to $90 billion using a 3-percent discount rate and $33 billion to $81 billion using a 7-percent discount rate. *See* 80 FR 75040 (December 1, 2015). These estimates included the portion of the HAP benefits described in section III.A that could be monetized at the time, along with additional health benefits associated with the controls necessary to control the HAP emissions from U.S. EGUs. Specifically, as noted, the net benefits estimates included only one of the many HAP benefits associated with reduction of HAP. Nonetheless, the monetized benefits of MATS outweighed the estimated $9.6 billion in annual monetized costs by between 3-to-1 or 9-to-1 depending on the benefit estimate and discount rate used. The implementation of control technologies to reduce HAP emissions from EGU sources also led to reductions in emissions of SO_2, direct $PM_{2.5}$, as well as other precursors to $PM_{2.5}$ and ozone. In the 2011 RIA, the EPA did not quantify the benefits associated with ozone reductions resulting from the emissions controls under MATS, but we did include estimates of the projected benefits associated with reductions in $PM_{2.5}$. These benefits were quite substantial and had a large economic value. Newer scientific studies strengthen our understanding of the link between $PM_{2.5}$ exposure to a variety of health problems, including: premature death, lung cancer, non-fatal heart attacks, new onset asthma, irregular heartbeat, aggravated asthma, decreased lung function, and respiratory symptoms, such as irritation of the airways, coughing or difficulty breathing. Furthermore, since the RIA was completed in 2011, the EPA has updated its conclusions about how $PM_{2.5}$ emissions can adversely affect the environment through acidic deposition, materials damage, visibility impairment, and exacerbating climate change (EPA, 2019).[120] In its most recent review of the effects of ozone pollution, the EPA concluded that ozone is associated with a separate but similarly significant set of adverse outcomes including respiratory-related premature death, increased frequency of asthma attacks, aggravated lung disease, and damage to vegetation (EPA, 2020).[121]

BCAs are a useful tool to ''estimate the *total* costs and benefits to society of an activity or program,'' and ''can be thought of as an accounting framework of the overall social welfare of a program.'' EPA Economic Guidelines, Appendix A, A–6 (emphasis in

[119] We use the term ''formal benefit-cost analysis'' to refer to an economic analysis that attempts to quantify all significant consequences of an action in monetary terms in order to determine whether an action increases economic efficiency. Assuming that all consequences can be monetized, actions with positive net benefits (*i.e.,* benefits exceed costs) improve economic efficiency.

[120] U.S. EPA. *Integrated Science Assessment (ISA) for Particulate Matter* (Final Report, Dec 2019). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R–19/188, 2019.

[121] U.S. EPA. *Integrated Science Assessment (ISA) for Ozone and Related Photochemical Oxidants* (Final Report, Apr 2020). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R–20/012, 2020.

original).[122] In a BCA, ''[t]he favorable effects of a regulation are the benefits, and the foregone opportunities or losses in utility are the costs. Subtracting the total costs from the total monetized benefits provides an estimate of the regulation's net benefits to society.'' *Id.* Importantly, however, ''[t]he key to performing BCA lies in the ability to measure both benefits and costs in monetary terms so that they are comparable.'' *Id.; see also* OMB Circular A–4 (''A distinctive feature of BCA is that both benefits and costs are expressed as monetary units, which allows you to evaluate different regulatory options with a variety of attributes using a common measure.'').[123]

In the 2020 Final Action, the EPA rescinded the 2016 alternative approach on the basis that it was ''fundamentally flawed'' because it applied ''a formal cost-benefit analysis'' to the CAA section 112(n)(1)(A) determination. The Agency's objection at the time to the use of ''a formal cost-benefit analysis'' in the context of this determination was that doing so ''implied that an equal weight was given to the non-HAP co-benefit emission reductions and the HAP-specific benefits of the regulation.'' *See* 85 FR 31299 (May 22, 2020). The Agency concluded that it was not appropriate to use a formal BCA in this situation because ''to give equal weight to the monetized $PM_{2.5}$ co-benefits would permit those benefits to become the driver of the regulatory determination, which the EPA believes would not be appropriate.'' *Id.* The EPA reiterated in the 2020 Final Action that ''HAP benefits, as compared to costs, must be the primary question in making the 'appropriate and necessary' determination'' and ''the massive disparity between co-benefits and HAP benefits on this record would mean that that alternative approach clearly elevated co-benefits beyond their permissible role.'' *Id.* at 31303. ''To be valid, the EPA's analytical approach to [CAA section 112(n)(1)(A)] must recognize Congress' particular concern about risks associated with HAP and the benefits that would accrue from reducing those risks.'' *Id.* at 31301.

