conclude this proposal would only result in 500MW coal capacity retirement.[7] At the very least EPA should have modeled an alternative scenario incorporating less presumptive assumptions regarding unit retirements and considered that alternative scenario in the RIA and when determining the costs associated with the proposal assume unit retrofits to comply with the proposal.

In addition, EPA did not consider the reliability impacts of the proposal's required emission control upgrades and additions to units. It is likely that many units that would have to incur millions of dollars to retrofit emissions controls to comply with this proposal would not do so. We encourage EPA to be concerned with grid reliability and consider the impacts of this proposal on it using reasonable retrofit costs as detailed in Section 5 of the Cichanowicz Report.

[7] Regulatory Impact Analysis at Section 5.3.3 page 5-13

Technical Comments on National Emission Standards for Hazardous Air Pollutants: Coal- and Oil-fired Electric Utility Steam Generating Units Review of Residual Risk and Technology

Prepared by

J. Edward Cichanowicz
Consultant
Saratoga, CA

James Marchetti
Consultant
Washington, DC

Michael C. Hein
Hein Analytics, LLC
Whitefish, MT

Prepared for the

National Rural Electric Cooperative Association
American Public Power Association
America's Power
Midwest Ozone Group
NAACO
National Mining Association
Power Generators Air Coalition

June 19, 2023

8. EPA IPM RESULTS: EVALUATION AND CRITIQUE

EPA used the Integrated Planning Model (IPM) to establish a Baseline Scenario from which to measure compliance impacts of the proposed rule. This Baseline Scenario is premised upon IPM's Post-IRA 2022 Reference Case. In this Post-IRA simulation, IPM evaluated a number of tax credit provisions of the Inflation Reduction Act of 2022 (IRA), which address application of Carbon Capture and Storage (CCS) and other means to mitigate carbon dioxide (CO_2). These are the (i) New Clean Electricity Production Tax Credit (45Y); (ii) New Clean Electricity Investment Credit (48E); Manufacturing Production Credit (45X); CCS Credit (45Q); Nuclear Production Credit (45U); and Production of Clean Hydrogen (45V). Also, the Post-IRA 2022 Reference Case includes compliance with the proposed Good Neighbor Policy (Transport Rule).[47]

A critique of EPA's methodology and findings is described subsequently.

8.1 IPM 2030 Post-IRA 2022 Reference Case: A Flawed Baseline

The IPM Post-IRA 2022 Reference Case for the years 2028 and 2030 comprises a flawed baseline to measure compliance impacts of the proposed rule. This flawed baseline centers around IPM projected coal retirements in both 2028 and 2030 as well as units projected to deploy CCS in 2030. Specifically, IPM has erroneously retired numerous coal units expected to operate beyond 2028 and 2030 based upon current announced retirement plans; consequently, these units are subject to the proposed rule beginning in 2028. There are numerous challenges and limitations to deploying CCS as EPA has projected on 27 coal units in 2030. These units would also be subject to the proposed. Consequently, IPM's compliance impacts of the proposed rule is likely understated.

8.1.1 Analytical Approach

This analysis identifies those units IPM modeled as coal retirements, CCS retrofits and coal to gas (C2G) conversions in both 2028 and 2030, and compares them to announced plans for unit retirements, technology retrofits and C2G conversions. To identify errors for 2028, the parsed file for the 2028 Post-IRA 2022 Reference Case was used. Since EPA did not provide a parsed

[47] In addition to the IRA and GNP, the Post-IRA 2022 Reference Case takes into account compliance with the following: (i) Revised Cross-State Air Pollution Rule (CSAPR) Update Rule; (ii) Standards of Performance for Greenhouse Gas Emissions from New, Modified and Reconstructed Stationary Sources: Electric Utility Generating Units; (iii) MATS Rule which was finalized in 2011; (iv) Various current and existing state regulations; (v) Current and existing RPS and Current Energy Standards; (vi) Regional Haze Regulations and Guidelines for Best Available Retrofit Technology (BART); and, (vii) Platform reflects California AB 32 and RGGI. Three non-air federal rules affecting EGUs: (i) Cooling Water Intakes (316(b) Rule; (ii) Coal Combustion Residuals (CCR), which reflects EPA's July 29, 2020 position on retrofitting or closure of surface impoundments; and, (iii) Effluent Limitation Guidelines, which includes the 2020 Steam Electric Reconsideration Rule (cost adders were applied starting in 2025).

file of the 2030 Post-IRA 2022 Reference Case, an abbreviated parsed file was created using four different IPM files. These are: (i) 2028 parsed file of the Post-IRA 2022 Reference Case; (ii) Post-IRA 2022 Reference Case RPE File for the year 2030; (iii) Post-IRA 2022 Reference Case RPT Capacity Retrofits File for the year 2030; and, (iv) National Electrical Energy Data System (NEEDS) file for the Post-IRA 2022 Reference Case. These parsed files allow identifying IPM modeled retirements in 2028 and 2030, CCS retrofits in 2030 and C2G in both 2028 and 2030. These modeled retirements and conversions were compared to announced information in the James Marchetti Inc ZEEMS Data Base.

8.1.2 Coal Retirements

The 2028 IPM modeling run retired 112 coal units (53.6 GW) from 2023 to 2028. In the 2030 analysis, IPM retired an additional 52 coal units (25.5 GW). The total number of retirements for the two modeling run years is 164 coal units (79.1 GW).

Table 8-1 summarizes the IPM retirement errors in the 2028 and 2030 modeling runs. Specifically, IPM incorrectly retired 29 coal units (14.0 GW) by 2028 and an additional 23 coal units (14.1 GW) in 2030. In addition, there are 3 coal units (1.6 GW) that EPA listed in the NEEDS file as being retired before 2028 that will operate beyond 2030. In total, there are 55 coal units that IPM erroneously retired in the 2028 and 2030 modeling runs that will be operating and subject to some aspect of the proposed rule beginning in 2028.

Table 8-1. Coal Retirement Errors

Year	Description	Number
2028	Retiring after 2028	29
2030	Retiring after 2030	23
2030	NEEDS retirements that should be in the 2030 modeling platform	3
Total		55

Tables 8-2 to 8-6 lists each of the coal units IPM has incorrectly retired, incorrectly deployed CCS, or switched to natural gas.

Table 8-2. IPM Coal Retirement Errors: 2028 Post-IRA 2022 Reference Case Run

No.	RegionName	StateName	ORISCode	UnitID	PlantName	Capacity	Observation
1	WECC_Arizona	Arizona	6177	U1B	Coronado	380	To be retired by 2032 and continued seasonal curtailemts,
2	SPP West	Arkansas	6138	1	Flint Creek	528	Retire January 1, 2039 - Entergy LL 2023 IRP (March 31, 2023).
3	MISO_Arkansas	Arkansas	6641	1	Independence	809	Agreement with Sierra Club and NPCA to cease coal by Dec 31, 2030.
4	MISO_Arkansas	Arkansas	6641	2	Independence	842	Agreement with Sierra Club and NPCA to cease coal by Dec 31, 2030.
5	SERC_Central_TVA	Kentucky	1379	2	Shawnee	134	TVA planning assumption retirement (5/21) - December 31, 2033
6	SERC_Central_TVA	Kentucky	1379	3	Shawnee	134	TVA planning assumption retirement (5/21) - December 31, 2033
7	SERC_Central_TVA	Kentucky	1379	5	Shawnee	134	TVA planning assumption retirement (5/21) - December 31, 2033
8	SERC_Central_TVA	Kentucky	1379	6	Shawnee	134	TVA planning assumption retirement (5/21) - December 31, 2033
9	SERC_Central_TVA	Kentucky	1379	7	Shawnee	134	TVA planning assumption retirement (5/21) - December 31, 2033
10	SERC_Central_TVA	Kentucky	1379	8	Shawnee	134	TVA planning assumption retirement (5/21) - December 31, 2033
11	SERC_Central_TVA	Kentucky	1379	9	Shawnee	134	TVA planning assumption retirement (5/21) - December 31, 2033
12	MISO_Minn/Wisconsin	Minnesota	6090	3	Sherburne County	876	PSC approved closure (2/8/22). Upper Midwest Resource Plan (6/25/21) for 2030.
13	MISO_Missouri	Missouri	2103	1	Labadie	593	2022 IRP Update retire in 2042 (6/24/22).
14	MISO_Missouri	Missouri	2103	2	Labadie	593	2022 IRP Update retire in 2042 (6/24/22).
15	MISO_Missouri	Missouri	2103	3	Labadie	593	2022 IRP Update (6/24/22) retirement in 2036
16	MISO_Missouri	Missouri	2103	4	Labadie	593	2022 IRP Update (6/24/22) retirement in 2036
17	MISO_Missouri	Missouri	2107	1	Sioux	487	2022 IRP Update (6/24/22) - To be retired in 2030
18	MISO_Missouri	Missouri	2107	2	Sioux	487	2022 IRP Update (6/24/22) - To be retired in 2030
19	SERC_VACAR	North Carolina	2712	3A.3B	Roxboro	694	2022 Carbon Reduction Plan per PSC retirement Jan. 1, 2028-34 (12/30/22).
20	SERC_VACAR	North Carolina	2712	4A, 4B	Roxboro	698	2023 Carbon Reduction Plan per PSC retirement Jan. 1, 2028-34 (12/30/22).
21	ERCOT_Rest	Texas	298	LIM1	Limestone	831	EIA 860 has retirement December 2029
22	ERCOT_Rest	Texas	298	LIM2	Limestone	858	EIA 860 has retirement December 2029
23	WECC_Utah	Utah	7790	1-1	Bonanza	458	Unit is planned to retire in 2030,
24	WECC_Utah	Utah	8069	2	Huntington	450	Retire in 2032 - 2023 IRP (3/31/23)
25	PJM_Dominion	Virginia	7213	1	Clover	440	Dominion 2023 IRP - Retirement Date 2040 (5/1/23)
26	PJM_Dominion	Virginia	7213	2	Clover	437	Dominion 2023 IRP - Retirement Date 2040 (5/1/23)
27	PJM_AP	West Virginia	3943	1	Fort Martin	552	EPA Settlement on wastewater upgrades (8/9/22). 2020 IRP through 2035
28	PJM_AP	West Virginia	3943	2	Fort Martin	546	EPA Settlement on wastewater upgrades (8/9/22). 2020 IRP through 2036
29	WECC_Wyoming	Wyoming	6101	BW91	Wyodak	332	Retire in 2039 - IRP (3/31/23)

Table 8-3. IPM Coal Retirement Errors: 2030 Post IRA 2022 Reference Case Modeling Run

No.	RegionName	StateName	ORISCode	UnitID	PlantName	Capacity	Observations
1	WECC_Arizona	Arizona	6177	U2B	Coronado	382	To be retired by 2032 and contined seasonal curtailments
2	FRCC	Florida	628	4	Crystal River	712	To be retired in 2034 (2020 Sustainability Report)
3	FRCC	Florida	628	5	Crystal River	710	To be retired in 2034 (2020 Sustainability Report)
4	SERC_Southeastern	Georgia	6257	1	Scherer	860	ELG Compliance - Wastewater Treatment - No Announced Retirement
5	SERC_Southeastern	Georgia	6257	2	Scherer	860	ELG Compliance - Wastewater Treatment - No Announced Retirement
6	PJM West	Indiana	1040	1	Whitewater Valley	35	Biased to peak load duty. 2020 IRP Base Case has retirement May 31, 2034
7	MISO_Iowa	Iowa	1167	9	Muscatine Plant #1	163	ELG compliance options for FGDW and BATW, possible 2028 retirement
8	SPP North	Kansas	6068	1	Jeffrey Energy Center	728	To be retired at the end of 2039 (2021 IRP)
9	SPP North	Kansas	1241	2	La Cygne	662	To be retired at the end of 2039 (2021 IRP)
10	SERC_Central_Kentucky	Kentucky	1356	1	Ghent	474	To be retired 2034
11	SERC_Central_Kentucky	Kentucky	1356	3	Ghent	485	To be retired 2037.
12	SERC_Central_Kentucky	Kentucky	1356	4	Ghent	465	To be retired 2037.
13	SPP North	Missouri	6065	1	Iatan	700	To be retired at the end of 2039 (2021 IRP)
14	SPP North	Missouri	6195	1	John Twitty	184	Beyond 2030 retirement date - new 2022 IRP
15	SERC_VACAR	North Carolina	8042	1	Belews Creek	1110	1/1/2036 retirement per 2022 Carbon Reduction Plan
16	SERC_VACAR	North Carolina	8042	2	Belews Creek	1110	1/1/2036 retirement per 2022 Carbon Reduction Plan
17	SERC_VACAR	North Carolina	2727	3	Marshall (NC)	658	2022 Carbon Reduction Plan accepted by PSC retirement Jan. 1, 2033 (12/30/22)
18	SERC_VACAR	North Carolina	2727	4	Marshall (NC)	660	2022 Carbon Reduction Plan accepted by PSC retirement Jan. 1, 2033 (12/30/22)
19	MISO_MT, SD, ND	North Dakota	8222	B1	Coyote	429	Active perl reliablity concerns in MISO. End of depreciable life - 2041
20	SERC_VACAR	South Carolina	6249	1	Winyah	275	2023 IRP: operate unit through 2030 for reliability (4/19/23)
21	SERC_VACAR	South Carolina	6249	2	Winyah	285	2024 IRP: operate unit through 2030 for reliability (4/19/23)
22	SERC_VACAR	South Carolina	6249	3	Winyah	285	2025 IRP: operate unit through 2030 for reliability (4/19/23)
23	SERC_VACAR	South Carolina	6249	4	Winyah	285	2026 IRP: operate unit through 2030 for reliability (4/19/23)
24	PJM West	West Virginia	3935	1	John E Amos	800	Approved ELG upgrades to keep plant open until 2040.
25	PJM West	West Virginia	3935	2	John E Amos	800	Approved ELG upgrades to keep plant open until 2040.
26	PJM_AP	West Virginia	3954	1	Mt Storm	554	Dominion 2023 IRP - Retirement Date 2044 (5/1/23)
27	PJM_AP	West Virginia	3954	2	Mt Storm	555	Dominion 2023 IRP - Retirement Date 2044 (5/1/23)

Table 8-4 Units in the NEEDS to Be Operating in 2028

No.	Region Name	State Name	ORIS Plant	Unit ID	Plant Name	Capacity (MW)	NEEDS Retirement Year	Observations
1	SPP_N	Kansas	1241	1	La Cygne	736	2025	2022 IRP Update to be retired in 2032
2	MIS_LA	Louisiana	6190	3-1, 3-2	Brame Energy Center	626	2027	No plans to retire. Evaluating CCS
3	WECC_WY	Wyoming	4158	BW44	Dave Johnston	330	2027	Retire in 2039 - 2023 IRP (3/31/23).

631a

Table 8-5 Units IPM Predicts CCS By 2030

No.	Region Name	StateName	ORISCode	UnitID	PlantName	Capacity	Observations
1	ERCOT_Rest	Texas	6179	3	Fayette Power Project	286.05	
2	ERCOT_Rest	Texas	7097	BLR2	J K Spruce	537.93	Board voted to convert to natural gas by 2027 (1/23/23)
3	ERCOT_Rest	Texas	6180	1	Oak Grove (TX)	572.77	
4	ERCOT_Rest	Texas	6180	2	Oak Grove (TX)	570.97	
5	ERCOT_Rest	Texas	6183	SM-1	San Miguel	237.74	
6	FRCC	Florida	645	BB04	Big Bend	292.27	
7	MISO_Indiana	Indiana	6113	1	Gibson	594.24	
8	PJM West	Kentucky	6018	2	East Bend	399.00	
9	PJM West	West Virginia	3948	1	Mitchell (WV)	537.77	
10	PJM West	West Virginia	3948	2	Mitchell (WV)	537.77	
11	SERC_Southeastern	Alabama	6002	4	James H Miller Jr	477.05	
12	SPP_WAUE	North Dakota	6469	B1	Antelope Valley	289.22	
13	SPP_WAUE	North Dakota	6469	B2	Antelope Valley	288.38	
14	SPP_WAUE	North Dakota	2817	2	Leland Olds	279.16	
15	WECC_Arizona	Arizona	8223	3	Springerville	281.05	
16	WECC_Arizona	Arizona	8223	4	Springerville	281.05	
17	WECC_Colorado	Colorado	470	3	Comanche (CO)	501.15	To be retired Dec 31 2030 (10/31/22)
18	WECC_Colorado	Colorado	6021	C3	Craig (CO)	305.66	To be retired Dec 2029 - Electric Resource Plan (12/1/20)
19	WECC_Utah	Utah	6165	1	Hunter	319.80	Retire in 2031- 2023 IRP (3/31/23)
20	WECC_Utah	Utah	6165	2	Hunter	292.44	Retire in 2032 - 2023 IRP (3/31/23).
21	WECC_Utah	Utah	6165	3	Hunter	314.06	Retire in 2032 - 2023 IRP (3/31/23).
22	WECC_Utah	Utah	8069	1	Huntington	311.54	Retire in 2032 - 2023 IRP (3/31/23).
23	WECC_Wyoming	Wyoming	8066	BW73	Jim Bridger	354.02	Convert to natural gas in 2030 - 2023 IRP (3/31/23)
24	WECC_Wyoming	Wyoming	8066	BW74	Jim Bridger	349.78	Convert to natural gas in 2030 - 2023 IRP (3/31/23)
25	WECC_Wyoming	Wyoming	6204	1	Laramie River Station	385.22	
26	WECC_Wyoming	Wyoming	6204	2	Laramie River Station	382.92	
27	WECC_Wyoming	Wyoming	6204	3	Laramie River Station	383.45	

Table 8-6 Units IPM Erroneously Predicts Switch to Natural Gas

No.	RegionName	StateName	ORISCode	UnitID	PlantName	Year	Capacity	Observations
1	SPP West (Oklahoma	Arkansas	56564	1	John W Turk Jr Power Plant	2030	609	Retire Jan 1, 2068 - SWEPCO 2023 IRP (March 29, 2023)
2	PJM West	Kentucky	6041	2	H L Spurlock	2028	510	No announced C2G or co-firing
3	ERCOT_Rest	Texas	56611	S01	Sandy Creek Energy Station	2030	933	No announced conversion

8.1.3 Coal CCS

Table 8-5 identifies the 27 units IPM projected to retrofit CCS by 2030; none of these have been involved in any Front-End Engineering and Design (FEED) Studies. However, 9 of the units identified by IPM will be either be retired or converted to natural gas in and around 2030. There are major questions addressing infrastructure and project implementation that present challenges to IPM's CCS projection for 2030. Indeed, it is next to impossible for these units to be in position to retrofit CCS by 2030.

8.1.4 Coal to Gas Conversions (C2G)

The 2028 IPM modeling run converted 36 coal units to gas (14.3 GW). In the 2030 IPM modeling run an additional 2 coal units (1.5 GW) were converted to gas (Turk and Sandy Creek). As shown in Table 8.6, three of these units have no announced plans to convert to gas by 2028 or 2030 and will be subject to the proposed rule.

8.2 Summary

The major issues associated with EPA's IPM modeling of the 2028 and 2030 Post-IRA 2022 Reference Case are summarized as follows:

- The 2028 and 2030 Baseline (Post-IRA 2022 Reference Case) used to measure the compliance impacts of proposed rule is flawed and needs to be revised
- Most notably, IPM erred in retiring 55 coal units that will be subject to the proposed rule beginning in 2028.
- IPM retrofitted 27 units with CCS in 2030, 19 of which will be subject to the proposed rule. It is next to impossible for these units to retrofit CCS by 2030.
- The IPM modeled compliance impacts for the proposed rule in 2028 and 2030 is very likely understated.

RAINBOW ENERGY CENTER

2875 Third Street SW
Underwood, North Dakota 58576
701.207.9988
rainbowenergycenter.com

June 23, 2023

U.S. Environmental Protection Agency
Docket ID No. EPA–HQ–OAR–2018–0794
1200 Pennsylvania Avenue, NW
Washington, DC 20460

Submitted via docket

RE: REC Comments – *National Emission Standards for Hazardous Air Pollutants: Coal- and Oil-Fired Electric Utility Steam Generating Units Review of the Residual Risk and Technology Review*, 88 Fed. Reg. 24,854 (Apr. 24, 2023) ("Proposed Rule")

Rainbow Energy Center ("REC") appreciates the opportunity to submit comments on the Proposed Rule—particularly the need for alignment between the Proposed Rule and the proposed Section 111(d) Guidelines—and would welcome the opportunity to constructively engage with EPA as it considers comments on the proposal.