We agree that the analytical framework for the appropriate and necessary determination should first and foremost be one that is focused on ''Congress' particular concern about risks associated with HAP and the benefits that would accrue from reducing those risks.'' *Id.* It is for this reason, as discussed in section III.C of this preamble, that we propose to revoke the analytical framework advanced for the appropriate and necessary determination by the 2020 Final Action, as being insufficiently attentive to the public health advantages of regulation. However, if the decisional framework is going to be one that considers advantages to regulation primarily in terms of potential monetized outcomes (*see* 85 FR 31296–97; May 22, 2020), a formal BCA that estimates net outcomes (*i.e.,* by comparing total losses and gains) and conforms to established economic best practices and accounts for *all* of the effects of the rule that can be quantified should be used.[124]

Consistent with scientific principles underlying BCA, both OMB Circular A–4 and the EPA's Guidelines for Preparation of Economic Analyses direct the Agency to include all benefits in a BCA. Per Circular A–4, OMB instructs ''Your analysis should look beyond the direct benefits and direct costs of your rulemaking and consider any important ancillary benefits and countervailing risks. An ancillary benefit is a favorable impact of the rule that is typically unrelated or secondary to the statutory purpose of the rulemaking.'' Circular A–4 at 26. Similarly, the Guidelines state, ''An economic analysis of regulatory or policy options should present all identifiable costs and benefits that are incremental to the regulation or policy under consideration. These should include directly intended effects and associated costs, as well as ancillary (or co-) benefits and costs.'' Guidelines at 11–2. As discussed in prior MATS rulemakings (*see, e.g.,* 80 FR 75041; December 1, 2015), installing control technologies and implementing the compliance strategies necessary to reduce the HAP emissions directly regulated by the MATS rule also results in reductions in the emissions of other pollutants such as directly emitted $PM_{2.5}$ and SO_2 (a $PM_{2.5}$ precursor). A particularly cost-effective control of emissions of particulate-bound mercury and non-mercury metal HAP is through the use of PM control devices that indiscriminately collect PM along with the metal HAP, which are predominately present as particles. Similarly, emissions of the acid gas HAP are reduced by acid gas controls that are also effective at reducing emissions of SO_2 (also an acid gas, but not a HAP). *Id.* While these $PM_{2.5}$ and SO_2 emission reductions are not the objective of the MATS rule, the reductions are, in fact, a direct consequence of regulating the HAP emissions from EGUs. Specifically, controls on direct $PM_{2.5}$ emissions are required to reduce non-mercury metal HAP, while SO_2 emissions reductions come from controls needed to reduce acid gas emissions from power plants.

However, we recognize that there are significant reasons to question whether a formal BCA is the best way to interpret the Agency's mandate in CAA section 112(n)(1)(A), and we take comment on whether the Agency should continue to rely on this alternative basis for making its determination. We have consistently taken the position that a formal BCA is not required under CAA section 112(n)(1)(A). *See* 80 FR 75039 (December 1, 2015). As set forth above, in *Michigan,* the Supreme Court declined to hold that CAA section 112(n)(1)(A) required such an assessment, stating, ''We need not and do not hold that the law unambiguously required the Agency, when making this preliminary estimate, to conduct a formal cost-benefit analysis in which each advantage and disadvantage is assigned a monetary value.'' *Michigan,* 576 U.S. at 759. However, the Court did note that ''[c]onsideration of cost reflects the understanding that reasonable regulation ordinarily requires paying attention to the advantages *and* disadvantages of agency decisions.'' *Id.* at 2707. Moreover, in finding the EPA's decision not to

[122] U.S. EPA. 2014. *Guidelines for Preparing Economic Analyses.* EPA–240–R–10–001. National Center for Environmental Economics, Office of Policy. Washington, DC. December. Available at *https://www.epa.gov/environmental-economics/guidelines-preparing-economic-analyses,* accessed July 23, 2021. Docket ID Item No. EPA–HQ–OAR–2009–0234–20503.

[123] U.S. OMB. 2003. *Circular A–4 Guidance to Federal Agencies on Preparation of Regulatory Analysis.* Available at *https://www.whitehouse.gov/sites/whitehouse.gov/files/omb/circulars/A4/a-4.pdf,* accessed July 23, 2021.

[124] In addition, CAA section 112(n)(1)(A) directs the EPA to evaluate the hazards to public health from EGU HAP emissions that a reasonably anticipated ''after imposition of the other requirements of the [CAA].'' The direction to consider the impacts of non-CAA section 112 requirements on HAP emissions from EGUs demonstrates that Congress understood that criteria pollutant controls would achieve HAP reductions. Given this understanding, it is reasonable for the EPA to consider the consequent criteria pollutant reductions attributable to CAA section 112 standards if a BCA is used to evaluate cost in the context of the appropriate finding. Furthermore, CAA section 112 legislative history not specifically directed at EGUs also supports the consideration of criteria pollutant benefits attributable to the regulation of HAP emissions. Specifically, the Senate report for the 1990 CAA amendments states: ''When establishing technology-based [MACT] standards under this subsection, the Administrator may consider the benefits which result from control of air pollutants that are not listed but the emissions of which are, nevertheless, reduced by control technologies or practices necessary to meet the prescribed limitation.'' A Legislative History of the Clean Air Act Amendments of 1990 (CAA Legislative History), Vol. 5, pp. 8512 (CAA Amendments of 1989; p. 172; Report of the Committee on Environment and Public Works S. 1630).

consider cost irrational, the Court suggested that unintended disadvantages of a regulation could be considered costs as well, implying that such disadvantages should be accounted for. *Id.* at 2707 (''The Government concedes that if the Agency were to find that emissions from power plants do damage to human health, but that the technologies needed to eliminate these emissions do even more damage to human health, it would still deem regulation appropriate. No regulation is 'appropriate' if it does significantly more harm than good.'').

In the 2015 Proposal, we identified several policy reasons for preferring to apply a totality-of-the-circumstances approach to weighing costs and benefits over using a formal BCA as our decisional framework under CAA section 112(n)(1)(A). *See* 80 FR 75025 (December 1, 2015). We recognized that benefits like those associated with reduction of HAP can be difficult to monetize, and this incomplete quantitative characterization of the positive consequences can underestimate the monetary value of net benefits. *See* 80 FR 75039 (December 1, 2015). This is well-established in the economic literature. As noted in OMB Circular A–4, ''[w]here all benefits and costs can be expressed as monetary units, BCA provides decision makers with a clear indication of the most efficient alternative.'' Circular A–4 at 2. However, ''[w]hen important benefits and costs cannot be expressed in monetary units, BCA is less useful, and it can even be misleading, because the calculation of net benefits in such cases does not provide a full evaluation of all relevant benefits and costs.'' Circular A–4 at 10. The EPA's Guidelines for Preparation of Economic Analyses also recognizes the limitations of BCA, noting that ''[m]ost important, [BCA] requires assigning monetized values to non-market benefits and costs. In practice it can be very difficult or even impossible to quantify gains and losses in monetary terms (*e.g.,* the loss of a species, intangible effects).'' Guidelines, Appendix A at A–7.

We also pointed out in the 2015 Proposal that national level BCAs may not account for important distributional effects, such as impacts to the most exposed and most sensitive individuals in a population. *See* 80 FR 75040 (December 1, 2015). These distributional effects and equity considerations are often considered outside of (or supplementary to) analyses like BCAs that evaluate whether actions improve economic efficiency (*i.e.,* increase net benefits). For example, children near a facility emitting substantial amounts of lead are at significantly greater risk of neurocognitive effects (including lost IQ) and other adverse health effects. One perspective on the costs and benefits of controlling lead pollution would be to aggregate those costs and benefits across society, as in a BCA net benefits calculation. However, neither costs nor benefits are spread uniformly across society and failing to take account of that can overlook significant health risks for sensitive subpopulations, such as children exposed to lead pollution. Similarly, in the context of this determination, where we have found disproportionate risk for certain highly exposed or sensitive populations, such considerations are also particularly relevant. *See* section II.B; section III.A.