REC owns and operates Coal Creek Station, a lignite coal-fired power plant located approximately six miles south of the city of Underwood, North Dakota. Coal Creek is a base load facility capable of sending 1,151 MW per hour into the Midcontinent Independent System Operator ("MISO") system. In addition to being a significant source of power for residents and businesses in the region, Coal Creek is responsible for more than 600 jobs in North Dakota and is a valuable contributor to the local and regional economy, providing a $1.5 billion estimated annual impact to the state of North Dakota.

Coal Creek anticipates playing a crucial role in helping the state of North Dakota achieve its aggressive goal of being carbon neutral by 2030, and reducing the carbon intensity of power delivered in the MISO region. In addition to plans to install 400 MW of wind at Coal Creek, REC is actively working toward the installation of a full-scale post-combustion CO_2 capture system ("CCS") designed to capture 95% of CO_2 emissions at the facility. REC is collaborating with the Energy Environment and Research Center at the University of North Dakota, and the project has been recognized as a key contributor to the carbon reduction goals established by Governor Burgum.[1]

REC is a member of the Class of '85 Regulatory Response Group and the Lignite Energy Council, and supports the comments submitted by both Groups, but submits the following comments because it is concerned with the costly redundant controls that would be required by the Proposed Section 111(d) Guidelines and the Proposed Rule, as well as flaws in the legal and technical underpinnings of the proposal.

[1] N.D. Office of the Governor, *Burgum, Sanford laud historic transfer of Coal Creek Station, transmission line to Rainbow Energy, Nexus Line* (May 2, 2022), https://www.governor.nd.gov/news/burgum-sanford-laud-historic-transfer-coal-creek-station-transmission-line-rainbow-energy.

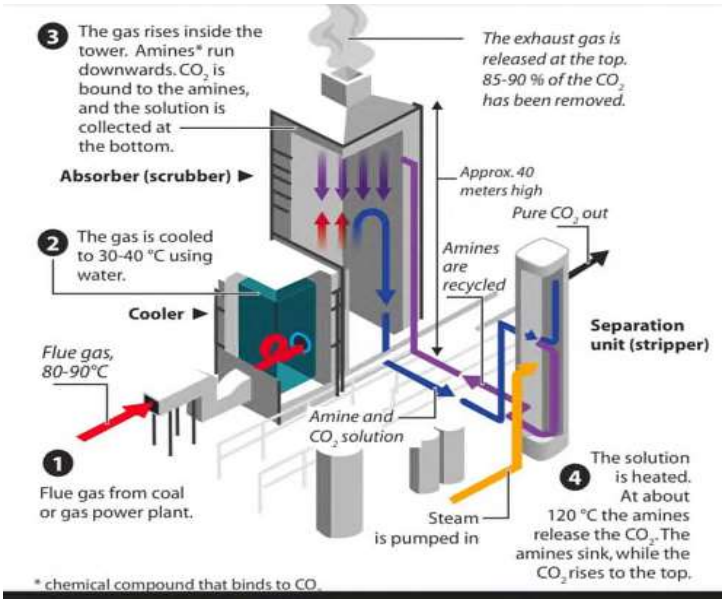
RAINBOW ENERGY CENTER

2875 Third Street SW
Underwood, North Dakota 58576
701.207.9988
rainbowenergycenter.com

2. Carbon Capture is a highly effective fPM control.

For more than two years, REC and its partners have worked with Mitsubishi Heavy Industries (MHI) on the design of a carbon capture island to be installed at Coal Creek. The carbon capture system requires the near total elimination of fPM emissions from the flue gas stream before it enters the island—otherwise, the system is exposed to amine-based solvent degradation.[7]

While not of Coal Creek, the diagram below illustrates the flow of flue gas through a carbon capture system and why removal of fPM is critical for effective operation of the system. When the flue gas enters "Step 2" at the Coal Creek Station CCS island, sulfur dioxide and fPM will be removed prior to entering "Step 3," where the flue gas is treated with amine solvent to absorb the carbon dioxide.



The highly effective fPM control of CCS is confirmed by EPA's own Proposed 111(d) technical support documents. The documents recognize that "flue gas from coal-fired facilities typically must be treated (e.g., must pass through a flue-gas desulfurization (FGD) scrubber and often a secondary polishing column prior to entering the absorption column)."[8] EPA further states that, because of the importance of removing fPM from the flue gas stream, in some instances an FGD column and a polishing column may also be necessary.

3. Nearly consecutive outages will strain system reliability at a critical point.

Eliminating duplicative control requirements between the Proposed Rule and the Proposed Section 111(d) Guidelines will help maintain system reliability. The confluence of three separate EPA regulatory programs in

[7] Energy & Environmental Research Center, "EERC Topical Report: Subtask 2.6 –Optimization of Aerosol Mitigation Technology for Postcombustion CO2 Capture; Cooperative Agreement No. DE-FE0024233 EERC Fund 24412" (Feb. 12, 2021).
[8] EPA, *Greenhouse Gas Mitigation Measures for Steam Generating Units Technical Support Document*, at 19, 43-44, available at: https://www.epa.gov/stationary-sources-air-pollution/greenhouse-gas-standards-and-guidelines-fossil-fuel-fired-power.

RAINBOW ENERGY CENTER

2875 Third Street SW
Underwood, North Dakota 58576
701.207.9988
rainbowenergycenter.com

the same five year compliance period—each requiring control installation (i.e., outages) or unit retirements—on both coal- and gas-fired units will strain system reliability, absent concerted effort by EPA.

EPA Regulation	Control Requirement	Timing
Cross State Air Pollution Rule	Requires emissions reductions commensurate with the installation of SCR at existing coal units and high-emitting gas units in 22 states, including numerous MISO states	By 2027
Proposed Rule	Potentially requires installation of fPM and mercury controls at existing coal-fired units	Est. 2027 or 2028
Proposed Section 111(d) Guidelines	Potentially requires installation of CCS controls or retirement of existing coal-fired units	Est. 2030

This clustering of extended temporary and permanent cessation of dispatchable resources exacerbates REC concerns as resource adequacy within the MISO system. "MISO is experiencing a trending decline in reserve margin and fewer always-on 'baseload' resources, which is largely the result of the retirement of significant amounts of dispatchable generation and the retirement of thermal units."[9] Traditional dispatchable generators like coal-fired units are being replaced by new, mostly intermittent facilities that are not valued at the same output, which presents significant risks to grid reliability.

Reducing unit downtime by consolidating control installation into a single outage aligns with EPA's recognition that "[a] reliable and resilient electric power system is indispensable to the national security and economic well-being of the United States."[10]

B. Existing Controls Provide An Ample Margin Of Safety And EPA Has Not Provided Sufficient Justification For The Proposed Rule.

As proposed, the Proposed Rule plainly exceeds EPA's authority under the Clean Air Act. EPA is authorized to update Section 112 standards "if needed to provide an ample margin of safety to protect public health" and "as necessary" to address technological developments.[11] Here, EPA's own analysis confirms that existing controls provide an ample margin of safety and that there are no new developments in hazardous air pollutants (HAP) emission controls—only that EPA now has more information about the cost and performance of *existing* technology.[12] Accordingly, REC asks EPA to reconsider proceeding with the final rule.

[9] Comments from the Midcontinent Independent System Operator, Inc. (MISO) Regarding the United States Environmental Protection Agency's Request for Comment re Docket ID Nos. EPA-HQ-OLEM-2021-0283, EPA-HQ-OLEM-2021-0282, EPA-HQ-OLEM-2021-0280, at 3 (Apr. 10, 2023) (attached hereto as Attachment A).
[10] EPA, DOE, Joint Memorandum on Interagency Communication and Consultation on Electric Reliability (Mar. 9, 2023), available at: https://www.epa.gov/power-sector/electric-reliability-mou.
[11] 88 Fed. Reg. at 24,859 (explaining CAA Section 112(f)(2) (called the residual risk review) and CAA Section 112(d)(6) (called the technology review)).
[12] 88 Fed. Reg. at 24,863, fn 15.

PGEN COMMENTS ON EPA'S PROPOSED RULE: NESHAP COAL- AND OIL- FIRED ELECTRIC UTILITY STEAM GENERATING UNITS REVIEW OF THE RESIDUAL RISK AND TECHNOLOGY REVIEW

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

The Power Generators Air Coalition ("PGen") appreciates the opportunity to submit these comments on the U.S. Environmental Protection Agency's ("EPA" or the "Agency") proposed rule entitled "National Emission Standards for Hazardous Air Pollutants: Coal- and Oil-Fired Electric Utility Steam Generating Units Review of the Residual Risk and Technology Review" ("Proposed Rule" or "Proposal").[1] The Proposed Rule proposes to amend the Mercury and Air Toxics Standards ("MATS") regulations.[2] Particularly, EPA proposes to amend the surrogate standard for non-mercury metal HAP—i.e., for filterable particulate matter (fPM)—for existing coal-fired EGUs; eliminate the individual non-Hg metal HAP standards; require the use of a Particulate Matter Continuous Emissions Monitoring System ("PM CEMS") for compliance for all units, thus eliminating the stack testing option; amend the mercury ("Hg") standard for lignite-fired EGUs; and eliminate one of two definitions of startup currently in the regulations. EPA proposes to keep the remaining standards unchanged.

PGen is an incorporated nonprofit 501(c)(6) organization whose members are diverse electric generating companies—public power, rural electric cooperatives, and investor-owned utilities—with a mix of solar, wind, hydroelectric, nuclear, and fossil generation. PGen is a collaborative effort of electric generators to share information and expertise in the interest of constructively evaluating and effectively managing air emissions to meet and exceed environmental laws and regulations and in the interest of informing sound regulation and public policy.[3] Our members include leaders in the ongoing transition to cleaner energy in the United States. PGen and its members work to ensure that environmental regulations support a clean, safe, reliable, and affordable electric system for the nation.

PGen members own and operate EGUs that are regulated under the MATS rule. Indeed, PGen members have committed substantial resources to meet and maintain compliance with MATS. Accordingly, PGen has a substantial interest in the Proposed Rule.

SUMMARY OF COMMENTS

Section I – The MATS Rule Significantly Reduced HAPs and Require No Further Revision.

- MATS has resulted in substantial decreases in HAP emissions from affected EGUs. These emissions are continuing their rapid and steady decline because of regulatory and economic pressure that are inexorably leading to additional shutdowns of coal-fired

[1] National Emission Standards for Hazardous Air Pollutants: Coal- and Oil-Fired Electric Utility Steam Generating Units Review of the Residual Risk and Technology Review, 88 Fed. Reg. 24,854 (proposed Apr. 24, 2023) (to be codified at 40 C.F.R. pr. 63).

[2] 40 C.F.R. Part 63, Subpart UUUUU.

[3] Additional information on PGen and its members can be found at PGen.org.

practices.[43] Remarkably, however, EPA did not lower the standard for formaldehyde, despite data demonstrating these developments would result in lower actual emissions, because EPA saw a continuing downward trend in formaldehyde emissions from that industry and concluded that revising the standard merely to accelerate that trend slightly for some sources was not necessary.[44]

In short, in each of the RTRs EPA cites, EPA in fact found developments in practices, processes, or control technologies that warranted revisions of the respective standards. Here, EPA found no new developments in practices, processes, and control technologies. EPA merely found that fPM actual emissions were generally lower than the current emission limits. Without identifying any "development" as required in section 112(d)(6), EPA is not authorized to lower the emission standard of fPM in MATS. Moreover, even if EPA has such authority, EPA should treat EGU affected facilities as it treated Wool Fiberglass Manufacturing facilities in that RTR. EPA is fully aware that other regulatory programs, legislation, and the economics of power generation are leading inexorably to substantial retirements of coal-fired EGUs in the next decade or so. The reductions in HAPS (as well as all pollutants) from these retirements will dwarf any reductions that the Proposed Rule would mandate. In these circumstances, it makes no sense for EPA to pile on yet another costly, unnecessary mandate.

III. EPA'S ANALYSIS OF NON-HG METAL HAP SURROGATE, fPM, EMISSIONS DATA IS DEEPLY FLAWED AND DOES NOT SUPPORT A REVISED fPM STANDARD OF 0.010 lb/MMBtu, MUCH LESS A STANDARD AS LOW AS 0.006 lb/MMBtu.

EPA's proposal to revise the fPM standard for coal-fired EGUs to 0.010 lb/MMBtu is based on an "analysis" that is so deeply flawed that finalizing it would be plainly arbitrary and capricious. EPA analysis suffers from the following flaws:

- EPA relied on a very small set of quarterly data (either CEMS or quarterly stack tests) to characterize the emissions rates that EGUs can meet readily, even though EPA has in its possession data for all EGUs subject to MATS for every quarter since at least the start of 2017.

- The selection criteria for the very few quarters EPA chose to consider are unexplained and arbitrary.

- EPA's extremely truncated data set is not–indeed, it cannot–be representative of the units' long-term performance, quarter after quarter. This truncated data set allowed EPA to turn a blind eye to the variability in emissions rates that EGUs experience.

- Of two out of at least 20 quarters of available data for each EGU, EPA selected the quarter exhibiting the least emission rate (arbitrarily, at least for PM CEMS units, on the last day of the quarter) as indicative of the emission rate the unit must be capable of

[43] 82 Fed. Reg. at 40,975.

[44] *Id*.

achieving consistently. EPA's "explanation" as to why it selected the lowest of these two quarters is supported by no evidence and is contradicted by real-world data.

- In identifying EGUs that would have to upgrade their controls to meet the proposed revised rate of 0.010 lb/MMBtu, EPA completely ignored the need for a compliance margin. If the standard were lowered to 0.010 lb/MMBtu, EGU owners would have to target 0.005 lb/MMBtu to, at most, 0.008 lb/MMBtu, to have an adequate compliance margin that ensures they would be able to meet the proposed standard.

- EPA underestimates the cost of the main type of control equipment upgrades that EPA predicts would be required to meet the proposed standard of 0.010 lb/MMBtu. EPA estimates an ESP rebuild would cost $75-$100/kW. The Industry Study looked at four real-world ESP rebuild projects. The costs of three out of the four projects exceed the high end of EPA's range, with two at almost twice that amount (i.e., about $200/kW). Based on the four real-world ESP rebuilds, the mean cost is $133/kW. As a result, the proposed revision of the fPM standard is even less cost-effective than EPA says.

- Control upgrade capital costs EPA assumes would be required to meet the 0.010 lb/MMBtu standard (at units EPA's analysis determined would require such upgrades) range, based on EPA's own $100/kW cost for ESP rebuilds, from $52 million to $148 million *per unit*. Such high costs, in the current highly uncertain regulatory and economic climate (no pun intended) for coal-fired EGUs, would almost certainly cause the owners of these units to shut them down prematurely (i.e., by the effective date of the proposed rule – likely mid-2027, if EPA adopts a three years compliance deadline). This would raise the Proposed Rule's cost even more and would make it substantially less cost-effective. The premature retirement of these units would also pose a significant threat to the reliability of the power grid.

- EPA's own estimated $/ton of fPM removed for the proposed fPM standard of 0.010 lb/MMBtu is about the same and, in the majority of cases, vastly exceed previous $/ton amounts that EPA had found to be *not* cost-effective. Similarly, EPA's 0.006 lb/MMBtu cost-effectiveness estimates far exceed past analogous $/ton estimates EPA found to be not cost-effective.

A. EPA's Conclusion are Based on a Truncated and Unrepresentative Set of Data, Even Though EPA has in its Possession Data for Every Quarter for Every Unit Since MATS Took Effect.

EPA's rationale for revising the MATS fPM standard hinges on an analysis replete with errors and unexplained and arbitrary selections. As an initial matter, it is a mystery why EPA excluded from its database (i.e., the inventory of EGUs it analyzed) units that "will shut or no longer burn coal/oil by December 31, 2028." Assuming EPA adopts a three-year compliance deadline for a revised standard, that deadline would likely be about mid-2027, which means units that will shut down by the end of 2028 would have to meet the revised standard for a year and half. If these units can readily meet the revised standard (and some units can), they will presumably continue to do so between mid-2027 and the end of 2028. But what are the units that currently do not meet

Rebecca McGrew, RPG
Director, Environmental and Regulatory Affairs

Telephone: 972-448-5470
Email: rebecca.mcgrew@nacco.com

June 23, 2023
U.S. Environmental Protection Agency
EPA Docket Center ID No. EPA-HQ-OAR-2018-0794
Mail Code 28221T
1200 Pennsylvania Avenue NEW
Washington, D.C.

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

Re: National Emission Standards for Hazardous Air Pollutants: Coal- and Oil-Fired Electric Utility Steam Generating Units Review of the Residual Risk and Technology Review; Notice of Proposed Rulemaking (88 Fed. Reg. 24854 (April 24, 2023)).

Dear Administrator Reagan,

The North American Coal Corporation ("NA Coal") submits these comments in response to the United States Environmental Protection Agency's ("EPA") proposed rule, National Emission Standards for Hazardous Air Pollutants: Coal- and Oil-Fired Electric Utility Steam Generating Units Review of the Residual Risk and Technology Review; Notice of Proposed Rulemaking (the "Proposed Rule").[1] NA Coal owns and/or operates surface coal mines in Mississippi and North Dakota that supply approximately 25 million tons per year of coal, on a long-term contractual basis, to lignite-fired electric generating units ("EGUs") in those states, as well as a lignite mine that provides lignite as feedstock for carbon activation operations in Louisiana. In addition to providing a reliable, onsite power fuel supply, NA Coal facilities have more than 1,500 highly paid personnel in the mining sector. NA Coal contributes to the communities in which it operates and is an industry leader in environmental responsibility.

The Proposed Rule in its current form will not survive legal challenge and would have the effect of degrading U.S. energy security. EPA has not adequately demonstrated that hazardous air pollutant ("HAP") emissions, including mercury ("Hg") emissions, from coal- and oil-fired EGUs, especially lignite-fired EGUs, pose an unacceptable risk under the applicable regulatory requirements. Rather, the Proposed Rule is the product of a deeply flawed and unlawful "appropriate and necessary" finding in EPA's National Emission Standards for Hazardous Air Pollutants: Coal- and Oil-Fired Electric Utility Steam Generating United Revocation of 2020

[1] 88 Fed. Reg. 24854 (April 24, 2023)

social cost of greenhouse gas metric.[57] Baseload power is a critical component of the utility grid and the grid must maintain a certain level of baseload power for stability purposes. Because the Proposed Rule incentivizes switching to less carbon intensive fuels – either coal to natural gas or fossil fired generation to nuclear – fuel switching is expected to occur as a result of the Proposed Rule. By weighing the benefits of a reduction in CO_2 emissions arising from projected EGU closures, EPA acknowledges that its Proposed Rule would command or force such fuel switching.

Such generation-shifting considerations are impermissible. EPA attempts to hide the fact that the rule promotes "generation shifting" by focusing on CO_2 reductions without acknowledging fundamental aspects of the United States utility grid. Indeed, this type of forced "generation shifting" has already been considered and rejected by the Supreme Court in *West Virginia v. EPA*, where the Court explained that the CAA does not vest the EPA with sweeping authority to "substantially restructure the American energy market."[58] Considering the benefits of CO_2 emissions reductions associated with EGU closures in MATS is effectively considering the restructuring of the American energy market as a benefit of the rule. This is a fatal flaw in EPA's benefits analysis in the 2023 Revocation, and in the Proposed Rule.

II. Lignite-Fired EGUs Do Not Present Unacceptable Risks.

A. EPA has no authority to issue risk and technology review rules in the absence of unacceptable risk, and lignite-fired EGUs pose no unacceptable risks.

EPA periodically conducts Risk and Technology Reviews ("RTR(s)") pursuant to CAA Sections 112(d)(6)[59] and (f)(2). Section 112(f)(2) requires an unacceptable risk to exist for the agency to promulgate revised emissions standards. If no unacceptable risk exists, CAA Section 112 does not grant EPA authority to promulgate revised standards. Here, EPA has not plausibly demonstrated that lignite-fired EGUs create an unacceptable risk, thereby calling into question EPA's authority to promulgate revised emissions standards.

1. *Lignite-fired EGUs do not pose an unacceptable risk under the most stringent criteria utilized by EPA.*

Even if it were appropriate and necessary to regulate EGUs under CAA Section 112, the CAA does not require additional HAP standards for lignite-fired EGUs because HAPs from lignite-fired EGUs do not cause a lifetime risk of cancer greater than 1-in-1 million to any individual in the

[57] RIA at Section 4.4.
[58] 142 S.Ct. at 2610.
[59] EPA does not consider any new practices, processes, and control technologies for MATS, thus additional regulation under CAA 112(d)(6) is prohibited.

population who is most exposed to emissions of such pollutants from any lignite-fired EGU.[60] As noted above, the 2020 Reconsideration determined that only four oil-fired facilities in Puerto Rico caused a cancer risk above 1-in-1 million.[61] As only oil-fired EGUs present cancer risk above the 1-in-1 million threshold, lignite-fired EGUs do not.

Coal-fired EGUs present risk far lower than 1-in-1 million cancer threshold described above. Based on EPA's RTR analysis in the 2020 Reconsideration, the highest risk currently presented by any coal-fired EGU is actually just 0.344-in-1 million, which is well below the low risk level assigned to the source category in its RTR.[62] [63] And most lignite-fired EGUs present a considerably *lower* risk than all coal-fired EGUs.

The "lignite-fired" units have predicted maximum individual cancer risks are shown in the table below:[64]

Lignite-Fired EGU	**Cancer MIR[65] (-in-1 million)**
Antelope Valley #1	0.0121
Antelope Valley #2	0.0121
Coal Creek #1	0.0131
Coal Creek #2	0.0131
Coyote	0.00512
Leland Olds #1	0.00309
Leland Olds #2	0.00309
Milton R. Young #1	0.0807
Milton R. Young #2	0.0807
Spiritwood	0.00351
Limestone #1	0.0396
Limestone #2	0.0396
Major Oak #1	0.0446

[60] *See* 42 U.S.C. §7412(f)(2)(A) (noting the 1-in-1 million standard).
[61] *See* 85 Fed. Reg at 31319; *see also* Proposed Rule at 24863, FN 16.
[62] EPA's conclusion with respect to other health risks in the 2020 RTR is similar. EPA states that "the highest chronic noncancer [target organ-specific hazard index] and the highest acute non-cancer [hazard quotient] were below 1, indicated low likelihood of adverse noncancer effects from inhalation exposures. There were also low risks associated with ingestion, with the higher cancer risk being less than 50-in-1 million based on a conservative screening assessment, and the highest non-cancer risk being less than 1 based on a site-specific multipathway assessment." 88 Fed. Reg. at 24,865.
[63] *See e.g., Residual Risk Assessment for the Coal- and Oil-Fired EGU Source Category in Support of the 2020 Risk and Technology Review Final Review*, at Appendix 10, Tables 1 & 2a (Facility NEI ID 540336271711).
[64] *See id.* at Appendix 10, Tables 1 and 2a. Combined lignite-fired EGU average is depicted for facilities with more than one lignite-fired EGU.
[65] MIR stands for Maximum Individual Risk.

Lignite-Fired EGU	Cancer MIR[65] (-in-1 million)
Major Oak #2	0.0446
Martin Lake #1	0.137
Martin Lake #2	0.137
Martin Lake #3	0.137
Oak Grove #1	0.0352
Oak Grove #2	0.0352
Red Hills #1	0.0863
Red Hills #2	0.0863
San Miguel	0.191

Indeed, EPA's RIA for the Proposed Rule *reinforces* the data demonstrating that the risk associated with Hg and other HAP emissions from all EGUs—including the lignite-fired EGUs—is low:

- "[E]stimated risks from exposure to non-mercury metal HAP were not expected to exceed acceptable levels…."[66]
- "All of the exposure results generated as part of the 2020 Residual Risk analysis were below the presumptive acceptable cancer risk threshold and noncancer health-based thresholds …. [T]hese results suggest that the residual risks from HAP exposure are low[.]"[67]
- "U.S. EGU source category emissions of non-mercury HAP are not expected to exceed 1 in a million for inhalation cancer risk for those facilities impacted by the proposed controls. Further, cancer risk was determined to fall within the acceptable range for multipathway exposure to the persistent and bioaccumulative non-mercury metal HAP, such as arsenic, cadmium, and lead."[68]
- "As HAP exposure results generated as part of the 2020 Residual Risk analysis were below both the presumptive acceptable cancer risk threshold and the noncancer health benchmarks, and this proposed regulation should further reduce exposure to HAP, there are no 'disproportionate and adverse effects' of potential EJ concern."[69]

In any event, additional regulation of lignite-fired EGUs is inappropriate and inconsistent with EPA's congressional mandate. Moreover, EPA has the authority to establish subcategories within source categories and distinguish among classes, types and sizes when promulgating standards.[70] Here, any additional regulation should be limited to a new subcategory of facilities that of the class

[66] RIA at 4-2.
[67] *Id.* at 4-4.
[68] *Id.* at 4-7.
[69] *Id.* at 6-4.
[70] 42 U.S.C. §§ 7412(c)(1), (d)(1).

and type that pose risk in excess of 1-in-1 million—the threshold for deregulation—which are all oil-fired EGUs.[71] In fact, the significant differences between the liquid-fueled (such as oil) EGUs and solid-fueled (such as coal) EGUs justifying regulating them as entirely different source categories.

B. The absence of documented health risks suggest that EPA has an ulterior motive for the more-stringent standards for lignite-fired EGUs set forth in the Proposed Rule.

As described above, the evidence cited by EPA for the Proposed Rule demonstrates that the health and environmental impacts of HAP emissions from lignite-fired EGUs are minimal. This lack of compelling evidence, coupled with contemporaneous EPA proposals targeting coal-fired EGUs and their operators, suggests EPA is taking another bite at the "generation shifting" apple after the Supreme Court in *West Virginia v. EPA* stymied EPA's efforts to that end last year.[72] In other words, EPA is attempting to use the weight of numerous, exceptionally burdensome rules to effect results the Supreme Court has already rejected—namely, the reduction of CO_2 emissions through the effective forced retirement of coal-fired EGUs in favor of energy sources that may have less CO_2 emissions.

The Biden Administration has been candid about its desire to close coal plants and reduce greenhouse gas emissions. In fact, President Biden made a pledge to world leaders to cut greenhouse gas emissions in half by 2030 and be net zero by 2050[73]. A 2021 executive order builds on his "whole-of-government" effort to tackle the "climate crisis" by transitioning federal infrastructure to zero-emission vehicles and buildings powered by carbon free electricity by 2030 and be net-zero by 2050[74]. The only way the administration can meet these targets is for the energy grid to transition away from coal-fired generation, install carbon capture and storage ("CCS") technology on the coal fleet, or a combination of both. Since CCS is not yet adequately

---

[71] Despite presenting greater health risks than coal-fired EGUs, EPA is not proposing more stringent emissions standards for oil-fired EGUs.

[72] *See, e.g., New Source Performance Standards for Greenhouse Gas Emissions From New, Modified, and Reconstructed Fossil Fuel-Fired Electric Generating Units; Emission Guidelines for Greenhouse Gas Emissions From Existing Fossil Fuel-Fired Electric Generating Units; and Repeal of the Affordable Clean Energy Rule*, 88 Fed. Reg. 33240 (May 23, 2023) (requiring coal-fired EGUs to shut down or implement carbon capture and sequestration/storage control); *Supplemental Effluent Limitations Guidelines and Standards for the Steam Electric Power Generating Point Source Category*, 88 Fed. Reg. 18824 (Mar. 29, 2023) (imposing substantially more restrictive wastewater discharge effluent limitations); *Hazardous and Solid Waste Management System: Disposal of Coal Combustion Residuals From Electric Utilities; Legacy CCR Surface Impoundments*, 88 Fed. Reg. 31982 (May 18, 2023) (expanding regulation of areas containing coal combustion residuals).

[73] Biden commits to cutting U.S. emissions in half by 2030 as part of Paris climate pact (nbcnews.com) (last accessed June 2021)

[74] FACT SHEET: President Biden Signs Executive Order Catalyzing America's Clean Energy Economy Through Federal Sustainability | The White House (last accessed June 2023)

MEMORANDUM

DATE: July 2018

TO: Docket ID No: EPA-HQ-OAR-2018-0794

FROM: Nick Hutson, Melanie King, and Mary Johnson
U.S. EPA/OAQPS/SPPD/ESG
Steven McLeod and Mike Laney, RTI International

SUBJECT: Technology Review for the Coal- and Oil-Fired EGU Source Category

This memorandum summarizes the results of an analysis the U.S. Environmental Protection Agency (EPA) conducted in accordance with section 112(d)(6) of the Clean Air Act (CAA) to identify developments in practices, processes, and control technologies applicable to sources subject to the National Emission Standards for Hazardous Air Pollutants (NESHAP) for coal- and oil-fired electric utility steam generating units (EGUs) (40 CFR 63, subpart UUUUU). Specifically, the analysis focused on developments that have occurred since the original promulgation of subpart UUUUU. This memorandum is organized as follows:

1.0 BACKGROUND

1.1 Requirements of Section 112(d)(6) of the CAA

Section 112 of the CAA requires the EPA to establish technology-based standards for listed source categories that are sources of hazardous air pollutants (HAP). These technology-based standards are often referred to as maximum achievable control technology, or MACT, standards. Section 112 also contains provisions requiring the EPA to periodically review these standards. Specifically, paragraph 112(d)(6) states:

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

1.2 Description of the Coal- and Oil-fired Electric Utility Steam Generating Source Category and Requirements of the Current NESHAP

The current NESHAP for the Coal- and Oil-Fired EGUs source category were promulgated on February 16, 2012 (77 FR 9303) and are codified at 40 CFR part 63, subpart UUUUU (commonly referred to as the Mercury and Air Toxics Standards (MATS)). The MATS rule was

2.3 Mercury (Hg)

Subpart UUUUU regulates emissions of Hg from coal- and oil-fired EGUs. During combustion Hg in the resulting flue gas is speciated into elemental mercury vapor (Hg^0), gaseous oxidized mercury compounds (Hg^{2+}), and particle-bound (Hg-p). Finely powdered sorbent (usually activated carbon) injected upstream of a PM collection device can be used to capture Hg present in the flue gas. Also, existing air pollution control devices installed for reducing emissions of nitrogen oxide (NO_X), PM and sulfur oxides (SO_X) can have a co-beneficial effect on Hg control. For example, fabric filters or ESPs for PM control capture particle-bound Hg.

2.3.1 Hg Reduction – Current Implementation

Activated carbon injection (ACI) is the most commonly used mercury-specific control technology being implemented at coal-fired EGUs. An ACI system is an add-on air pollution control system in which sorbent is injected into the flue gas upstream of a PM control device to bind the gas phase Hg in the exhaust stream. The gaseous Hg is bound to the powdered activated carbon and then removed by the downstream PM control device

From a review of CAMD databases, we compiled a list of control technologies being used on EGUs currently in operation. The number of each Hg control or control combination by primary fuel type as reported to CAMD is summarized in Table 3 below.

Table 3 - Counts of Each Hg Control / Control Combinations by Primary Fuel Type

Control Type(s)[a, b]	Bituminous Coal	Sub-bituminous Coal	Lignite	Coal Refuse	Petroleum Coke	Residual Oil	Diesel Oil	Other Oil	Total
APAC	**4**	**32**	**3**	--	--	--	--	--	**39**
APAC, HPAC	**6**	**4**	--	--	--	--	--	--	**10**
APAC, SORB, UPAC	--	--	**2**	--	--	--	--	--	**2**
APAC, UPAC	**8**	**7**	**2**	--	--	--	--	--	**17**
CAT	**4**	**4**	--	--	--	--	--	--	**8**
CAT, HPAC	**1**	--	--	--	--	--	--	--	**1**
HPAC	**8**	**97**	**3**	--	**1**	--	--	--	**109**
HPAC, REAC	--	**1**	--	--	--	--	--	--	**1**
HPAC, SB	**2**	--	--	--	--	--	--	--	**2**
REAC	--	**1**	--	--	--	--	--	--	**1**
SB	**2**	--	--	--	--	--	--	--	**2**
SORB	**2**	**1**	--	--	--	--	--	--	**3**
SORB, UPAC	**2**	--	--	--	--	--	--	--	**2**
UPAC	**7**	**6**	**3**	--	--	--	--	--	**16**
(N/A or None)	**214**	**93**	**10**	**19**	**5**	**25**	**1**	**30**	**397**
									610

Control Type(s)[a, b]	Bituminous Coal	Sub-bituminous Coal	Lignite	Coal Refuse	Petroleum Coke	Residual Oil	Diesel Oil	Other Oil	Total

[a] APAC = Additives to enhance powdered activated carbon (PAC) and existing equipment performance, CAT = Catalyst (e.g., gold, palladium, other) used to oxidize Hg, HPAC = Halogenated PAC sorbent injection, REAC = Regenerative activated coke technology SB = Sodium based, SDA = Spray dryer absorber, SORB = Injection of other (non-PAC) sorbents, UPAC = Untreated PAC sorbent injection, N/A = not available

[b] APAC, HPAC, and UPAC are types of ACI

The reported Hg-specific air pollution control devices and control device combinations for solid fuels are primarily sorbent injection technologies. Specifically, activated carbon injection technologies such as APAC (additives to enhance powdered activated carbon and existing equipment performance) and HPAC (halogenated[b] powdered activated carbon sorbent injection) are reported to be installed most frequently. However, most of the facilities reported no Hg-specific control devices and are assumed to be meeting the MATS rule with co-beneficial Hg capture coming as a result of air pollution control devices that are installed for other pollutants.

2.3.2 Hg Reduction – Developments

This review identified no developments (as defined in Section 2.0 above) in practices, processes, or control technologies for Hg that have been implemented in this source category since promulgation of the current MATS rule.

The existing Hg air pollution control technologies that are currently in use are well-established and provide the capture efficiencies necessary for compliance with the subpart UUUUU Hg limits. Hg is being removed by activated carbon control technologies and by air pollution control devices such as wet FGD, ESP, and SCR that are installed at EGUs to control criteria pollutants.[5]

Based on the effectiveness and proven reliability of these Hg control technologies, and the relatively short period of time (~six years) since the promulgation of the MATS rule, no developments in practices, processes, or control technologies nor any new technologies or practices were identified.

2.4 Organic HAP

Subpart UUUUU contains work practice standards for the control of organic HAP emissions, including emissions of dioxins and furans, for all subcategories of EGUs. These work practice standards require periodic burner tune-ups to ensure good combustion. The standard requires maintaining and inspecting the boiler burners and associated combustion controls, tuning the specific burner type to optimize combustion, obtaining and recording carbon monoxide (CO) and NO_X values before and after the burner adjustments, keeping records of activity and measurements, and submitting a report, if requested, for each tune-up conducted.

[b] Halogenated PAC is most of often PAC that has been treated with bromine or a bromine compound (i.e., "brominated PAC").

Residual Risk Assessment for the Coal- and Oil-Fired EGU Source Category in Support of the 2020 Risk and Technology Review Final Rule

EPA's Office of Air Quality Planning and Standards
Office of Air and Radiation
September 2019

Appendix 10
Detailed Risk Modeling Results

Table 1 - Facility Identification Information

Facility NEI ID	Facility Name	Address	City	State	County
010731003111	James H Miller Jr	4250 Porter RD	Quinton	AL	Jefferson County
010971056111	Barry	Hwy 43	Bucks	AL	Mobile County
01117949211	E C Gaston	Hwy 25	Wilsonville	AL	Shelby County
011277917311	Gorgas	460 Gorgas Rd	Parrish	AL	Walker County
011291028611	Charles R Lowman	Larson Rd	Leroy	AL	Washington County
0206812662311	Healy Power Plant	Mile 2.5 Healy Spur Rd	Healy	AK	Denali Borough
040017735011	Coronado Generating Station	6MI/NE ST JOHNS-HWY191/B1018	ST JOHNS	AZ	Apache County
040017735111	Springerville Generating Station	OFF RTE 191, APP 15 MI NE SPRI	SPRINGERVILLE, A	AZ	Apache County
04003862811	Apache Station	3525 NORTH HIGHWAY 191	COCHISE	AZ	Cochise County
0400513606211	Navajo Generating Station	5 MI E OF PAGE ON HWY 98	PAGE	AZ	Coconino County
04017863011	Cholla	4801 CHOLLA LAKE ROAD	JOSEPH CITY	AZ	Navajo County
050071015511	Flint Creek Power Plant	21797 SWEPCO PLANT RD	GENTRY	AR	Benton County
0505716584111	John W. Turk Jr. Power Plant	3711 Highway 355 South	FULTON	AR	Hempstead County
050631083411	Independence	555 POINT FERRY RD	NEWARK	AR	Independence County
05069893911	White Bluff	1100 WHITE BLUFF ROAD	REDFIELD	AR	Jefferson County
0509315259811	Plum Point Energy Station	2732 SOUTH COUNTY RD 623	OSCEOLA	AR	Mississippi County
080013555811	Cherokee	6198 FRANKLIN STREET	COMMERCE CITY A	CO	Adams County
08013778211	Valmont	1800 N 63RD ST	BOULDER AREA	CO	Boulder County
080414391711	Martin Drake	700 S CONEJOS ST	COLORADO SPRIN(	CO	El Paso County
080414392711	Ray D Nixon	14020 RAY NIXON RD.	FOUNTAIN AREA	CO	El Paso County
080694364011	Rawhide Energy Station	2700 E COUNTY ROAD 82	WELLINGTON 9.3 M	CO	Larimer County
080811839711	Craig	2101 S RANNEY	CRAIG 2.9 MI. SW (	CO	Moffat County
080853457111	Nucla	30739 DD 31 RD	NUCLA 2.2 MI. SE C	CO	Montrose County
08087897211	Pawnee	14940 COUNTY ROAD 24	BRUSH, 2.6 MI SW (	CO	Morgan County
081014367811	Comanche (470)	2005 LIME RD	PUEBLO	CO	Pueblo County
081074458511	Hayden	13125 US HWY 40	HAYDEN	CO	Routt County
09001754311	Bridgeport Harbor Station	1 ATLANTIC ST	BRIDGEPORT	CT	Fairfield County
09007715711	Middletown	1866 RIVER RD	MIDDLETOWN	CT	Middlesex County
09009643411	New Haven Harbor	1 WATERFRONT ST	NEW HAVEN	CT	New Haven County
09011552611	Montville	74 LATHROP RD	UNCASVILLE	CT	New London County
10005640911	Indian River	29416 POWER PLANT ROAD	DAGSBORO	DE	Sussex County
12001535011	Deerhaven	10001 NW 13th St	GAINESVILLE	FL	Alachua County
12017640611	Crystal River	15760 West Power Line Street	CRYSTAL RIVER	FL	Citrus County
12031640211_1	Northside	4377 Heckscher Drive	JACKSONVILLE	FL	Duval County
12031640211_2	St. Johns River Power	4377 Heckscher Drive	JACKSONVILLE	FL	Duval County
12033752711	Crist Electric Generating Plant	11999 Pate Street	PENSACOLA	FL	Escambia County
12057538611	Big Bend	13031 WYANDOTTE ROAD	APOLLO BEACH	FL	Hillsborough County
12085717611	Indiantown Cogeneration, LP	13303 SW SILVER FOX LANE	INDIANTOWN	FL	Martin County
12095845411	Curtis H. Stanton Energy Center	5100 Alafaya Trail	ORLANDO	FL	Orange County
12105643111	C D McIntosh Jr Power Plant	3030 EAST LAKE PARKER DRIVE	LAKELAND	FL	Polk County
12105751911	Polk	9995 STATE ROUTE 37 SOUTH	MULBERRY	FL	Polk County
121072474411	Seminole (136)	890 NORTH U.S. HIGHWAY 17	PALATKA	FL	Putnam County
130152813011	Bowen	317 Covered Bridge Rd	Cartersville	GA	Bartow County
131033711211	McIntosh (6124)	981 Old Augusta Road	Rincon	GA	Effingham County
131153713211	Hammond	5963 Alabama Hwy SW	Coosa	GA	Floyd County
131497415011	Wansley (6052)	1371 Liberty Church Road	Carrollton	GA	Heard County
132078354711	Scherer	10986 Highway 87	Juliette	GA	Monroe County