We note too that OMB Circular A–4 highlights the special challenges associated with the valuation of health outcomes for children and infants, because it is ''rarely feasible to measure a child's willingness to pay for health improvement'' and market valuations such as increased ''wage premiums demanded by workers to accept hazardous jobs are not readily transferred to rules that accomplish health gains for children.'' Circular A–4 at 31. We take comment on whether a BCA, on its own, is an appropriate tool to make a determination of whether to regulate under CAA section 112(n)(1)(A), given that it may not meaningfully capture all the societal interests the statute intends the EPA to consider. *See* Guidelines, Appendix A at A–7 (''In some cases a policy may be considered desirable even if the benefits do not outweigh the costs, particularly if there are ethical or equity concerns.'').

With those caveats, we propose to reaffirm using a BCA approach, based on the 2011 RIA performed as part of the original MATS rulemaking, as another way to make the CAA section 112(n)(1)(A) determination of whether it is appropriate to regulate HAP emissions from EGUs.

Applying the alternative approach, based on the 2011 RIA, we propose to find that it is appropriate to regulate EGUs for HAP under CAA section 112(n)(1)(A). In the 2011 RIA, the total benefits of MATS were estimated to vastly exceed the total costs of the regulation. As we found when applying the 2016 alternative approach, the formal BCA that the EPA performed for the 2012 MATS Final Rule estimated that the final MATS rule would yield annual monetized total benefits (in 2007 dollars) of between $37 billion to $90 billion using a 3-percent discount rate and between $33 billion to $81 billion using a 7-percent discount rate; this compares to projected annual compliance costs of $9.6 billion. This estimate of benefits was limited to those health outcomes the EPA was able to monetize. Despite the fact that these estimates captured only a portion of the benefits of the rule, excluding many important HAP and criteria pollutant-related endpoints which the Agency was unable to monetize (*see* section III.A.4) and instead discussed qualitatively in the 2011 RIA, it was clear that MATS was projected to generate overwhelmingly net positive effects on society. We continue to think that the BCA approach independently supports the conclusion that regulation of HAP emissions from EGUs is appropriate.

Although as discussed in section III.B.2 it was not possible for the EPA to update the entire comprehensive cost estimate found in the 2011 RIA, we think the new information presented in sections III.A and III.B directionally supports the net benefits calculation of the 2016 alternative approach. That is, we have attempted to quantify additional risks, including risks of premature death from heart attacks that result from exposure to methylmercury associated with domestic EGU emissions, and we believe the 2011 RIA's projected cost was almost certainly significantly overestimated. Therefore, we propose that if BCA is a reasonable tool to use in the context of the EPA's determination under CAA section 112(n)(1)(A), newer data collected since 2011 overwhelmingly support an affirmative determination. Further, that both analytical approaches to addressing the inquiry posed by *Michigan* lead to the same result reinforces the reasonableness of the EPA's ultimate decision that it is appropriate and necessary to regulate HAP emissions from EGUs after considering cost.

In this proposal, the EPA has re-examined the extensive record, amassed over 2 decades, identifying the advantages of regulating HAP from EGUs and evaluating the costs of doing so. We have, for purposes of this proposal, also updated information on both benefits and costs. Of note, we find that new scientific literature indicates that methylmercury exposure from EGUs, absent regulation, poses cardiovascular and neurodevelopmental risks to all Americans and particularly those most exposed to this pollution. With respect to costs, we explain the combination of factors that occurred since the promulgation of MATS that leads us to believe that the projected, sector-level $9.6 billion estimate of the cost of compliance of the rule in 2015 was almost certainly significantly overestimated. We propose two different approaches to considering all of this information, applying first a totality-of-the-circumstances methodology weighing of benefits and costs and focusing particularly on those factors that we were instructed by the statute to study under CAA section 112(n)(1), and next using a formal benefit-cost approach consistent with established guidance and economic principles. Under either approach, whether looking at only the information available at the time of our initial decision to regulate or at all currently available information, we propose to conclude that it remains appropriate and necessary to regulate EGUs for HAP. Substantial emission reductions have occurred after implementation of MATS, the emission limits established pursuant to the Agency's 2012 affirmative appropriate and necessary determination, and these limits provide the only Federal guarantee of these emission reductions from EGUs, which, absent regulation, were the largest domestic anthropogenic source of a number of HAP. Finalizing this affirmative threshold determination would provide important certainty about the future of MATS for regulated industry, states, other stakeholders, and the American public. We take comment on the information relied upon in this proposal and the EPA's proposed approaches to considering that information for this determination.