Table 1 - Facility Identification Information

Facility NEI ID	Facility Name	Address	City	State	County
150037320911	Waiau Generating Station	475 Kamehameha Hwy.	Pearl City	HI	Honolulu County
150037429511	Kahe Generating Station	92-200 Farrington Highway	Kapolei	HI	Honolulu County
150038354011	AES Hawaii	91-086 Kaomi Loop	Kapolei	HI	Honolulu County
170211929211	Kincaid Generating Station	4 Mi W Of Kincaid Rte 104	Kincaid	IL	Christian County
170573206511	Duck Creek	17751 N Cilco Rd	Canton	IL	Fulton County
170792587011	Newton	6725 N 500th St	Newton	IL	Jasper County
170977792311	Waukegan	401 E Greenwood Ave	Waukegan	IL	Lake County
171257337411	Havana	15260 N Rte 78	Havana	IL	Mason County
171277808911	Joppa Steam	2100 Portland Rd	Joppa	IL	Massac County
171357340311	Coffeen	134 CIPS Ln	Coffeen	IL	Montgomery County
171435422711	E D Edwards	7800 S Cilco Ln	Bartonville	IL	Peoria County
171554685311	Hennepin Power Station	13498 E 800 St	Hennepin	IL	Putnam County
171577954611	Baldwin Energy Complex	10901 Baldwin Rd	Baldwin	IL	Randolph County
171677377311	Dallman	3100 Stevenson Dr	Springfield	IL	Sangamon County
171798199411	Powerton	13082 E Manito Rd	Pekin	IL	Tazewell County
1718910857911	Prairie State Generating Station	3872 County Hwy 12	Marissa	IL	Washington County
171978018111	Will County	529 E 135th St	Romeoville	IL	Will County
171998164511	Marion	10825 Lake of Egypt Rd	Marion	IL	Williamson County
180437742411	R Gallagher	30 Jackson St	New Albany	IN	Floyd County
180517363111	Gibson	1097 N CR 950 W	Owensville	IN	Gibson County
180737957011	R M Schahfer Generating Station	2723 E CR 1500 N	Wheatfield	IN	Jasper County
180777744211	Clifty Creek	1335 Clifty Hollow Rd	Madison	IN	Jefferson County
180834478911	Edwardsport Generating Station	15424 E SR 358	Edwardsport	IN	Knox County
180918011511	Michigan City Generating Station	101 Wabash St	Michigan City	IN	La Porte County
181257362411	IPL - Petersburg Generating Station	6925 N SR 57	Petersburg	IN	Pike County
181277376611	Bailly Generating Station	246 Bailly Station Rd	Chesterton	IN	Porter County
181298166111	A B Brown Generating Station	8511 Welborn Rd	Mount Vernon	IN	Posey County
181478017211	Rockport	2791 N US Hwy 231	Rockport	IN	Spencer County
181538396211	Merom	5500 W Old SR 54	Sullivan	IN	Sullivan County
181657248511	Cayuga	3300 N SR 63	Cayuga	IN	Vermillion County
181738183011	F B Culley Generating Station	3711 Darlington Rd	Newburgh	IN	Warrick County
181738183111	Alcoa Allowance Management Inc	4700 Darlington Rd	Newburgh	IN	Warrick County
181775506011	Whitewater Valley	2000 US Hwy 27 S	Richmond	IN	Wayne County
190055509311	Lansing	2320 POWER PLANT DR	LANSING	IA	Allamakee County
1901312806211	Streeter Station	UTILITY PKWY	CEDAR FALLS	IA	Black Hawk County
190575511811	Burlington (IA)	4282 SULLIVAN SLOUGH RD	BURLINGTON	IA	Des Moines County
191133940211	Prairie Creek	3300 C ST SW	CEDAR RAPIDS	IA	Linn County
191153942411	Louisa	8602 172ND ST	MUSCATINE	IA	Louisa County
191397892811	Muscatine	1700 DICK DRAKE WAY	MUSCATINE	IA	Muscatine County
191552992611	Walter Scott Jr. Energy Center	7215 NAVAJO ST	COUNCIL BLUFFS	IA	Pottawattamie County
191793732211	Ottumwa	20775 POWER PLANT RD	OTTUMWA	IA	Wapello County
191932943411	George Neal North	1151 260TH ST	SERGEANT BLUFF	IA	Woodbury County
191932943511	George Neal South	2761 PORT NEAL CIR	SALIX	IA	Woodbury County
200454827111	Lawrence Energy Center	1250 N 1800 RD	LAWRENCE	KS	Douglas County
200553167611	Holcomb	2440 HOLCOMB LANE	HOLCOMB	KS	Finney County
201075367811	La Cygne	25166 E 2200 RD	LA CYGNE	KS	Linn County
201495406811	Jeffrey Energy Center	25905 JEFFREY RD	ST. MARYS	KS	Pottawatomie County
201773823011	Tecumseh Energy Center	2ND & DUPONT RD	TECUMSEH	KS	Shawnee County
202094633811	Nearman Creek	4240 N 55TH	KANSAS CITY	KS	Wyandotte County
210156040811	East Bend	6293 Beaver Rd	Union	KY	Boone County

Table 1 - Facility Identification Information

Facility NEI ID	Facility Name	Address	City	State	County
210415198511	Ghent	9485 US 42 E	Ghent	KY	Carroll County
210595891711	Elmer Smith	4301 US 60 E	Owensboro	KY	Daviess County
211016067211	HMP&L Station 2	9000 KY 2096	Robards	KY	Henderson County
211117353711	Mill Creek	14660 DIXIE HWY	LOUISVILLE	KY	Jefferson County
211456037011	Shawnee	7900 Metropolis Lake Rd	West Paducah	KY	McCracken County
211617335511	H L Spurlock	KY 8	Maysville	KY	Mason County
211675933111	E W Brown	815 Dix Dam Rd	Harrodsburg	KY	Mercer County
211775196711	Paradise	13246 KY 176 Ste 10	Drakesboro	KY	Muhlenberg County
211835561611	D B Wilson	5663 KY 85 W	Centertown	KY	Ohio County
211995787711	John S. Cooper	7130 KY 1247 S	Somerset	KY	Pulaski County
212235742811	Trimble County	487 Corn Creek Rd	Bedford	KY	Trimble County
212336098611	R D Green	Jct of KY 2097 & KY 2096	Sebree	KY	Webster County
220198361211	R S Nelson	3500 Houston River Rd	Westlake	LA	Calcasieu Parish
220317354411	Dolet Hills Power Station	963 Power Plant Rd	Mansfield	LA	De Soto Parish
220778020711	Big Cajun 2	10431 Cajun 2 Rd (Hwy 981)	New Roads	LA	Pointe Coupee Parish
220797446811	Brame Energy Center	275 Rodemacher Rd	Lena	LA	Rapides Parish
230055823511	William F Wyman	677 COUSINS ST	YARMOUTH	ME	Cumberland County
240017717711	AES Warrior Run	11600 Mexico Farms Rd, SE	Cumberland	MD	Allegany County
240036084311_1	Brandon Shores	1005 Brandon Shores Rd	Baltimore	MD	Anne Arundel County
240036084311_2	Herbert A Wagner	1005 Brandon Shores Rd	Baltimore	MD	Anne Arundel County
240055155011	C P Crane	1001 Carroll Island Road	Middle River	MD	Baltimore County
240176011511	Morgantown	12620 Crain Hwy	Newburg	MD	Charles County
240197945511	Vienna	PO Box 128	Vienna	MD	Dorchester County
240315998011	Dickerson	21200 Martinsburg Rd	Dickerson	MD	Montgomery County
240336011911	Chalk Point	8711 Westphalia Rd	Aquasco	MD	Prince George's County
250017718511	Canal Station	9 FREEZER RD	SANDWICH	MA	Barnstable County
250055058811	Cleary Flood	1314 SOMERSET AVE	TAUNTON	MA	Bristol County
250136028411	West Springfield	15 AGAWAM AVE	WEST SPRINGFIEL	MA	Hampden County
260178172811	Dan E Karn	2742 N. Weadock Hwy.	ESSEXVILLE	MI	Bay County
260454174811	Erickson	3725 South Canal Road	LANSING	MI	Eaton County
260655985211	Eckert Station	601 Island Ave	LANSING	MI	Ingham County
261014856911	TES Filer City Station	700 Mee Street	FILER CITY	MI	Manistee County
261037778411	Presque Isle	2701 N LAKESHORE BOULEVARD	MARQUETTE	MI	Marquette County
261037779711	Shiras	400 E HAMPTON	MARQUETTE	MI	Marquette County
261157888311	Monroe	3500 E FRONT ST	MONROE	MI	Monroe County
261396336811	J B Sims	1231 N. Third St.	GRAND HAVEN	MI	Ottawa County
261398125511	J H Campbell	17000 Croswell	WEST OLIVE	MI	Ottawa County
261477239111_1	Belle River	4901 POINTE DR.	SAINT CLAIR	MI	St. Clair County
261477239111_2	St. Clair	4901 POINTE DR.	SAINT CLAIR	MI	St. Clair County
261637422511	Trenton Channel	4695 W JEFFERSON AVE	TRENTON	MI	Wayne County
261638229311	River Rouge	1 BELANGER PARK DR	RIVER ROUGE	MI	Wayne County
270317039811	Taconite Harbor Energy Center	8124 W Highway 61	Schroeder	MN	Cook County
270616173211	Boswell Energy Center	1210 NW 3rd St	Cohasset	MN	Itasca County
271117072311	Hoot Lake	water plant road	Fergus Falls	MN	Otter Tail County
271416990811	Sherburne County	13999 Industrial Blvd	Becker	MN	Sherburne County
271636772111	Allen S King	1103 King Plant Rd	Bayport	MN	Washington County
280197053011	Red Hills Generation Facility	2391 Pensacola Road	Ackerman	MS	Choctaw County
280596251011	Daniel Electric Generating Plant	13201 Highway 63 North	Moss Point	MS	Jackson County

Table 1 - Facility Identification Information

Facility NEI ID	Facility Name	Address	City	State	County
280737154411	R D Morrow Senior Generating Plant	304 Old Okahola Schoolhouse Road	Purvis	MS	Lamar County
290716032111	Labadie	LABADIE BOTTOM ROAD	LABADIE	MO	Franklin County
290777496411	John Twitty Energy Center	5100 WEST FARM ROAD 164	SPRINGFIELD	MO	Greene County
290837529611	Montrose	400 SW HIGHWAY P	CLINTON	MO	Henry County
290957663711	Hawthorn	8700 HAWTHORN ROAD	KANSAS CITY	MO	Jackson County
290957664111	Sibley	33200 EAST JOHNSON RD	SIBLEY	MO	Jackson County
290975321511	Asbury	21133 UPHILL LANE	ASBURY	MO	Jasper County
290995258811	Rush Island	HWY 61 AT AA VIA BIG HOLLOW RD	FESTUS	MO	Jefferson County
291435363811	New Madrid Power Plant	41 ST. JUDE ROAD	MARSTON	MO	New Madrid County
291656795111	Iatan	20250 HIGHWAY 45 NORTH	WESTON	MO	Platte County
291756688411	Thomas Hill Energy Center	5693 HWY F	CLIFTON HILL	MO	Randolph County
291836783411	Sioux	HWY 94	WEST ALTON	MO	St. Charles County
291896816611	Meramec	8200 FINE RD	ST. LOUIS	MO	St. Louis County
292017595411	Sikeston	1551 W WAKEFIELD ST	SIKESTON	MO	Scott County
300037851511	Hardin Generating Station	SUGAR FACTORY RD	HARDIN	MT	Big Horn County
300837618511	Lewis & Clark	MT HWY 23	SIDNEY	MT	Richland County
300877765611	Colstrip	WILLOW AVENUE	COLSTRIP	MT	Rosebud County
300877854911	Colstrip Energy Limited Partnership	ROSEBUD PLANT	COLSTRIP	MT	Rosebud County
301115270711	Yellowstone Energy Limited Partnership	2215 N FRONTAGE RD	BILLINGS	MT	Yellowstone County
310018399211	Gerald Whelan Energy Center	4520 E South St	Hastings	NE	Adams County
310537766111	Lon D Wright Power Plant	2701 E 1st St	Fremont	NE	Dodge County
310556732411	North Omaha Station	7475 Pershing Drive	Omaha	NE	Douglas County
310798212011	Platte	1035 W Wildwood Dr	Grand Island	NE	Hall County
311095281111	Sheldon	4500 W Pella Rd	Hallam	NE	Lancaster County
311117766511	Gerald Gentleman Station	6089 S Highway 25	Sutherland	NE	Lincoln County
311317303711	Nebraska City Station	7264 L Rd	Nebraska City	NE	Otoe County
3201112758911	TS Power Plant	3 mi North of Dunphy	DUNPHY	NV	Eureka County
320137302011	North Valmy	North of I80 Stonehouse Int 212	VALMY	NV	Humboldt County
330138178911	Merrimack	431 RIVER ROAD	BOW	NH	Merrimack County
330157287811	Schiller	400 GOSLING ROAD	PORTSMOUTH	NH	Rockingham County
330157288011	Newington	165 GOSLING ROAD	NEWINGTON	NH	Rockingham County
340095133011	B L England	900 NORTH SHR RD	BEESLEY'S POINT	NJ	Cape May County
340158093811	Logan Generating Plant	76 RT 130	SWEDESBORO	NJ	Gloucester County
340337989011	Carneys Point	500 SHELL RD	CARNEYS POINT	NJ	Salem County
350315597111	Escalante	County Road 19	Prewitt	NM	McKinley County
350457197711	Four Corners Steam Elec Station	US 550	Fruitland	NM	San Juan County
350457991911	San Juan	6800 N County Road	Waterflow	NM	San Juan County
360637417811	Somerset Operating Company (Kintigh)	7725 LAKE RD	BARKER	NY	Niagara County
360718427811	Roseton Generating LLC	992 RIVER RD	NEWBURGH	NY	Orange County
360757980511	Oswego Harbor Power	261 WASHINGTON BLVD	OSWEGO	NY	Oswego County
360818309011	Ravenswood Generating Station	38-54 VERNON BLVD	QUEENS	NY	Queens County
361098542611	Cayuga Operating Company, LLC	228 CAYUGA DR	LANSING	NY	Tompkins County
370218392811	Asheville	200 CP&L Drive	Arden	NC	Buncombe County
370358370411	Marshall	8320 East NC Hwy 150	Terrell	NC	Catawba County
370458300611	Cliffside	573 Duke Power Road (SR 1002)	Mooresboro	NC	Cleveland County
370658124311	Edgecombe Genco, LLC	6358 Old Battleboro Road	Battleboro	NC	Edgecombe County
370718137511	G G Allen	253 Plant Allen Rd.	Belmont	NC	Gaston County

Table 1 - Facility Identification Information

Facility NEI ID	Facility Name	Address	City	State	County
370838048111_1	Westmoreland Partners Roanoke Valley I	290 Power Place	Weldon	NC	Halifax County
370838048111_2	Westmoreland Partners Roanoke Valley II	290 Power Place	Weldon	NC	Halifax County
371457826011	Roxboro	1700 Dunnaway Road	Semora	NC	Person County
371457826111	Mayo	10660 Boston Road	Roxboro	NC	Person County
371698514011	Belews Creek	3195 Pine Hall Road	Walnut Cove	NC	Stokes County
380558011011	Coal Creek	2875 3rd St SW	Underwood	ND	McLean County
380578086311	Leland Olds	3901 Hwy 200A	Stanton	ND	Mercer County
380578086511	Antelope Valley	294 County Road 15	Beulah	ND	Mercer County
380578086611	Coyote	6240 13th St SW	Beulah	ND	Mercer County
380598087011	R M Heskett	T139 R81 Sct10	Mandan	ND	Morton County
380658087911	Milton R Young	3401 24th St SW	Center	ND	Oliver County
3809316937511	Spiritwood Station	93rd Ave SE	Spritwood	ND	Stutsman County
390018101311	J M Stuart	745 U.S. Route 52	Aberdeen	OH	Adams County
390018101411	Killen Station	14869 U.S. Route 52	Manchester	OH	Adams County
390258294311	W H Zimmer Generating Station	1781 US Route 52	Moscow	OH	Clermont County
390318010811	Conesville	47201 County Road 273	Conesville	OH	Coshocton County
390537983011	Kyger Creek	5758 State Route 7 North	Cheshire	OH	Gallia County
390538148511	Gen J M Gavin	7397 N. St Rt #7	Cheshire	OH	Gallia County
390617738711	Miami Fort Power Station	11021 Brower Road	North Bend	OH	Hamilton County
390818115711	Cardinal	306 County Road 7 East	Brilliant	OH	Jefferson County
390818190811	W H Sammis	29503 State Rte 7	Stratton	OH	Jefferson County
390938130811	Avon Lake Power Plant	33570 Lake Road	Avon Lake	OH	Lorain County
390958302011	Bay Shore	4701 Bay Shore Road	Oregon	OH	Lucas County
400238449511	Hugo	970N 4335 Rd	FORT TOWSON	OK	Choctaw County
400798148711	AES Shady Point, LLC	3 MILES E OF HWY 31/59 JCT	PANAMA	OK	Le Flore County
400978522311	Grand River Dam Authority	8142 HWY 412B	CHOUTEAU	OK	Mayes County
401018506011	Muskogee	5501 Three Forks Road	FORT GIBSON	OK	Muskogee County
401038519411	Sooner	10800 COUNTY RD 230	RED ROCK	OK	Noble County
401318212411	Northeastern	SE OF HWY169 & HWY88	OOLOGAH	OK	Rogers County
410498171111	Boardman	CARTY RESERVOIR POWER SITE, TOWER ROAD	BOARDMAN	OR	Morrow County
420038404811	Cheswick	100 PITTSBURGH ST	SPRINGDALE	PA	Allegheny County
420053866111	Keystone	313 KEYSTONE DR	SHELOCTA	PA	Armstrong County
420073853711	Bruce Mansfield	128 FERRY HILL RD	SHIPPINGPORT	PA	Beaver County
420216594311	Ebensburg Power Company	CAMBRIA CNTY IND PARK	REVLOC	PA	Cambria County
420216594411	Colver Power Project	141 INTERPOWER DR	COLVER	PA	Cambria County
420216594511	Cambria Cogen	243 RUBISCH RD	EBENSBURG	PA	Cambria County
420257889011	Panther Creek Energy Facility	4 DENNISON RD	NESQUEHONING	PA	Carbon County
420456662011	Eddystone Generating Station	1 INDUSTRIAL HWY	EDDYSTONE	PA	Delaware County
420632905911	Conemaugh	1442 POWER PLANT RD	NEW FLORENCE	PA	Indiana County
420633005111	Seward	595 PLANT RD	NEW FLORENCE	PA	Indiana County
420633005211	Homer City	1750 POWER PLANT RD	HOMER CITY	PA	Indiana County
420933881111	Montour, LLC	18 MCMICHAEL RD	WASHINGTONVILLE	PA	Montour County
420953881711	Martins Creek, LLC	FOUL RIFT RD	MARTINS CREEK	PA	Northampton County
420956558911	Northampton Generating Plant	1 HORWITH DR	NORTHAMPTON	PA	Northampton County
420973762011	Mt. Carmel Cogeneration	MARION HEIGHTS RD	MARION HEIGHTS	PA	Northumberland County
421074105111	Gilberton Power Company	50 ELEANOR DR	FRACKVILLE	PA	Schuylkill County
421074105211	Northeastern Power Company	ROUTE 309	MCADOO	PA	Schuylkill County
421074735811	WPS Westwood Generation, LLC	490 W MAIN ST	TREMONT	PA	Schuylkill County
421078331411	Wheelabrator - Frackville	475 MOREA RD	FRACKVILLE	PA	Schuylkill County

Table 1 - Facility Identification Information

Facility NEI ID	Facility Name	Address	City	State	County
421078406511	St. Nicholas Cogeneration Project	120 YATESVILLE RD	SHENANDOAH	PA	Schuylkill County
421214760211	Scrubgrass Generating Plant	2151 LISBON RD	KENNERDELL	PA	Venango County
421333193911	Brunner Island, LLC	1400 WAGO RD	YORK HAVEN	PA	York County
450154120411	Cross	553 CROSS STATION RD	PINEVILLE	SC	Berkeley County
450158306711	Williams	2242 BUSHY PARK RD	GOOSE CREEK	SC	Berkeley County
450436652811	Winyah	661 STEAM PLANT DR	GEORGETOWN	SC	Georgetown County
450757870811	Cope Station	405 TEAMWORK RD	COPE	SC	Orangeburg County
450797126411	Wateree	RTE 2 HWY 601	EASTOVER	SC	Richland County
460514962811	Big Stone	Northwest Of Big Stone City	Big Stone City	SD	Grant County
470016196011	Bull Run	1265 EDGEMOOR ROAD	CLINTON	TN	Anderson County
470855720911	Johnsonville	535 STEAM PLANT ROAD	NEW JOHNSONVILI	TN	Humphreys County
471454979111	Kingston	714 SWAN POND ROAD	HARRIMAN	TN	Roane County
471575720111	Allen	2474 Plant Road	Memphis	TN	Shelby County
471614979311	Cumberland	815 CUMBERLAND CITY ROAD	CUMBERLAND	TN	Stewart County
471655610411	Gallatin	1499 STEAM PLANT ROAD	GALLATIN	TN	Sumner County
480134898511	San Miguel	11 MI S, SH 16; 6 MI E FM 3387	CHRISTINE	TX	Atascosa County
480295617211_1	J T Deely	12940 S US HWY 181	SAN ANTONIO	TX	Bexar County
480295617211_2	J K Spruce	12940 S US HWY 181	SAN ANTONIO	TX	Bexar County
481494144811	Sam Seymour	7 M E OF LA GRANG ON HWY 71	LA GRANGE	TX	Fayette County
481573968411	W A Parish	2500 Y U JONES RD	THOMPSONS	TX	Fort Bend County
481754018411	Coleto Creek	45 FM 2987	FANNIN	TX	Goliad County
481856436311	Gibbons Creek Steam Electric Station	FM 244 2.5 MI N OF HWY 30; NEAR CARLOS	BRYAN	TX	Grimes County
482034845611	H W Pirkey Power Plant	RT 2 BOX 165	HALLSVILLE	TX	Harrison County
482794930011	Tolk Station	ON HWY 70 9 MIL EAST OF MULESHOE TX THEN 3 MI S FROM FM 2910	MULESHOE	TX	Lamb County
482935650511	Limestone	9 MI N OF JEWETT ON FM 39	JEWETT	TX	Limestone County
4830915628511	Sandy Creek Energy Station	APPX 2 MI W OF RIESEL; FROM FM 1860 TURN N AT THE 2ND ENTRANCE TO RATTLESNAKE RD; GO 1/2 MI; TURN R	RIESEL	TX	McLennan County
483755745311	Harrington Station	2.7 M N ON LAKESIDE DR FROM SH 136	AMARILLO	TX	Potter County
4839513385811	Oak Grove	11 MI E OF TOWN	FRANKLIN	TX	Robertson County
483957552911	Twin Oaks	8 M N OF CALVERT ON HWY 6	CALVERT	TX	Robertson County
484014207311	Martin Lake	8850 FM 2658 N	TATUM	TX	Rusk County
484494164411	Welsh Power Plant	1187 CR 4865	MOUNT PLEASANT	TX	Titus County
484877927311	Oklaunion Power Station	3.5 MI SSW OF OKLAUNION ON FM 3430	OKLAUNION	TX	Wilbarger County
490075066411	Sunnyside Cogeneration Associates	State Road 123	Carbon County	UT	Carbon County
490155050511	Hunter	P.O. Box 569	Castle Dale	UT	Emery County
490155050611	Huntington	P. O. Box 680	Huntington	UT	Emery County
490277558311	Intermountain	850 West Brush Wellman Road	Delta	UT	Millard County
490476281811	Bonanza	12500 East 25500 South	Vernal	UT	Uintah County
510414181011	Chesterfield Power Station	500 Coxendale Rd	Chester	VA	Chesterfield County

Table 1 - Facility Identification Information

Facility NEI ID	Facility Name	Address	City	State	County
510836160611	Clover Power Station	4091 Clover Road	Clover	VA	Halifax County
510996148811	Birchwood Power Facility	10900 Birchwood Dr	King George	VA	King George County
511175748311	Mecklenburg Power Station	204 Cogen Drive	Clarksville	VA	Mecklenburg County
511537520511	Possum Point Power Station	19000 Possum Point Rd	Dumfries	VA	Prince William County
5119516530111	Virginia City Hybrid Energy Center	3425 Russell Creek Road	St Paul	VA	Wise County
511994565211	Yorktown Power Station	1600 Waterview Rd	Yorktown	VA	York County
517604039911	Spruance Genco, LLC	5001 Commerce Rd	Richmond	VA	Richmond city
530416281311	Centralia	913 Big Hanaford Road	Centralia	WA	Lewis County
540236257011	Mount Storm Power Station	436 DOMINION BLVD	MOUNT STORM	WV	Grant County
540336271711	Harrison Power Station	STATE ROUTE 20	HAYWOOD	WV	Harrison County
540494864511	Grant Town Power Plant	Route 17	Grant Town	WV	Marion County
540516902311	Mitchell (WV)	STATE ROUTE 2	CRESAP	WV	Marshall County
540536760811	Mountaineer (1301)	STATE ROUTE 62	NEW HAVEN	WV	Mason County
5406116320111	Longview Power	1375 FORT MARTIN ROAD	MAIDSVILLE	WV	Monongalia County
540616773611	Fort Martin Power Station	STATE ROUTE 53	MAIDSVILLE	WV	Monongalia County
540616773811	Morgantown Energy Facility	555 BEECHURST AVENUE	MORGANTOWN	WV	Monongalia County
540734782811	Pleasants Power Station	No.1 Power Station Boulevard	WILLOW ISLAND	WV	Pleasants County
540796789111	John E Amos	STATE ROUTE 817	ST. ALBANS	WV	Putnam County
550095295111	Pulliam	1501 Bylsby Ave	Green Bay	WI	Brown County
550114958511	J P Madgett	500 Old State Road 35	Alma	WI	Buffalo County
550217673611	Columbia	W8375 Murray Rd	Pardeeville	WI	Columbia County
550597509411	Pleasant Prairie	8000 95th St	Pleasant Prairie	WI	Kenosha County
550717179611	Manitowoc	701 Columbus St	Manitowoc	WI	Manitowoc County
550737078511	Weston	2501 Morrison Ave	Rothschild	WI	Marathon County
550796330411_1	South Oak Creek	11060 S Chicago Rd	Oak Creek	WI	Milwaukee County
550796330411_2	Elm Road Generating Station	11060 S Chicago Rd	Oak Creek	WI	Milwaukee County
551177692911	Edgewater (4050)	3739 Lakeshore Dr	Sheboygan	WI	Sheboygan County
551237711211	Genoa	Rr 1 Box 276	Genoa	WI	Vernon County
5600512810911	Wygen I	27,50N,71W	Campbell	WY	Campbell County
5600512811111	Wygen II	22,50N,71W	Campbell	WY	Campbell County
5600515064111	Wygen III	27,50N,71W	Campbell	WY	Campbell County
5600515659411	Dry Fork Station	24,51N,72W	Campbell	WY	Campbell County
560057844911	Neil Simpson II	27,50N,71W	Campbell	WY	Campbell County
560058041911	Wyodak	27,50N,71W	Campbell	WY	Campbell County
560096418211	Dave Johnston	7,33N,74W	Converse	WY	Converse County
560238419211	Naughton	32,21N,116W	Lincoln	WY	Lincoln County
560314207711	Laramie River	30,25N,66W	Platte	WY	Platte County
560373962711	Jim Bridger	3,20N,101W	Sweetwater	WY	Sweetwater County
720577128511	AES Puerto Rico, LP	PR 3, Km 142, Jobos Ward	Guayama	PR	Guayama Municipio
720597129111	Costa Sur Steam Power Plant	Road 127	Guayanilla	PR	Guayanilla Municipio
721236958711	Aguirre Steam Power Plant	Road PR-3, Km 152.3	Salinas	PR	Salinas Municipio
721276878311	San Juan Steam Power Plant	Mercado Central Ave, Zona Central Ave, PR-28	San Juan	PR	San Juan Municipio
721377438511	Palo Seco Steam Power Plant	Road 165, Km 3.8, Toa Baja	Toa Baja	PR	Toa Baja Municipio

Table 2a – Maximum Predicted HEM-3 Chronic Risks
Actual Emissions

Facility NEI ID	Category Chronic Risk [1]				Facility Chronic Risk [1]			SC % of Facility-wide Cancer Risk
	Cancer MIR	Cancer Incidence	Noncancer Max HI	Target Organ	Cancer MIR	Noncancer Max HI	Target Organ	
010731003111	1.32E-07	2.24E-04	4.52E-04	developmental	1.32E-07	4.52E-04	developmental	100%
010971056111	7.12E-08	5.10E-05	2.54E-04	developmental	3.37E-07	3.19E-03	respiratory	21%
01117949211	4.78E-09	7.80E-06	8.99E-05	respiratory	4.78E-09	8.99E-05	respiratory	100%
011277917311	1.71E-08	2.00E-05	1.54E-04	respiratory	1.71E-08	1.54E-04	respiratory	100%
011291028611	8.44E-08	8.71E-06	2.92E-04	respiratory	8.44E-08	2.92E-04	respiratory	100%
0206812662311	2.59E-07	1.71E-07	2.17E-03	developmental	8.14E-08	9.05E-04	neurological	100%
040017735011	3.70E-08	1.22E-06	1.28E-04	developmental	3.70E-08	1.28E-04	developmental	100%
040017735111	1.34E-08	6.95E-07	1.30E-04	respiratory	1.34E-08	1.30E-04	respiratory	100%
04003862811	3.53E-08	9.43E-07	1.21E-04	developmental	3.54E-08	1.21E-04	developmental	100%
0400513606211	2.75E-07	1.36E-05	9.50E-04	developmental	2.75E-07	9.50E-04	developmental	100%
04017863011	3.47E-08	1.57E-06	3.57E-04	respiratory	3.47E-08	3.58E-04	respiratory	100%
050071015511	5.66E-09	3.83E-06	8.20E-05	respiratory	6.23E-08	2.61E-04	immunological	9%
0505716584111	2.14E-09	5.81E-07	4.50E-05	respiratory	3.64E-09	5.84E-05	respiratory	59%
050631083411	2.48E-08	1.01E-05	1.24E-04	respiratory	2.15E-07	4.33E-03	respiratory	12%
05069893911	4.61E-08	7.72E-05	1.88E-04	respiratory	4.55E-08	1.86E-04	respiratory	100%
0509315259811	1.19E-08	9.34E-06	1.32E-04	respiratory	1.22E-08	1.31E-04	respiratory	98%
080013555811	6.89E-09	5.78E-05	1.03E-04	respiratory	6.90E-09	2.85E-04	liver	100%
08013778211	1.63E-09	3.07E-06	3.05E-05	respiratory	1.67E-08	2.91E-04	kidney	10%
080414391711	1.55E-08	1.18E-05	3.29E-04	respiratory	1.55E-08	3.29E-04	respiratory	100%
080414392711	6.84E-09	1.02E-05	4.87E-05	respiratory	1.87E-08	1.97E-04	respiratory	37%
080694364011	8.72E-09	4.28E-06	8.61E-05	respiratory	8.72E-09	8.61E-05	respiratory	100%
080811839711	6.77E-08	6.27E-06	5.86E-04	respiratory	6.77E-08	5.86E-04	respiratory	100%
080853457111	3.72E-09	3.99E-08	4.96E-05	skeletal	3.89E-09	5.18E-05	skeletal	96%
08087897211	9.11E-09	9.48E-07	1.05E-04	respiratory	1.08E-08	1.22E-04	respiratory	85%
081014367811	4.38E-08	3.67E-05	4.92E-04	respiratory	4.40E-08	4.94E-04	respiratory	100%
081074458511	3.58E-08	2.56E-06	4.15E-04	respiratory	3.58E-08	4.15E-04	respiratory	100%
09001754311	1.13E-08	7.77E-05	2.51E-04	skeletal	1.14E-08	2.54E-04	skeletal	99%
09007715711	4.83E-09	2.95E-05	1.27E-04	respiratory	9.79E-09	1.65E-04	neurological	49%
09009643411	1.99E-09	1.09E-05	5.21E-05	respiratory	5.24E-09	1.29E-04	neurological	38%
09011552611	9.49E-09	2.42E-05	2.48E-04	respiratory	9.52E-09	2.47E-04	respiratory	100%
10005640911	1.87E-09	1.27E-06	2.35E-05	respiratory	2.38E-09	2.51E-05	neurological	79%
12001535011	1.76E-08	1.32E-05	1.54E-04	respiratory	1.76E-08	1.54E-04	respiratory	100%
12017640611	6.39E-08	4.51E-05	2.85E-04	respiratory	6.39E-08	2.85E-04	respiratory	100%
12031640211_1	4.83E-09	1.31E-05	1.95E-04	respiratory	4.83E-09	1.95E-04	respiratory	100%
12031640211_2	1.83E-07	7.94E-04	7.00E-04	respiratory	1.83E-07	7.00E-04	respiratory	100%
12033752711	2.62E-07	6.82E-04	9.09E-04	developmental	2.63E-07	9.12E-04	developmental	100%
12057538611	1.05E-07	4.78E-04	6.05E-04	respiratory	1.05E-07	6.05E-04	respiratory	100%
12085717611	2.55E-10	3.46E-07	6.25E-06	#N/A	5.05E-10	1.05E-05	kidney	50%
12095845411	2.82E-07	1.41E-03	9.74E-04	respiratory	4.23E-07	2.31E-01	respiratory	67%
12105643111	3.88E-08	1.11E-04	1.96E-04	respiratory	4.90E-08	3.14E-04	respiratory	79%
12105751911	5.32E-09	1.20E-05	2.17E-05	respiratory	9.97E-09	6.23E-05	respiratory	53%
121072474411	3.09E-07	2.59E-04	1.07E-03	developmental	3.29E-07	1.08E-03	developmental	94%
130152813011	1.50E-07	8.90E-04	6.06E-04	respiratory	1.50E-07	6.06E-04	respiratory	100%
131033711211	3.93E-10	4.67E-07	8.98E-06	#N/A	6.04E-10	8.98E-06	#N/A	65%
131153713211	4.42E-09	2.96E-06	1.52E-05	developmental	4.42E-09	1.52E-05	developmental	100%
131497415011	3.44E-08	3.27E-05	1.18E-04	developmental	3.78E-08	1.30E-04	developmental	91%
132078354711	1.67E-08	1.49E-05	1.29E-04	respiratory	1.67E-08	1.29E-04	respiratory	100%
150037320911	8.40E-07	3.79E-04	2.20E-02	respiratory	8.27E-07	2.17E-02	respiratory	100%
150037429511	1.29E-07	8.34E-05	3.39E-03	respiratory	1.29E-07	3.39E-03	respiratory	100%
150038354011	2.77E-08	3.40E-05	2.31E-04	developmental	2.77E-08	2.31E-04	developmental	100%
170211929211	3.99E-09	6.74E-06	2.53E-05	respiratory	3.97E-09	2.53E-05	respiratory	100%
170573206511	3.99E-08	2.59E-05	1.38E-04	developmental	3.96E-08	1.37E-04	developmental	100%
170792587011	2.56E-08	7.92E-06	1.81E-04	respiratory	2.56E-08	1.81E-04	respiratory	100%
170977792311	1.09E-07	4.73E-04	3.89E-04	developmental	1.10E-07	3.97E-04	developmental	99%
171257337411	5.78E-10	1.86E-07	2.68E-05	respiratory	8.85E-10	2.75E-05	respiratory	65%
171277808911	4.49E-08	1.48E-05	5.35E-04	developmental	4.49E-08	5.35E-04	developmental	100%
171357340311	3.46E-08	1.22E-05	1.19E-04	developmental	3.47E-08	4.53E-04	respiratory	100%
171435422711	4.87E-08	6.10E-05	4.13E-04	developmental	4.87E-08	4.13E-04	developmental	100%
171554685311	1.58E-09	4.36E-07	1.75E-04	skeletal	1.58E-09	1.75E-04	skeletal	100%
171577954611	8.53E-09	8.33E-06	1.31E-04	respiratory	8.57E-09	1.31E-04	respiratory	100%
171677377311	8.41E-08	1.24E-04	4.08E-04	respiratory	8.41E-08	4.09E-04	respiratory	100%
171798199411	3.56E-08	1.09E-04	1.27E-04	developmental	3.53E-08	1.26E-04	developmental	100%
1718910857911	3.93E-08	2.28E-05	3.42E-04	respiratory	3.95E-08	3.45E-04	respiratory	100%
171978018111	6.25E-09	1.00E-04	3.40E-05	respiratory	7.19E-09	3.70E-05	respiratory	87%
171998164511	8.49E-08	2.80E-05	5.04E-04	developmental	1.00E-07	1.73E-03	developmental	85%
180437742411	1.83E-09	6.49E-06	4.01E-05	skeletal	1.83E-09	4.01E-05	skeletal	100%

Table 2a – Maximum Predicted HEM-3 Chronic Risks
Actual Emissions

	Category Chronic Risk [1]				Facility Chronic Risk [1]			
Facility NEI ID	Cancer MIR	Cancer Incidence	Noncancer Max HI	Target Organ	Cancer MIR	Noncancer Max HI	Target Organ	SC % of Facility-wide Cancer Risk
180517363111	2.22E-07	9.65E-05	1.06E-03	respiratory	2.22E-07	1.06E-03	respiratory	100%
180737957011	4.75E-08	5.12E-05	1.64E-04	developmental	4.79E-08	1.68E-04	respiratory	99%
180777744211	5.60E-09	5.92E-06	5.40E-05	respiratory	5.60E-09	5.40E-05	respiratory	100%
180834478911	4.04E-08	8.34E-06	1.43E-04	developmental	4.79E-08	1.80E-04	respiratory	84%
180918011511	8.29E-10	3.17E-06	1.56E-05	respiratory	8.61E-10	1.62E-05	respiratory	96%
181257362411	1.54E-08	8.07E-06	1.38E-04	respiratory	1.55E-08	1.38E-04	respiratory	99%
181277376611	2.66E-08	9.66E-05	9.18E-05	developmental	2.68E-08	9.25E-05	developmental	99%
181298166111	1.13E-07	6.22E-05	5.29E-04	respiratory	1.32E-07	6.00E-04	respiratory	85%
181478017211	9.92E-09	2.32E-05	6.27E-05	respiratory	1.01E-08	6.37E-05	respiratory	98%
181538396211	3.17E-08	1.51E-05	1.41E-04	respiratory	3.18E-08	1.41E-04	respiratory	100%
181657248511	3.16E-08	1.62E-05	1.23E-04	respiratory	3.22E-08	1.29E-04	respiratory	98%
181738183011	3.42E-08	2.80E-05	3.04E-04	respiratory	3.43E-08	3.05E-04	respiratory	100%
181738183111	8.81E-08	9.83E-05	3.05E-04	developmental	8.80E-08	3.05E-04	developmental	100%
181775506011	4.77E-10	2.32E-07	5.47E-05	skeletal	4.77E-10	5.47E-05	skeletal	100%
190055509311	1.01E-09	2.47E-07	1.42E-05	respiratory	1.01E-09	1.42E-05	respiratory	100%
1901312806211	4.41E-10	3.97E-07	2.25E-06	respiratory	4.41E-10	2.25E-06	respiratory	100%
190575511811	6.49E-08	2.16E-05	2.43E-04	respiratory	6.49E-08	2.43E-04	respiratory	100%
191133940211	6.42E-08	3.72E-05	2.78E-04	respiratory	6.42E-08	2.78E-04	respiratory	100%
191153942411	1.70E-08	7.45E-06	1.24E-04	respiratory	1.71E-08	1.24E-04	respiratory	100%
191397892811	3.03E-08	1.42E-05	1.17E-04	respiratory	3.03E-08	1.19E-04	respiratory	100%
191552992611	6.65E-08	1.34E-04	5.19E-04	respiratory	6.65E-08	5.19E-04	respiratory	100%
191793732211	7.61E-09	3.15E-06	6.73E-05	respiratory	3.67E-07	8.47E-03	respiratory	2%
191932943411	6.99E-09	3.55E-06	6.24E-05	respiratory	6.97E-09	7.54E-05	respiratory	100%
191932943511	1.14E-09	8.18E-07	1.39E-05	skeletal	1.08E-09	3.35E-05	respiratory	100%
200454827111	5.56E-08	5.79E-05	4.38E-04	respiratory	5.56E-08	4.38E-04	respiratory	100%
200553167611	1.37E-09	2.01E-07	1.26E-05	respiratory	1.37E-09	1.26E-05	respiratory	100%
201075367811	2.44E-08	4.86E-06	1.94E-04	respiratory	2.42E-08	1.93E-04	respiratory	100%
201495406811	1.22E-07	3.80E-05	4.21E-04	developmental	1.23E-07	4.24E-04	developmental	99%
201773823011	5.45E-08	3.18E-05	2.17E-04	respiratory	5.45E-08	2.17E-04	respiratory	100%
202094633811	7.11E-09	1.76E-05	9.49E-05	respiratory	7.54E-09	9.78E-05	respiratory	94%
210156040811	1.06E-07	3.15E-04	3.67E-04	developmental	1.06E-07	3.67E-04	developmental	100%
210415198511	7.45E-08	4.54E-05	8.39E-04	respiratory	7.45E-08	8.39E-04	respiratory	100%
210595891711	6.59E-08	9.84E-05	2.27E-04	developmental	6.61E-08	2.28E-04	developmental	100%
211016067211	5.84E-08	4.38E-05	3.10E-04	respiratory	5.88E-08	3.11E-04	respiratory	99%
211117353711	4.70E-08	1.36E-04	4.37E-04	respiratory	**1.99E-06**	1.63E-02	developmental	2%
211456037011	1.66E-08	1.20E-05	1.22E-04	respiratory	1.66E-08	1.22E-04	respiratory	100%
211617335511	8.74E-08	1.24E-05	5.90E-04	developmental	8.74E-08	5.90E-04	developmental	100%
211675933111	3.14E-08	3.63E-05	1.12E-04	respiratory	3.39E-08	1.38E-04	respiratory	93%
211775196711	5.71E-08	2.84E-05	1.98E-04	developmental	5.73E-08	1.99E-04	developmental	100%
211835561611	1.44E-07	6.03E-05	5.05E-04	respiratory	1.44E-07	5.59E-04	respiratory	100%
211995787711	3.66E-09	2.68E-06	2.69E-05	respiratory	5.04E-09	4.12E-05	respiratory	73%
212235742811	6.99E-08	5.34E-05	6.23E-04	respiratory	1.01E-07	2.22E-03	neurological	69%
212336098611	4.29E-08	3.25E-05	1.86E-04	respiratory	4.29E-08	1.86E-04	respiratory	100%
220198361211	8.99E-08	1.15E-04	3.57E-04	respiratory	8.99E-08	3.57E-04	respiratory	100%
220317354411	8.35E-09	3.45E-06	1.30E-04	respiratory	8.35E-09	1.91E-03	respiratory	100%
220778020711	3.42E-08	4.41E-05	1.54E-04	skeletal	3.42E-08	1.54E-04	skeletal	100%
220797446811	5.91E-08	8.76E-06	7.69E-04	respiratory	5.91E-08	7.69E-04	respiratory	100%
230055823511	9.69E-09	7.28E-06	2.63E-04	respiratory	2.00E-08	4.80E-04	respiratory	48%
240017717711	5.30E-08	1.05E-05	5.12E-04	respiratory	5.70E-08	5.50E-04	respiratory	93%
240036084311_1	5.44E-08	2.60E-04	4.22E-04	respiratory	5.44E-08	4.22E-04	respiratory	100%
240036084311_2	2.26E-08	7.64E-05	2.36E-04	respiratory	2.26E-08	2.36E-04	respiratory	100%
240055155011	2.02E-08	5.05E-05	1.65E-04	developmental	2.02E-08	1.65E-04	developmental	100%
240176011511	2.34E-08	2.95E-05	1.62E-04	respiratory	5.59E-08	2.41E-03	respiratory	42%
240197945511	1.42E-09	7.89E-07	3.77E-05	respiratory	1.42E-09	3.77E-05	respiratory	100%
240315998011	2.09E-09	9.91E-06	2.66E-05	respiratory	2.09E-09	2.66E-05	respiratory	100%
240336011911	1.35E-08	2.30E-05	6.79E-05	respiratory	1.39E-08	6.97E-05	respiratory	98%
250017718511	1.08E-09	2.05E-06	2.68E-05	respiratory	1.08E-09	2.68E-05	respiratory	100%
250055058811	1.10E-08	1.66E-05	2.90E-04	respiratory	1.26E-08	3.06E-04	respiratory	87%
250136028411	4.67E-09	1.18E-05	1.24E-04	respiratory	5.56E-09	1.33E-04	respiratory	84%
260178172811	3.55E-09	7.08E-06	4.61E-05	respiratory	3.56E-09	4.63E-05	respiratory	100%
260454174811	4.24E-08	1.01E-04	2.68E-04	respiratory	4.25E-08	2.69E-04	respiratory	100%
260655985211	2.03E-08	6.28E-05	8.00E-05	respiratory	6.27E-07	6.19E-03	respiratory	3%
261014856911	9.12E-09	7.56E-07	2.02E-04	respiratory	9.12E-09	2.02E-04	respiratory	100%
261037778411	7.16E-09	2.23E-06	1.78E-04	skeletal	7.16E-09	1.78E-04	skeletal	100%
261037779711	7.36E-09	1.61E-06	8.10E-05	respiratory	7.36E-09	8.10E-05	respiratory	100%
261157888311	3.85E-08	2.11E-04	1.36E-04	respiratory	4.02E-08	1.45E-04	developmental	96%