IV. Summary of Cost, Environmental, and Economic Impacts

The EPA estimates that there are 557 existing EGUs located at 265 facilities that are subject to the MATS rule. Because the EPA is not proposing any amendments to the MATS rule, there would not be any cost, environmental, or economic impacts as a result of the proposed action.

V. Request for Comments and for Information To Assist With Review of the 2020 RTR

On January 20, 2021, President Biden signed Executive Order 13990, ''Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis'' (86 FR 7037; January 25, 2021). That order, among other things, instructs the EPA to consider publishing a proposed rule suspending, revising, or rescinding the May 22, 2020 final action, ''National Emission Standards for Hazardous Air Pollutants: Coal- and Oil-Fired Electric Utility Steam Generating Units—Reconsideration of Supplemental Finding and Residual Risk and Technology Review.'' The 2020 Final Action contained two distinct, but related, final actions—(1) a reconsideration of the 2016 Supplemental Finding and (2) the RTR. This notice fulfills the Agency's obligation to address the first action. We solicit comments on all aspects of this proposed action.

Separate from this proposal, the EPA has initiated a review of the RTR, taking into account the latest information available on the experience of EGUs in complying with MATS and implementing measures to reduce HAP emissions. As previously noted, since MATS was promulgated in 2012, power sector emissions of mercury, acid gas HAP, and non-mercury metal HAP have decreased by about 86 percent, 96 percent, and 81 percent, respectively, as compared to 2010 emissions levels (Table 4 at 84 FR 2689, February 7, 2019). While EGUs remain the largest domestic emitter of mercury (and other HAP), their emissions and contribution to total mercury in the environment is significantly less now than before MATS implementation. The EPA is seeking input into how both of these facts should factor into its review of the RTR.

In this notice, the EPA is soliciting information to allow for a more thorough review of the 2020 MATS RTR. The EPA is soliciting broadly for any data or information—including risk-related information—that will assist in the review of the RTR. The EPA is also soliciting specifically for any information on performance or cost of new or additional control technologies, improved methods of operation, or other practices and technologies that may result in cost-effective reductions of HAP emissions from coal- or oil-fired EGUs. In addition, the EPA is interested in receiving information on improvements or upgrades to existing controls that may result in cost-effective reductions of HAP emissions from coal- or oil-fired EGUs. The EPA also seeks information on the cost or performance of technologies and practices relating to monitoring of HAP emissions, and control of HAP emissions during startup and shutdown events, that could result in cost-effective reductions in HAP or assure improved operation of existing controls. We are seeking input from all interested stakeholders, including states, owners of EGUs, technology vendors and developers, and communities impacted by the emissions from EGUs.

VI. Statutory and Executive Order Reviews

Additional information about these statutes and Executive Orders can be found at *https://www.epa.gov/laws-regulations/laws-and-executive-orders.*

A. Executive Order 12866: Regulatory Planning and Review and Executive Order 13563: Improving Regulation and Regulatory Review

This action is a significant regulatory action that was submitted to OMB for review under Executive Order 12866. Any changes made in response to OMB recommendations have been documented in the docket. The EPA does not project any incremental costs or benefits associated with this action because it does not impose standards or other requirements on affected sources.

B. Paperwork Reduction Act (PRA)

This action does not impose any new information collection burden under the PRA. OMB has previously approved the information collection activities contained in the existing regulations and has assigned OMB control number 2060–0567. This action does not impose an information collection burden because the EPA is not proposing any changes to the information collection requirements.

C. Regulatory Flexibility Act (RFA)

I certify that this action will not have a significant economic impact on a substantial number of small entities under the RFA. This action will not impose any requirements on small entities. The EPA does not project any incremental costs or benefits associated with this action because it does not impose standards or other requirements on affected sources.