Table 2a – Maximum Predicted HEM-3 Chronic Risks
Actual Emissions

	Category Chronic Risk [1]				Facility Chronic Risk [1]			
Facility NEI ID	Cancer MIR	Cancer Incidence	Noncancer Max HI	Target Organ	Cancer MIR	Noncancer Max HI	Target Organ	SC % of Facility-wide Cancer Risk
261396336811	6.97E-09	7.67E-06	8.91E-05	respiratory	7.03E-09	8.94E-05	respiratory	99%
261398125511	4.48E-09	1.25E-05	4.51E-05	respiratory	4.53E-09	4.59E-05	respiratory	99%
261477239111_1	3.66E-08	6.30E-05	1.99E-04	skeletal	3.66E-08	1.99E-04	skeletal	100%
261477239111_2	4.13E-08	1.28E-04	2.20E-04	skeletal	4.13E-08	2.20E-04	skeletal	100%
261637422511	8.92E-08	7.33E-04	3.39E-04	respiratory	8.97E-08	3.41E-04	respiratory	99%
261638229311	1.86E-08	1.76E-04	8.85E-05	skeletal	1.92E-08	8.85E-05	skeletal	97%
270317039811	8.05E-08	5.57E-07	3.17E-04	respiratory	8.05E-08	3.17E-04	respiratory	100%
270616173211	2.62E-08	7.45E-06	1.72E-04	respiratory	2.63E-08	1.73E-04	respiratory	100%
271117072311	8.81E-09	1.21E-06	4.27E-05	skeletal	9.31E-09	4.27E-05	skeletal	95%
271416990811	3.11E-08	8.78E-05	1.14E-04	respiratory	3.12E-08	1.14E-04	respiratory	100%
271636772111	1.20E-08	3.89E-05	1.20E-04	respiratory	1.23E-08	1.21E-04	respiratory	98%
280197053011	8.63E-08	2.34E-05	7.24E-04	developmental	8.62E-08	7.22E-04	developmental	100%
280596251011	1.47E-08	1.32E-05	5.72E-05	respiratory	8.95E-08	1.39E-03	kidney	16%
280737154411	2.29E-08	5.23E-06	7.91E-05	developmental	9.49E-07	2.34E-02	neurological	2%
290716032111	2.50E-07	1.44E-03	9.16E-04	respiratory	2.54E-07	9.34E-04	respiratory	98%
290777496411	1.57E-08	8.48E-06	2.06E-04	skeletal	1.60E-08	2.09E-04	skeletal	98%
290837529611	1.11E-08	1.61E-06	4.27E-05	respiratory	1.11E-08	4.27E-05	respiratory	100%
290957663711	6.64E-09	2.14E-05	9.09E-05	respiratory	8.15E-09	1.06E-04	respiratory	81%
290957664111	5.09E-08	1.35E-04	1.82E-04	developmental	5.09E-08	1.82E-04	developmental	100%
290975321511	6.04E-09	1.44E-06	9.36E-05	respiratory	6.04E-09	9.36E-05	respiratory	100%
290995258811	8.85E-08	2.00E-04	3.65E-04	respiratory	8.87E-08	3.66E-04	respiratory	100%
291435363811	4.79E-08	2.17E-05	1.71E-04	developmental	4.79E-08	1.71E-04	developmental	100%
291656795111	2.05E-08	2.57E-05	1.54E-04	respiratory	2.05E-08	1.54E-04	respiratory	100%
291756688411	3.34E-08	8.63E-06	1.83E-04	skeletal	3.36E-08	1.84E-04	skeletal	99%
291836783411	8.36E-09	6.61E-05	4.84E-05	respiratory	8.36E-09	4.84E-05	respiratory	100%
291896816611	4.69E-08	2.21E-04	1.74E-04	respiratory	4.66E-08	1.73E-04	respiratory	100%
292017595411	1.23E-08	2.98E-06	1.11E-04	respiratory	1.23E-08	1.11E-04	respiratory	100%
300037851511	4.66E-09	9.93E-08	4.56E-05	respiratory	4.66E-09	4.56E-05	respiratory	100%
300837618511	2.22E-08	8.05E-07	2.26E-04	developmental	2.22E-08	2.26E-04	developmental	100%
300877765611	1.47E-07	5.82E-06	1.50E-03	developmental	1.47E-07	1.50E-03	developmental	100%
300877854911	3.85E-09	4.63E-08	7.83E-05	respiratory	9.86E-08	1.53E-04	respiratory	4%
301115270711	2.94E-08	6.86E-06	1.16E-03	respiratory	2.94E-08	1.16E-03	respiratory	100%
310018399211	3.21E-08	6.50E-06	1.73E-04	respiratory	9.02E-08	6.43E-03	skeletal	36%
310537766111	7.71E-09	2.72E-06	6.03E-05	respiratory	**3.69E-06**	4.74E-02	developmental	0%
310556732411	1.70E-07	2.40E-04	8.35E-04	respiratory	1.70E-07	8.35E-04	respiratory	100%
310798212011	2.96E-09	8.22E-07	4.38E-05	respiratory	2.96E-09	1.80E-02	respiratory	100%
311095281111	1.23E-08	7.86E-06	5.53E-04	skeletal	1.23E-08	5.53E-04	skeletal	100%
311117766511	1.81E-08	2.60E-06	1.99E-04	skeletal	8.18E-08	1.45E-03	respiratory	22%
311317303711	3.04E-08	8.19E-06	2.26E-04	respiratory	3.57E-08	3.97E-04	respiratory	85%
3201112758911	2.48E-09	1.25E-07	2.03E-05	respiratory	2.48E-09	2.03E-05	respiratory	100%
320137302011	2.94E-09	2.01E-07	2.17E-05	respiratory	2.94E-09	2.17E-05	respiratory	100%
330138178911	1.59E-09	5.29E-06	9.79E-06	respiratory	2.37E-09	2.81E-05	neurological	67%
330157287811	5.02E-09	3.17E-06	4.76E-05	skeletal	5.07E-09	4.76E-05	skeletal	99%
330157288011	9.22E-10	1.80E-06	2.47E-05	respiratory	9.22E-10	2.47E-05	respiratory	100%
340095133011	1.01E-08	1.90E-05	2.51E-04	respiratory	2.10E-08	1.70E-03	skeletal	48%
340158093811	9.37E-09	1.06E-04	9.43E-05	respiratory	1.36E-07	7.32E-03	respiratory	7%
340337989011	1.60E-08	6.02E-05	2.05E-04	respiratory	9.76E-07	1.04E-02	respiratory	2%
350315597111	3.98E-08	1.44E-06	3.71E-04	respiratory	3.98E-08	3.71E-04	respiratory	100%
350457197711	8.38E-08	1.49E-05	8.08E-04	respiratory	8.38E-08	8.08E-04	respiratory	100%
350457991911	3.42E-08	2.46E-05	3.12E-04	respiratory	3.42E-08	3.12E-04	respiratory	100%
360637417811	1.28E-08	1.10E-05	4.44E-05	developmental	1.28E-08	4.44E-05	developmental	100%
360718427811	7.72E-08	1.99E-04	2.03E-03	respiratory	7.86E-08	2.04E-03	respiratory	98%
360757980511	1.30E-09	1.28E-06	3.12E-05	respiratory	1.35E-09	3.14E-05	respiratory	96%
360818309011	3.26E-08	1.48E-03	8.51E-04	respiratory	1.77E-07	1.79E-03	respiratory	18%
361098542611	1.06E-07	7.06E-06	3.66E-04	developmental	1.04E-07	3.60E-04	developmental	100%
370218392811	9.34E-08	4.67E-05	5.76E-04	respiratory	1.11E-07	6.19E-04	respiratory	84%
370358370411	3.80E-08	1.41E-04	2.35E-04	respiratory	**5.55E-06**	1.54E-01	neurological	1%
370458300611	2.72E-08	2.23E-05	2.11E-04	respiratory	1.51E-07	7.17E-03	neurological	18%
370658124311	4.20E-09	9.14E-07	4.77E-05	respiratory	9.79E-08	6.72E-04	respiratory	4%
370718137511	5.02E-08	9.00E-05	1.78E-04	respiratory	**2.07E-06**	1.81E-03	liver	2%
370838048111_1	1.31E-10	3.26E-08	3.01E-06	#N/A	1.31E-10	3.31E-06	#N/A	100%
370838048111_2	2.28E-11	4.81E-09	2.68E-07	respiratory	2.28E-11	2.68E-07	respiratory	100%
371457826011	4.15E-08	2.71E-05	1.45E-04	respiratory	4.63E-07	2.79E-03	developmental	9%
371457826111	8.77E-08	2.69E-05	3.03E-04	developmental	1.36E-07	6.79E-04	developmental	65%
371698514011	7.14E-08	1.70E-04	3.62E-04	respiratory	2.81E-07	1.12E-02	neurological	25%
380558011011	1.31E-08	9.95E-07	4.73E-05	neurological	1.31E-08	4.73E-05	neurological	100%

Table 2a – Maximum Predicted HEM-3 Chronic Risks
Actual Emissions

	Category Chronic Risk [1]				Facility Chronic Risk [1]			
Facility NEI ID	Cancer MIR	Cancer Incidence	Noncancer Max HI	Target Organ	Cancer MIR	Noncancer Max HI	Target Organ	SC % of Facility-wide Cancer Risk
380578086311	3.09E-08	1.52E-06	1.13E-04	respiratory	3.09E-08	1.13E-04	respiratory	100%
380578086511	1.21E-08	7.01E-07	9.91E-05	respiratory	1.21E-08	9.91E-05	respiratory	100%
380578086611	5.12E-09	2.99E-07	6.42E-05	respiratory	5.14E-09	6.43E-05	respiratory	100%
380598087011	5.24E-08	1.53E-05	1.89E-04	developmental	5.28E-08	1.89E-04	developmental	99%
380658087911	8.07E-08	1.99E-05	3.02E-04	respiratory	8.07E-08	3.02E-04	respiratory	100%
3809316937511	3.51E-09	9.04E-08	2.81E-05	developmental	3.51E-09	2.81E-05	developmental	100%
390018101311	4.40E-08	1.73E-05	2.16E-04	respiratory	4.46E-08	2.24E-04	respiratory	99%
390018101411	1.71E-08	4.42E-06	1.05E-04	respiratory	1.78E-08	1.06E-04	respiratory	96%
390258294311	3.08E-08	5.25E-05	2.72E-04	skeletal	3.13E-08	2.72E-04	skeletal	99%
390318010811	2.89E-08	2.48E-05	9.98E-05	developmental	2.89E-08	9.98E-05	developmental	100%
390537983011	4.96E-08	1.81E-05	3.00E-04	respiratory	4.96E-08	3.00E-04	respiratory	100%
390538148511	2.62E-07	1.14E-04	9.47E-04	respiratory	2.67E-07	9.63E-04	respiratory	98%
390617738711	3.74E-08	2.58E-04	1.29E-04	developmental	3.72E-08	1.29E-04	developmental	100%
390818115711	4.84E-08	1.05E-04	1.71E-04	respiratory	4.84E-08	1.71E-04	respiratory	100%
390818190811	8.04E-08	3.60E-04	2.81E-04	respiratory	8.04E-08	2.81E-04	respiratory	100%
390938130811	2.98E-09	1.44E-05	2.79E-05	skeletal	2.44E-08	7.42E-04	neurological	12%
390958302011	3.41E-08	4.91E-05	7.25E-04	respiratory	4.42E-08	7.81E-04	respiratory	77%
400238449511	1.09E-08	2.23E-06	1.38E-04	skeletal	1.10E-08	1.39E-04	skeletal	99%
400798148711	7.35E-08	3.19E-05	4.17E-04	respiratory	7.35E-08	4.17E-04	respiratory	100%
400978522311	1.70E-08	1.07E-05	1.33E-04	respiratory	1.70E-08	1.33E-04	respiratory	100%
401018506011	1.06E-07	4.39E-05	5.65E-04	respiratory	1.06E-07	5.65E-04	respiratory	100%
401038519411	6.99E-08	2.14E-05	2.91E-04	respiratory	6.99E-08	2.91E-04	respiratory	100%
401318212411	1.08E-08	6.17E-06	1.49E-04	respiratory	2.90E-07	2.42E-03	respiratory	4%
410498171111	4.43E-09	1.39E-06	2.30E-05	skeletal	4.44E-09	2.30E-05	skeletal	100%
420038404811	1.84E-08	1.21E-04	6.85E-05	respiratory	1.84E-08	6.83E-05	respiratory	100%
420053866111	2.64E-07	1.97E-04	9.28E-04	respiratory	2.64E-07	9.28E-04	respiratory	100%
420073853711	1.72E-07	4.61E-04	8.90E-04	developmental	1.72E-07	8.90E-04	developmental	100%
420216594311	2.32E-08	8.28E-06	2.28E-04	respiratory	2.32E-08	2.28E-04	respiratory	100%
420216594411	4.86E-08	1.84E-05	5.71E-04	respiratory	4.86E-08	5.71E-04	respiratory	100%
420216594511	1.11E-07	3.08E-05	9.53E-04	respiratory	1.11E-07	9.53E-04	respiratory	100%
420257889011	1.49E-09	1.83E-06	1.35E-05	respiratory	1.49E-09	1.35E-05	respiratory	100%
420456662011	7.42E-09	1.81E-04	1.97E-04	respiratory	7.48E-09	1.97E-04	respiratory	99%
420632905911	1.17E-07	1.01E-04	5.26E-04	respiratory	1.17E-07	5.26E-04	respiratory	100%
420633005111	2.43E-08	1.87E-05	2.02E-04	developmental	2.43E-08	2.02E-04	developmental	100%
420633005211	2.36E-08	2.49E-05	1.38E-04	respiratory	2.36E-08	1.38E-04	respiratory	100%
420933881111	8.40E-09	1.29E-05	4.76E-05	skeletal	8.46E-09	4.76E-05	skeletal	99%
420953881711	2.39E-08	5.86E-05	6.29E-04	respiratory	2.03E-08	5.32E-04	respiratory	100%
420956558911	1.00E-08	2.20E-05	8.35E-05	developmental	3.76E-08	1.04E-02	respiratory	27%
420973762011	6.24E-08	5.95E-05	5.24E-04	developmental	1.74E-07	1.02E-03	respiratory	36%
421074105111	4.12E-08	3.77E-05	3.45E-04	developmental	4.12E-08	3.45E-04	developmental	100%
421074105211	9.27E-09	9.71E-06	7.75E-05	developmental	9.27E-09	7.75E-05	developmental	100%
421074735811	2.08E-09	2.03E-06	1.75E-05	developmental	2.09E-09	1.75E-05	developmental	100%
421078331411	2.51E-08	1.74E-05	2.10E-04	developmental	1.93E-07	1.24E-03	respiratory	13%
421078406511	9.89E-08	1.04E-04	8.30E-04	developmental	1.35E-07	1.55E-03	kidney	73%
421214760211	9.93E-09	4.51E-06	1.39E-04	respiratory	9.93E-09	1.39E-04	respiratory	100%
421333193911	2.84E-08	1.01E-04	1.68E-04	respiratory	2.85E-08	1.68E-04	respiratory	100%
450154120411	1.47E-07	5.90E-05	5.61E-04	respiratory	1.48E-07	5.69E-04	respiratory	99%
450158306711	2.51E-09	6.64E-06	1.36E-05	respiratory	2.80E-09	3.23E-05	neurological	90%
450436652811	1.85E-07	2.75E-05	6.41E-04	developmental	1.85E-07	6.41E-04	developmental	100%
450757870811	5.47E-08	1.44E-05	4.10E-04	respiratory	5.47E-08	4.10E-04	respiratory	100%
450797126411	9.18E-09	9.10E-06	1.07E-04	respiratory	9.20E-09	1.07E-04	respiratory	100%
460514962811	3.84E-10	3.00E-08	1.71E-05	respiratory	3.84E-10	1.71E-05	respiratory	100%
470016196011	3.40E-07	4.05E-04	1.18E-03	developmental	3.46E-07	1.23E-03	developmental	98%
470855720911	2.65E-08	1.27E-05	1.01E-04	respiratory	2.77E-08	1.08E-04	respiratory	95%
471454979111	9.17E-08	1.01E-04	3.66E-04	respiratory	9.17E-08	3.66E-04	respiratory	100%
471575720111	1.12E-07	3.68E-04	7.91E-04	respiratory	1.12E-07	7.93E-04	respiratory	100%
471614979311	7.05E-08	4.75E-05	3.45E-04	respiratory	7.24E-08	3.65E-04	respiratory	97%
471655610411	2.41E-08	5.28E-05	2.07E-04	respiratory	2.46E-08	2.12E-04	respiratory	98%
480134898511	1.91E-07	2.09E-05	6.61E-04	developmental	1.94E-07	4.80E-03	respiratory	98%
480295617211_1	7.47E-08	3.84E-04	9.72E-04	respiratory	7.47E-08	9.72E-04	respiratory	100%
480295617211_2	1.40E-07	6.90E-04	1.05E-03	respiratory	1.40E-07	1.05E-03	respiratory	100%
481494144811	2.50E-07	3.15E-05	8.63E-04	developmental	2.50E-07	8.63E-04	developmental	100%
481573968411	1.23E-08	8.75E-05	4.59E-04	skeletal	1.24E-08	4.64E-04	skeletal	99%
481754018411	2.93E-08	4.37E-06	2.39E-04	developmental	2.93E-08	2.39E-04	developmental	100%
481856436311	1.15E-08	6.38E-06	4.04E-05	respiratory	1.15E-08	4.10E-05	respiratory	100%
482034845611	2.92E-08	2.56E-05	1.17E-04	respiratory	2.92E-08	1.17E-04	respiratory	100%

Table 2a – Maximum Predicted HEM-3 Chronic Risks
Actual Emissions

	Category Chronic Risk [1]				Facility Chronic Risk [1]			
Facility NEI ID	Cancer MIR	Cancer Incidence	Noncancer Max HI	Target Organ	Cancer MIR	Noncancer Max HI	Target Organ	SC % of Facility-wide Cancer Risk
482794930011	3.86E-09	2.43E-07	1.89E-04	skeletal	3.81E-09	1.71E-03	respiratory	100%
482935650511	3.96E-08	5.09E-06	1.94E-04	respiratory	4.05E-08	1.98E-04	respiratory	98%
4830915628511	4.65E-08	1.56E-05	4.75E-04	respiratory	4.61E-08	4.71E-04	respiratory	100%
483755745311	8.90E-08	5.72E-05	4.50E-04	developmental	8.90E-08	2.38E-02	respiratory	100%
4839513385811	3.52E-08	3.73E-06	5.17E-04	respiratory	3.51E-08	5.14E-04	respiratory	100%
483957552911	4.46E-08	4.69E-06	3.73E-04	developmental	4.34E-08	2.04E-03	respiratory	100%
484014207311	1.37E-07	1.15E-04	6.22E-04	respiratory	1.37E-07	6.22E-04	respiratory	100%
484494164411	6.72E-09	2.21E-06	2.47E-04	skeletal	6.72E-09	2.47E-04	skeletal	100%
484877927311	1.38E-08	8.67E-07	6.51E-05	respiratory	1.38E-08	6.51E-05	respiratory	100%
490075066411	4.88E-08	5.24E-07	8.15E-04	respiratory	5.32E-08	3.48E-03	developmental	92%
490155050511	7.77E-08	2.45E-06	7.84E-04	respiratory	7.77E-08	7.84E-04	respiratory	100%
490155050611	4.93E-08	2.45E-06	4.58E-04	respiratory	4.94E-08	4.59E-04	respiratory	100%
490277558311	1.12E-08	4.11E-07	8.79E-05	respiratory	1.13E-08	3.64E-03	respiratory	99%
490476281811	9.69E-09	1.14E-06	8.85E-05	respiratory	9.69E-09	8.85E-05	respiratory	100%
510414181011	5.78E-08	1.14E-04	2.37E-04	respiratory	6.67E-08	3.26E-04	respiratory	87%
510836160611	9.03E-08	1.44E-05	7.06E-04	respiratory	9.03E-08	7.06E-04	respiratory	100%
510996148811	3.28E-09	2.68E-06	4.21E-05	respiratory	3.28E-09	4.21E-05	respiratory	100%
511175748311	7.10E-10	1.09E-07	1.87E-05	respiratory	1.63E-07	4.08E-04	respiratory	0%
511537520511	2.80E-08	1.87E-04	7.41E-04	respiratory	3.19E-08	8.63E-04	respiratory	88%
5119516530111	1.36E-08	7.53E-06	1.10E-04	developmental	4.00E-08	6.23E-04	neurological	34%
511994565211	1.43E-08	5.23E-05	3.85E-04	respiratory	1.55E-08	3.92E-04	respiratory	92%
517604039911	7.45E-09	1.81E-05	1.16E-04	respiratory	7.47E-09	1.17E-04	respiratory	100%
530416281311	1.79E-07	2.54E-04	6.19E-04	developmental	4.30E-07	7.65E-04	respiratory	42%
540236257011	1.35E-07	2.40E-05	4.67E-04	developmental	1.35E-07	4.67E-04	developmental	100%
540336271711	3.44E-07	2.99E-04	1.19E-03	developmental	3.44E-07	1.19E-03	developmental	100%
540494864511	1.44E-07	3.87E-05	1.32E-03	respiratory	1.44E-07	1.32E-03	respiratory	100%
540516902311	3.14E-08	1.86E-05	1.49E-04	respiratory	3.13E-08	1.48E-04	respiratory	100%
540536760811	1.20E-07	3.98E-05	4.61E-04	respiratory	1.20E-07	4.64E-04	respiratory	100%
5406116320111	8.63E-08	9.67E-05	7.33E-04	respiratory	8.63E-08	7.33E-04	respiratory	100%
540616773611	1.34E-07	1.33E-04	4.63E-04	developmental	1.33E-07	4.59E-04	developmental	100%
540616773811	8.79E-08	4.31E-05	7.34E-04	developmental	8.79E-08	7.34E-04	developmental	100%
540734782811	2.44E-07	6.55E-05	8.43E-04	developmental	2.44E-07	8.43E-04	developmental	100%
540796789111	3.29E-08	6.94E-05	2.17E-04	respiratory	3.33E-08	2.20E-04	respiratory	99%
550095295111	7.30E-09	1.19E-05	7.05E-05	skeletal	7.47E-09	7.05E-05	skeletal	98%
550114958511	6.91E-09	2.49E-06	6.04E-05	respiratory	7.95E-09	1.57E-04	neurological	87%
550217673611	3.01E-09	4.23E-06	4.52E-05	respiratory	3.07E-09	4.60E-05	respiratory	98%
550597509411	2.19E-08	1.41E-04	9.12E-05	respiratory	2.19E-08	9.12E-05	respiratory	100%
550717179611	1.39E-09	4.67E-07	5.54E-05	respiratory	6.75E-09	1.95E-01	respiratory	21%
550737078511	6.08E-09	5.05E-06	5.55E-05	respiratory	6.14E-09	1.40E-04	neurological	99%
550796330411_1	1.10E-07	4.33E-04	3.80E-04	developmental	1.10E-07	3.80E-04	developmental	100%
550796330411_2	1.24E-08	4.80E-05	1.04E-04	respiratory	1.24E-08	1.04E-04	respiratory	100%
551177692911	3.66E-08	4.92E-05	1.50E-04	respiratory	3.66E-08	1.50E-04	respiratory	100%
551237711211	1.21E-08	8.71E-06	9.65E-05	respiratory	4.52E-08	1.76E-03	neurological	27%
5600512810911	7.42E-09	5.27E-07	5.63E-05	respiratory	7.42E-09	5.63E-05	respiratory	100%
5600512811111	4.11E-09	2.91E-07	3.18E-05	respiratory	4.11E-09	3.18E-05	respiratory	100%
5600515064111	4.15E-09	2.80E-07	3.22E-05	respiratory	4.15E-09	3.22E-05	respiratory	100%
5600515659411	3.21E-08	4.34E-06	2.60E-04	respiratory	3.21E-08	2.60E-04	respiratory	100%
560057844911	1.09E-08	7.77E-07	8.08E-05	respiratory	1.08E-08	8.09E-05	respiratory	100%
560058041911	1.47E-08	1.41E-06	1.86E-04	respiratory	1.44E-08	1.82E-04	respiratory	100%
560096418211	1.72E-08	1.77E-06	1.88E-04	respiratory	1.72E-08	1.88E-04	respiratory	100%
560238419211	2.75E-07	8.70E-06	9.90E-04	developmental	2.75E-07	9.90E-04	developmental	100%
560314207711	1.34E-07	2.46E-06	6.43E-04	respiratory	1.40E-07	6.71E-04	respiratory	96%
560373962711	6.74E-08	7.84E-06	2.84E-04	respiratory	6.87E-08	2.91E-04	respiratory	98%
720577128511	8.58E-08	6.16E-05	7.65E-04	respiratory	8.58E-08	7.65E-04	respiratory	100%
720597129111	1.09E-06	1.00E-03	2.87E-02	respiratory	1.09E-06	2.87E-02	respiratory	100%
721236958711	**1.92E-06**	2.62E-03	5.04E-02	respiratory	**1.93E-06**	5.04E-02	respiratory	99%
721276878311	**9.36E-06**	6.38E-03	2.45E-01	respiratory	**9.26E-06**	2.43E-01	respiratory	100%
721377438511	**4.47E-06**	3.79E-03	1.17E-01	respiratory	**4.47E-06**	1.17E-01	respiratory	100%

1 BOLD indicates a cancer risk great than 1 in a million or a noncancer risk greater than 1

MEMORANDUM

FROM:	Sarah Benish, Nick Hutson, Erich Eschmann U.S. EPA/OAR
TO:	Docket ID. No: EPA-HQ-OAR-2018-0794
DATE:	January 2023
SUBJECT:	2023 Technology Review for the Coal- and Oil-Fired EGU Source Category

This memorandum documents detailed data and analysis, including costs and filterable PM and mercury emissions impacts, as part of the technology review the U.S. Environmental Protection Agency (EPA) conducted in accordance with section 112(d)(6) of the Clean Air Act (CAA) to identify developments in practices, processes, and control technologies applicable to sources subject to the National Emissions Standards for Hazardous Air Pollutants (NESHAP) for coal- and oil-fired electric utility steam generating units (EGUs) (40 CFR 63, subpart UUUUU). The analysis focused on developments that have occurred since the 2020 technology review (see EPA-HQ-OAR-2018-0794-0015). This memorandum is organized as follows:

1. Background
2. Filterable Particulate Matter (fPM) Emission Limit
3. Mercury Limit for Lignite-Fired EGUs
4. Review of Acid Gas Emission Limits

1. Background

Sections 112(d)(2) and (3) of the CAA direct the EPA to develop maximum available control technology (MACT) standards to control hazardous air pollutants (HAP) emissions from major sources. For coal- and oil-fired EGUs, the MACT standards for major sources were promulgated on February 16, 2012, and are codified at 40 CFR part 63, subpart UUUUU (commonly referred to as Mercury and Air Toxics Standards (MATS)).

Section 112 of the CAA establishes a two-stage regulatory process to develop standards for emissions of HAP. Under CAA section 112(f)(2), the EPA assesses the residual risk for a source category to protect public health with "an ample margin of safety" or to prevent adverse environmental effects considering energy, costs, and other relevant factors within 8 years of promulgation of standards. CAA section 112(d)(6) requires EPA to review technology-based standards and to revise them "as necessary (taking into account developments in practices, processes, and control technologies)" no less frequently than every 8 years. These two reviews are commonly combined into a single rulemaking and referred to as the "risk and technology review" or RTR.

The EPA did not promulgate any revisions to the MATS rule based on its findings in the 2020 RTR, concluding that the residual risk of HAP remains low and no developments in practices, processes, or control technologies support altering the standards. The 2020 Technology Review concluded that existing air pollution control technologies that were in use were well-established

and provided the capture efficiencies necessary for compliance with the MATS emission limits. However, in the 2020 Technology Review, the EPA did not consider developments in the cost and effectiveness of these proven technologies and did not evaluate the current performance of emission reduction control equipment and strategies at existing MATS-affected EGUs, to determine whether revising the standards were warranted.

Pursuant to Executive Order 13990 "Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis" (86 FR 7037; January 25, 2021), the EPA initiated review of the 2020 RTR. In the same action as the proposed rulemaking reaffirming it remains appropriate and necessary to regulate HAP, EPA solicited information on the cost and performance of new or improved technologies that control HAP emissions, improved methods of operation, and risk-related information to further inform the Agency's assessment of the MATS RTR. Generally, the commenters were unaware of new technology, but indicated the current technology is more widely used, more effective, and cheaper than at the time of adoption of MATS (EPA-HQ-OAR-2018-0794-4962, EPA-HQ-OAR-2018-0794-5121, EPA-HQ-OAR-2018-0794-4942). Specific data or information regarding the technology review used to support this proposed action are discussed within.

2. Filterable Particulate Matter (fPM) Emission Limit

a) Baseline fPM Rates

The EPA evaluated quarterly fPM compliance data for coal-fired EGUs from 2017 to 2021 for units in the contiguous United States based on data availability. Rate estimates of fPM were based on recent data submitted via the EPA's Compliance and Emissions Data Reporting Interface (CEDRI) by facilities with affected EGUs. Quarterly data from 2017 (variable quarters) and 2019 (quarters three and occasionally four) were first reviewed because data for all affected EGUs subject to numeric emission limits had been previously extracted from CEDRI. In addition, the EPA obtained first and third quarter data for calendar year 2021 for a subset of EGUs with larger fPM rates (generally greater than 1.0E-02 lb/MMBtu for either 2017 or 2019). The quarterly 2021 data summarizes recent emissions and also reflect the time of year where electricity demand is typically higher and when EGUs tend to operate more and with higher loads. We removed units from this analysis that have shut down, will shut down or no longer burn coal/oil by December 31, 2028, and report data in lbs/MWh. The EPA evaluated fPM rates for a total of 275 individual EGUs. Only one facility outside the continental United States is expected to be subject to MATS by the proposed compliance period (up to three years after the effective date of the rule amendments).

Since operation of an EGU can vary year to year in response to weather, fuel prices, and energy demand, all available quarterly fPM data were evaluated independently for each EGU. Summary statistics (median, max, 99^{th}, 95^{th}, 90^{th}, 85^{th}, 80^{th}, and 75^{th} percentiles) for each quarter were compiled to characterize emissions variability within the quarter and are discussed below. Linear interpolation was used when the desired percentile fell between two points. Because in some cases multiple EGUs are routed to a single stack or a single EGU is routed to two stacks, the number of stacks is not the same as the number of EGUs. For units that demonstrate compliance

National Emission Standards for Hazardous Air Pollutants: Coal- and Oil-Fired Electric Utility Steam Generating Units

Review of the Residual Risk and Technology Review

Summary of Public Comments and Responses on Proposed Rule (88 FR 24854 April 24, 2023)

April 2024

- Commenters further noted that the EPA employed a different data selection methodology for each of those years and based on type of compliance measure used (CEMS vs. stack test).
- Commenters suggested that the EPA analyze more comprehensive historical data sets across a longer timeframe rather than using a snapshot of EGUs demonstrating compliance with the proposed limit during selected quarters prior to concluding that continuous compliance with the proposed limit is achievable.
- Comment: They also suggested if the EPA eliminates performance testing as a compliance option, then the EPA should rely exclusively on a robust set of PM CEMS data in terms of the number of units and datapoints used.

Commenters also provided unit-specific comments and observations:

- Commenters stated the Coronado PM CEMS data that the EPA's referenced for the proposal are not representative of the unit operations or capabilities, stating 10 of 20 quarters reported 90th percentile fPM rates higher than the proposed 0.010 lb/MMBtu fPM standard and 16 of 20 quarters exceeded the baseline fPM rate of 0.0086 lb/MMBtu estimated at proposal. The Coronado operator reports that quarter three of 2019, which is used in the EPA's dataset, reflects normal operation without any maintenance or optimization activities that could have impacted emissions during that quarter.

- Commenters requested correction of what they said are two errors in the EPA's January 2023 Memorandum re: the 2023 Technology Review for the Coal- and Oil-Fired EGU Source Category. They said in Appendix C, Nearman Creek facility (ID 6064_B_N1) is listed as having a capacity of 240 MW. They said the correct capacity for Nearman Creek is 268 MW. The commenters also said that Nearman Creek is identified as having both an ESP and a baghouse as PM controls. They said this is incorrect as Nearman Creek does not have an ESP.

Commenters recommended that the EPA correct the deficiencies, as well as make the Agency's statistical analysis or Python code used for the fPM evaluation available for public review to ensure that the proposed fPM limit is not deemed arbitrary and capricious.

Response 1: EPA appreciates the commenters' observations regarding issues about the fPM data. The rationale for the final standards is discussed in section IV.D of the preamble.

For the proposal, the Agency selected quarterly data during the time of year where electricity demand is typically higher (winter and summer) and when EGUs tend to operate more with higher loads, as described in the 2023 Technical Memo (Docket ID No. EPA-HQ-OAR-2018-0794-5789). The Agency did not intentionally exclude quarters with higher emissions, however, the review focused on evaluating the lowest fPM rates EGUs had historically achieved with existing PM controls. However, if the Agency were able to pull data for every quarter for every EGU in this analysis, it would only lower the lowest achieved fPM rate, therefore potentially decreasing PM upgrade costs to meet a lower fPM limit. The Agency disagrees that the data set should remove potential periods when coal units were co-firing with natural gas, as the Agency is not responsible or controls how particular EGUs decide to operate.

In revising the analysis, the Agency reviewed the impacted facility list and made changes based on commenters feedback, such as removing EGUs that have converted to natural gas. EGU retirement plans were updated based on the comments received and the most recent NEEDS database. Many commenters did not provide specific EGUs to include or remove from the analysis, so we were unable to ensure these updates were included. Regarding unit-specific comments, EPA's analysis is based on net summer generating capacity, which has been reported to EIA as 240 MW for Nearman Creek. EPA will update our control information to reflect the absence of a cold-side ESP at this unit.

In response to concerns about the use of limited quarterly compliance data, EPA expanded the analysis to include all available fPM compliance data for 60 EGUs at 18 facilities, including EGUs that the 2023 Proposal indicated would be impacted by the 0.010 lb/MMBtu fPM limit. The EPA acknowledges commenters requested a review of compliance data spanning longer time periods (*e.g.,* 2017-2021 or all available compliance data since promulgation of MATS). Obtaining quarterly compliance data for nearly 300 coal-fired EGUs even for a shorter period of 2017-2021 would require 6,000 separate downloads from CEDRI (5 years of quarterly data for 300 EGUs), producing pdf files unable to be directly evaluated through programming languages and requiring translation of either 3 stack runs and averages or daily 30-day rolling averages for the quarter into Excel. Electronic reporting requirements taking effect in 2024 will enable the Agency to review compliance data in a more time-effective manner. In addition, reviewing all available compliance data for all EGUs would only potentially lower the lowest achieved fPM rate used in the PM upgrade and cost assumptions. Thus, review of additional data could potentially lower costs.

The Agency focused its additional data review on the highest-emitting EGUs, spanning a variety of PM controls, locations, and capacities, and include the Coronado units that the commenters reference above (see Case Study 15 in Attachment 2 to the 2024 Technical Memo, available in the docket), as well as the Gallatin (Case Study 20), Trimble (Case Study 22), and Mill Creek (Case Study 23) facilities that commenters discuss in their comments (Docket ID No. EPA-HQ-OAR-2018-0794-5910). The review of a more comprehensive historical data set reveals the vast majority of EGUs analyzed have long-term records consistently meeting fPM rates of 0.010 lb/MMBtu or lower. For instance, 22 of 30 quarters, (spanning from 2015 to the end of quarter 1 2023, which is more data than the commenters evaluated) assessed for the Coronado facility indicate an average fPM rate equal or less than 0.010 lb/MMBtu. Similarly, the 30-boiler operating day average PM CEMS data from Coronado are greater than 0.010 lb/MMBtu only approximately 30 percent of the time. The review of a more comprehensive data set also revealed the top 20 fPM emitting EGUs discussed in the 2023 Proposal have larger variations in fPM quarter to quarter. As a result of the additional data review, the Agency determined the lowest quarter's 99th percentile is effective to identify EGUs that have historically achieved lower fPM rates despite not being required to do so and without additional capital investments. In order to account for the unit-specific variability, the EPA also assesses the average fPM rate when estimating whether additional improvements may be needed. The details of this expanded analysis, including code plotting historical fPM rates, is included in the 2024 Technical Memo entitled "2024 Update to the 2023 Proposed Technology Review for the Coal- and Oil-Fired EGU Source Category," available in the docket.

operating scenarios. Commenters expressed concern that the EPA's reliance on existing data does not appear to have adequately considered the impact of the degradation in the effectiveness of emission control devices and may have overestimated affected units' ability to comply with the proposed limit. Commenters specifically mentioned units with the same flue gas path and air pollution control equipment in series, yet the units result in significant differences in fPM reduction capabilities. Commenters indicated that some PM control technologies, such as, hotside ESPs, inherently have higher PM emissions. Commenters noted that depending on the coal combusted, units that utilize hydrated lime as a control technology for minimizing HAP, like Hg and sulfuric acid, inherently have higher PM emissions. Commenters noted that wet FGD may also result in higher PM emissions in particular, higher variability in fPM emission rates because wet FGD can either add particulate from mist eliminators or remove additional particulate. Commenters recognized that because control devices perform at their optimum when operating at full-load, steady state conditions, and additional transient operation will negatively affect their removal rates. Commenters stated that while PM emissions may be lower during low-load periods, there generally is particulate layout in the duct work during such periods and, as units ramp to higher loads, the particulate re-entrains, potentially leading to higher emissions, in addition at low loads, wet FGD mist eliminators operate at reduced efficiency and wet FGD slurry carryover can increase PM emissions at reduced loads. Commenters requested that the EPA factor in specific types of control configurations. Commenters noted that if the fPM limit were lowered to 0.006 lb/MMBtu instead of 0.010 lb/MMBtu, units with ESPs may be required to add FFs. They also stated this will leave virtually no margin to maintain compliance in the absence of significant upgrades to the emission control device(s) performance, which would not be cost effective for units with a remaining service life of less than six years.