D. Unfunded Mandates Reform Act (UMRA)

This action does not contain an unfunded mandate of $100 million or more as described in UMRA, 2 U.S.C. 1531–1538, and does not significantly or uniquely affect small governments. The action imposes no enforceable duty on any state, local, or tribal governments or the private sector.

E. Executive Order 13132: Federalism

This action does not have federalism implications. It will not have substantial direct effects on the states, on the relationship between the national government and the states, or on the distribution of power and responsibilities among the various levels of government.

F. Executive Order 13175: Consultation and Coordination With Indian Tribal Governments

This action does not have tribal implications as specified in Executive

Order 13175. The executive order defines tribal implications as ''actions that have substantial direct effects on one or more Indian tribes, on the relationship between the Federal Government and Indian tribes, or on the distribution of power and responsibilities between the Federal Government and Indian tribes.'' Revocation of the 2020 determination that it is not appropriate and necessary to regulate HAP emissions from coal- and oil-fired EGUs under CAA section 112 and reaffirmation of the 2016 Supplemental Finding that it remains appropriate and necessary to regulate HAP emissions from EGUs after considering cost would not have a substantial direct effect on one or more tribes, change the relationship between the Federal Government and tribes, or affect the distribution of power and responsibilities between the Federal Government and Indian tribes. Thus, Executive Order 13175 does not apply to this action.

G. Executive Order 13045: Protection of Children From Environmental Health Risks and Safety Risks

This action is not subject to Executive Order 13045 because it is not economically significant as defined in Executive Order 12866, and because this action does not impose new regulatory requirements that might present a disproportionate risk to children. This action reaffirms the 2016 Supplemental Finding that it is appropriate and necessary to regulate HAP emissions from U.S. EGUs, but does not impose control requirements, which were implemented through MATS (77 FR 9304; February 16, 2012). While this action does not impose or change any standards or other requirements, it addresses the underpinning for the HAP emission standards in MATS. The EPA believes the reductions in HAP emissions achieved under MATS have provided and will continue to provide significant benefits to children in the form of improved neurodevelopment and respiratory health and reduced risk of adverse outcomes. Analyses supporting the 2012 MATS Final Rule estimated substantial health improvements for children in 2016 in the form of 130,000 fewer asthma attacks, 3,100 fewer emergency room visits due to asthma, 6,300 fewer cases of acute bronchitis, and approximately 140,000 fewer cases of upper and lower respiratory illness. *See* 77 FR 9441 (February 16, 2012). Reaffirming the appropriate and necessary determination assures those benefits will continue to accrue among children.

H. Executive Order 13211: Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use

This action is not a ''significant energy action'' because it is not likely to have a significant adverse effect on the supply, distribution, or use of energy. This action is not anticipated to have impacts on emissions, costs, or energy supply decisions for the affected electric utility industry as it does not impose standards or other requirements on affected sources.

I. National Technology Transfer and Advancement Act (NTTAA)

This action does not involve technical standards.

J. Executive Order 12898: Federal Actions To Address Environmental Justice in Minority Populations and Low-Income Populations

The EPA believes that this action will not have disproportionately high and adverse human health or environmental effects on minority populations, low-income populations, and/or indigenous peoples, as specified in Executive Order 12898 (59 FR 7629; February 16, 1994), because it does not impose standards or other requirements on affected sources and is limited in scope to only consider whether it is appropriate and necessary to regulate HAP emissions from coal- and oil-fired EGUs. While this action does not impose or modify any standards or other requirements, it provides the underpinning for the emission standards regulating HAP from EGUs. As documented in both the NAS Study and Mercury Study, fish and seafood consumption is the primary route of human exposure to methylmercury originating from U.S. EGUs, with populations engaged in subsistence-levels of consumption being of particular concern. As shown in section III.A.5 of this preamble, certain minority, low-income, and indigenous populations are more likely to experience elevated exposures, thus higher health risks relative of the general population due to subsistence fishing. Furthermore, subpopulations with the higher exposure tend to overlap with those subpopulations that are particularly vulnerability to small changes in health risk because of other social determinants of health (*e.g.,* lack of access to health care and access to strong schooling), thereby compounding the implications of the implications of mercury exposure. Reaffirming the appropriate and necessary determination assures that the reduction in risks achieved by MATS continue.

Michael S. Regan,

Administrator.

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