Commenters noted that the highest emitting units have the oldest equipment, particularly those with scrubbers and ESPs, and that replacement or improvements to degraded controls should allow these units to meet the proposed 0.010 lb/MMBtu fPM standard.

Response 1: The EPA acknowledges these comments submitted about the variation of PM removal efficiencies based on control configuration. The EPA evaluated different control configurations for the proposal in Table 3 in the 2023 Technical Memo (Docket ID No. EPA-HQ-OAR-2018-0794-5789). This review found that EGUs with wet scrubbers only are associated with the largest fPM rates, and that other control configurations have lower fPM rates on average. The EPA also acknowledges that some control configurations have inherently higher PM emissions and that some downstream control devices (dry sorbent injection, activated carbon injects, *etc.*) can add particulate loading to the flue gas stream. But, as the EPA has noted several times, 93 percent of sources operating by the compliance period have demonstrated an ability to comply with the more stringent fPM limit of 0.010 lb/MMBtu. Those EGUs include units with a variety of downstream control configurations, including hotside ESPs, dry sorbent injection, and activated carbon injection, *etc*.

The Agency disagrees with commenters that the reliance on historical fPM compliance data does not consider the impact of degradation of the effectiveness of emission control devices that may overestimate unit's ability to comply with the proposed limit. However, the Agency recognizes that EGUs that may have demonstrated an ability to meet a lower fPM rate in the past may not do so consistently. For this reason, the fPM analysis assumptions have been updated to assess

both the lowest achieved fPM rate (defined as the lowest quarter's 99th percentile) and average of all evaluated fPM data when estimating PM upgrades. The average fPM rate will account for unit variability as well as some degradation of emission control effectiveness. In cases where the EGU has demonstrated an ability to meet a lower rate but does not do so on average, the Agency has updated PM assumptions based on the PM controls at the facility. If the EGU already has a fabric filter, we assume increased bag frequency change-out (unit specific) or an O&M cost of $100,000/year for EGUs without fabric filters. These assumptions are described in the 2024 Technical Memo entitled "2024 Update to the 2023 Proposed Technology Review for the Coal- and Oil-Fired EGU Source Category," and unit-specific cost assumptions are provided as an excel attachment to the memo.

Related to the comment about EGUs with ESPs needing to install FFs to meet a more stringent limit of 0.006 lb/MMBtu, this comment is not relevant as the Agency did not finalize this standard and therefore does not require a response.

Lastly, the Agency agrees with commenters that usually the highest emitting EGUs have the oldest equipment, and that improvements found to be cheaper than assumed at the original MATS rulemaking will allow EGUs to meet a limit of 0.010 lb/MMBtu.

2.4 Compliance Demonstration

2.4.1 Removal of PM LEE

Comment 1: Commenters stated that if there are to be changes to the numerical emission limit, then there should not be a change to the compliance demonstration method or to the frequency of testing to meet a numerical limit that is only two-thirds of the fPM emission rate that defined a LEE under the previous rule.

The commenters said that sources that are not "low-emitting sources" and required to install a PM CEMS are subject to more stringent requirements associated with the development of the PM CEMS correlation curve (see Performance Standard 11, Section 13.2), which are exceptionally challenging to develop irrespective of the source emitting status.

Commenters stated that this is especially true for EGUs that are equipped with FF PM control devices (baghouses) or equipped with an ESP and a FGD. Baghouses are the most effective fPM control devices available and typically an FGD will control an additional 70% of the fPM remaining after the exhaust gas passes through the ESP, which alone removes 98% - 99% of the fPM. The commenters said that so long as there is not a physical or permitted capability to allow discretionary bypass of the baghouse or ESP/FGD combination, there is no need to require continuous fPM monitoring. With these control equipment devices, which result in extremely low fPM emissions, in place, a requirement to site, procure, install, certify, operate and maintain, quality assure and maintain a data acquisition and handling system to record and maintain records is unnecessary and only serves to increase the cost of the demonstration of compliance with no demonstrated monetized benefit.

Commenters stated that there is no need to either require emissions measurement more frequently than the current fPM LEE schedule or require the use emissions measurement

shutdown, and malfunction periods) for Case Study 1 range from near-zero to 1.33 lb/MMBtu from one unit at the facility. The 30-boiler operating day averages for this unit range from 0.001 to 0.015 lb/MMBtu, considerably smoothing out the variable hourly averages. As mentioned above, there was no regulatory reason for this EGU to operate and report emissions less than the limit. In addition, in response to concerns about operational factors, as described in 63.10010(i)(4), data from PM CEMS during any scheduled maintenance are excluded when determining compliance. The EPA agrees with commenters that plantwide averaging is another compliance flexibility available to owners and operators.

Comment 2: Commenters suggested the Agency take into consideration the many variables affecting fuel characteristics. Commenters stated the availability of coal is limited to certain regions and, as a result, the characteristics of coal vary depending on location and may impact the unit's ability to demonstrate continuous compliance with the proposed fPM standard. Commenters noted that the ash content of the coal being fired may impact the ability of units to comply with the proposed limit, regardless of the effectiveness of the control technologies in place. Commenters conveyed that using fuel oil for startup and stabilization may impact the ability of units to comply with the proposed limit due to decreases in the removal effectiveness of the ESPs for a short period of time until enough coal is introduced so that the amount of coal ash in the combustion process has scoured the coating of the collecting plates and wires. They expressed concern that the costs associated with adding an FF to well-controlled units cannot be justified simply to address issues which arise rarely and for a short period of time.

Response 2: The Agency thanks commenters for providing these comments and agrees fuel characteristics can impact fPM emissions. Using fuel oil during periods of startup for short durations will likely raise fPM emissions for a short period of time, and the 30-day rolling average period will lessen its impact. The Agency previously evaluated the impact of fuel characteristics on fPM emission rates in the 2023 Technical Memo (Docket ID No. EPA-HQ-OAR-2018-0794-5789). This review found for the majority of EGUs burning either bituminous or subbituminous on average have lowest achieved fPM rates below the most stringent standard considered, with larger 95th percentiles of approximately 0.0106 and 0.0155 lb/MMBtu, respectively. These larger fPM values are found for only a few EGUs and are not surprising as there was little incentive towards reducing fPM rates already 50-65% below the standard (and outside the industry compliance margin).

Comment 3: Commenters suggested that the age and retirement date of affected units with ESPs should be considered. If an affected unit is planning to retire soon after the effective date of the proposal, installation of FFs would not be a cost-effective choice for the plant owner, who might choose to shut down the plant early and unnecessarily stress electricity generation supply or capacity. The commenters said that to maximize the flexibility of existing coal-fired units, maintain grid flexibility and to provide flexibility in the electric transmission system, the 0.010 lb/MMBtu standard should be preferred.

Response 3: The Agency agrees that age and retirement date of affected EGUs should be considered. Of EGUs not meeting the 0.010 lb/MMBtu proposed standard, 14 have announced retirement dates spanning from 2030 to 2042, half of which only have an ESP for controlling fPM (Labadie, Roxboro, Mayo, and Jim Bridger). To meet a 0.010 lb/MMBtu limit, the EPA

estimates ESP upgrades would be required for Labadie, Roxboro, and Mayo, while Jim Bridger only requires O&M at $100,000/year. Therefore, installation of FF would not be required at these EGUs to meet a 0.010 lb/MMBtu standard.

Comment 4: Commenters stated that the EPA must also investigate whether there are sufficient vendors to perform fPM upgrade projects or install new fPM controls. The commenters said that NRECA's Technical Report estimates that 26 units will be required to upgrade ESPs if the EPA sets the fPM emissions limit at 0.010 lb/MMBtu. This number grows substantially to 52 ESP-controlled units that would need to retrofit to a FF if the limit falls to 0.006 lb/MMBtu. Commenters said they believe there are only about 4 active vendors in the United States market.

Response 4: The EPA thanks commenters for providing these comments. In this final rule, the EPA estimates 2 EGUs may require a FF install, 11 may require ESP upgrades, 10 need either a bag type upgrade or increased changeout frequency, and 10 need O&M to meet the final fPM limit of 0.010 lb/MMBtu. The compliance deadline is three years after publication in the Federal Register, and owners and operators may request an additional year for installation of controls if necessary.

2.5.2 Intersection with Other Power Sector Rules

Comment 1: Commenters identified future regulations such as the Interstate Transport Rules and Regional Haze SIPS that may result in installation of DSI or SDA technologies to reduce SO_2 emissions are expected to increase inlet PM loading to the FFs due to more hydrated lime and reaction byproducts placing those units at risk of not being able to meet the proposed fPM standard of 0.010 lb/MMBtu. Commenters indicated that some units may inject sodium or calcium-based products upstream of the PM collection equipment which increases PM loading.

Commenters also requested that the EPA maximize all regulatory flexibilities at the Agency's disposal to align the requirements of the 2023 Proposal and the Proposed CAA section 111(d) Guidelines. The Proposed CAA section 111(d) Guidelines are part of an unprecedented rulemaking package that will transform the electric sector and will come at a similarly unprecedented cost that will be borne by individual residents and businesses. Commenters suggested, rather than exacerbate these costs and strain system reliability by imposing serial outages, the EPA should utilize its substantial discretion under CAA section 112 and decline to revise fPM standards for "long-term" coal units.

Commenters stated that CAA section 111(d)(6) affords the EPA significant discretion in determining whether to revise standards for sources within a source category: "The Administrator shall review, and revise as necessary…" (42 U.S.C. § 7412(d)(6)). Commenters urged the EPA to exercise this discretion and decline to establish fPM requirements for units designated as "long term" units in CAA section 111(d) state plans. Commenters stated that the 2023 Proposal itself acknowledges the breadth of the EPA's discretion. They said the EPA has proposed not to revise multiple standards established by the MATS—the acid gas standards for coal-fired units, the standards for continental and non-continental liquid oil-fired units, and the standards for existing IGCC units. The commenters said, notably, this demonstrates that the EPA is able to parse the need to revise standards for some pollutants and not others, within a single category of sources.

Commenters stated that likewise, it is well within the EPA's discretion to recognize coal-fired electric generating units designated as long-term units in CAA section 111(d) state plans and decline to revise fPM standards for these units—similar to its recognition of "non-continental units." They said, importantly, the EPA intends for states to designate units as long-term units no later than 2026 and that this timeline ensures that existing coal units that are not designated as long-term units would be subject to compliance with any revised fPM standard by the applicable statutory deadline.

Response 1: The EPA acknowledges and thanks commenters for these comments. Regarding aligning requirements of this rulemaking with the 111(d) Proposed Emission Guidelines, CAA section 112 specifies different requirements for compliance. Specifically, as defined in CAA section 112(i)(3)(A) "…the Administrator shall establish a compliance date or dates for each category or subcategory of existing sources, which shall provide for compliance as expeditiously as practicable, but in no event later than 3 years after the effective date of the standard." The Agency has not previously subcategorized based on retirements under CAA section 112, and do not find it appropriate to do so at this time.

2.6 Costs

2.6.1 General

Comment 1: Commenters suggested that the EPA's justification relies heavily on the Agency's estimation of lower than anticipated costs of control technology, significantly underestimating the 2023 Proposal's feasibility and cost of compliance. Commenters advocated that lower costs are neither developments in practices, processes, or control technologies as referenced in CAA section 112(d)(6), nor do lower costs equate to being cost-effective. They noted that the EPA's cost estimates seem to be substantial underestimates. Commenters felt that the EPA provides inaccurate cost estimates for tightening of the current fPM limitations and adequate consideration to the cost impacts of the 2023 Proposal have not been given, particularly for small power generation operators. They recognized that the EPA is required to factor in costs for the RTR analysis; however, in this case, commenters provided that the 2023 Proposal's cost estimates fail to account for all of the fPM upgrades and/or installations required for compliance with the new proposed lower limit. Commenters stated the EPA's cost study was deficient in terms of the number of ESP equipped units required to retrofit improvements, the capital cost assigned for the most significant ESP improvements, improvements in FF operation and maintenance, FF retrofit, and estimates of $/ton cost effectiveness incurred.

Commenters also stated that the EPA's deflated and unrepresentative fPM baseline is not accurate and therefore it is not possible to project the number of units that will need upgrades which lead to cost per ton underestimates that erode the EPA's overall assumption that the 2023 Proposal is cost effective. Specifically, commenters said the EPA's estimate that only 20 units are likely to incur any costs to meet the new standard is incorrect. As an initial matter, it is fatuous to conclude that a unit that happened to emit in a single quarter out of the last 20 quarters at 0.010 lb/MMBtu or less will not be required to do anything to meet the proposed revised standard. The commenters referred to a chart of data and said that even a unit that the EPA says has a "baseline fPM rate" of 0.086 lb/MMBtu was actually emitting more than 0.010 lb/MMBtu

(including controls the EPA considered during the development of the original MACT standards)." 88 FR 24863 (April 24, 2023). The EPA responds to comments on underestimated costs in section IV.C.1 of the preamble.

We also disagree with commenters that using the lowest demonstrated fPM rate is not useful to estimate which EGUs may need to upgrade PM controls. We recognize that EGUs may be capable of meeting lower emission rates, but may not consistently perform at such low emission rates. As such, the analysis has been updated to use the average of all quarterly data reviewed or the lowest achievable fPM rate (lowest quarter's 99th percentile) to identify EGUs requiring improvements to PM controls. Additional details of the revised PM analysis are discussed in the 2024 Technical Memo entitled "2024 Update to the 2023 Proposed Technology Review for the Coal- and Oil-Fired EGU Source Category."

Regarding comments that the proposed changes will cause inconsistency with existing permitting authorities' boilerplate special condition language and guidance documents, EPA routinely revises its regulations due to statutorily required reviews.

Regarding comments that costs of annual compliance costs will fall disproportionately on a few facilities, the EPA points out that the fleet has been able to "over comply" with the existing fPM standard due to the very high PM control effectiveness of well-performing ESPs and FFs. However, the performance of a few units lags well behind the vast majority of the fleet. For instance, Colstrip is the highest emitting EGU the EPA assessed and the only facility that the EPA is aware of not using the most modern PM controls (*i.e.,* ESP or FF), and instead using a venturi wet scrubber as the only means for fPM controls. In addition, to the comment that emissions are already at a level that does not pose a danger to the environment or public health, as well as emissions will only be incrementally reduced by this rule, the EPA's finding that there is an ample margin of safety under the residual risk review in no way interferes with the EPA's obligation to require more stringent standards under the technology review where developments warrant such standards. Indeed, the technology review required in CAA section 112(d)(6) further mandates that the EPA continually reassess standards to determine if additional reductions can be obtained, without evaluating the specific risk associated with the HAP emissions that would be reduced.

Regarding the comments that EPA overestimated costs of compliance, the Agency has reviewed the additional information the commenters referenced and agrees with the commenters that ESPs are able to achieve greater fPM emission reductions at lower costs than assumed at proposal. We have lowered the costs of some ESP upgrades and increased the collection efficiencies, as shown in Table 3 of the 2024 Technical Memo. The impact of these updates to the ESP assumptions is a reduced need for EGUs to install a FF to meet a fPM limit of 0.006 lb/MMBtu, which lowers annual costs to approximately $400 MM. However, as described in the final rule and throughout this document, the EPA is finalizing a fPM limit of 0.010 lb/MMBtu as this is the lowest possible fPM limit utilizing PM CEMS.

As stated in Chapter 1 above, the EPA requested comment on whether EGUs should be able to continue to use quarterly emissions testing past the proposed compliance date for a certain period of time or until EGU retirement, whichever occurs first, provided the EGU is on an enforceable

contribution to chronic and acute health disorders, as well as adverse impacts on the environment." (Final Rule, Revocation of the 2020 Reconsideration and Affirmation of the Appropriate and Necessary Supplemental Finding, 88 FR13956, 13968 (Mar. 6, 2023)). They said because of the proximity of the Northern Cheyenne tribal members to the Colstrip plant-living both on the Reservation and in the nearby community of Colstrip, where many tribal members are employed-they are disproportionately impacted by exposure to HAP.

The commenters stated that although cost-effective pollution controls are available to reduce toxic air emissions from Colstrip Units 3 and 4, namely baghouses and ESPs, Colstrip's owners have refused to install them and as a result, Colstrip has the highest rate of fPM emissions (a surrogate for non-Hg HAP) in the country and is the only plant still operating without industry-standard PM controls. They asserted that Colstrip has a history of exceeding even the current standard for non-Hg HAP.

The commenters stated that two of Colstrip's owners-NorthWestern Energy and Talen Montana-and Rosebud mine owner Westmoreland oppose the EPA's proposal to strengthen the MATS rule to align with CAA requirements. They said that according to the companies, compliance with lower limits for non-Hg HAP would be too costly. The commenters said that such arguments irresponsibly ignore the acute health effects-including premature deaths that Colstrip's toxic emissions have on Northern Cheyenne tribal members and the many others who live in close proximity to the plant.

The commenters urged the EPA to finalize MATS and said that under the new standards, Colstrip Units 3 and 4 should be required to install the same controls that other plants around the country have already installed and to operate those controls to achieve maximum emission reductions, as the CAA requires per 42 U.S.C. § 7412(d)(2), (f).

Response 1: The EPA thanks commenters for providing additional information and fPM compliance data for the Colstrip facility, which has been considered when establishing the final emission standard. Setting an alternative emission limit of 0.025 lb/MMBtu through subcategorization requires distinction among class, type, and size of sources. Given the similar characteristics of this facility, which is not unique in its design and circumstances compared to the rest of the fleet, the EPA disagrees with the notion that a lower standard for a subset of coal-fired EGUs is warranted. In fact, the only difference in circumstances that the EPA is aware of is the use of less-effective PM controls at Colstrip. Specifically, Colstrip is the only facility that the EPA is aware of using a venturi wet scrubber as the only means for fPM controls. The venturi wet scrubber has not been effective maintaining fPM rates below the current standard of 0.030 lb/MMBtu, as other commenters have pointed out previous fPM rate exceedances. As described in the 2024 Technical Memo, Colstrip is the only facility the EPA estimates need an FF install to comply with a 0.010 lb/MMBtu standard. Further rationale for the final emission standards is discussed in section IV.D of the preamble.

Regarding comments about the impact of closing Colstrip on reliable electrical service, facilities may request an additional time extension through the Department of Energy under the Federal Power Act section 202(c), which are made on a case-by-case basis based on a substantial need for grid reliability. In addition, as other commenters have noted, NorthWestern Energy has

recently joined the Western Resource Adequacy Program ("WRAP"), a regional reliability planning and compliance program in the West.

Comments supporting a lower fPM rate for the Colstrip facility are supportive of the Agency's position and do not require a response.

Comment 2: Commenters suggested further strengthening of the limit is essential because EGUs have seen significant improvements in fPM emissions rates since 2011 due to wider deployment of fPM control technologies on units projected by the EPA to be operating in 2028 which present a variety of approaches to lower fPM emission limits with implications for upgrades and actions required to meet a revised standard for fPM. Commenters felt an even stronger level could yield more health benefits and prevent hospital and emergency department admissions for cardiovascular and respiratory illnesses. Commenters in support of a lower more stringent limit stated that a fPM standard of 0.0024 lb/MMBtu would encourage many coal-fired EGUs to choose better-performing controls to achieve greater emission reductions using available control technologies in various configurations. Commenters suggested that the finding and fact that emissions performance still varies significantly not only supports revising the standards, but also provides support for a standard significantly below the proposed level of 0.010 lb/MMBtu. Commenters conveyed that the lagging performers in the coal fleet in particular are not even close to achieving the maximum degree of reduction in HAP emissions that can be achieved with proven controls and should be required to reduce their emissions further.

Response 2: We agree with commenters that further strengthening the fPM limit is essential. The rationale for the final emission standards is discussed in section IV.D of the preamble.

Comment 3: As an additional alternative, the EPA should establish a subcategory with units making an enforceable commitment to retire, where the fPM limit remains at 0.030 lb/MMBtu through retirement. Commenters expressed that the EPA's proposal to make the fPM limit more stringent, as well as require CEMS to demonstrate compliance with that limit, has far-reaching ramifications for EGUs, particularly given Colstrip's unique design and circumstances.

Response 3: The EPA's response about establishing a subcategory for EGUs making retirement commitments is provided in Chapter 2.5.2 of this document.

mined in North Dakota) has routinely demonstrated the ability to meet an emission limit of 1.2 lb/TBtu. The EPA also notes that, similar to many comments that were received on the 2023 Proposal suggesting that the proposed standard is unachievable, several commenters on the original MATS proposal argued, at that time, that the final Hg limit of 4.0 lb/TBtu for low rank (lignite) coal EGUs was "based on too little data" and was "technically and economically unattainable." (*See* 77 FR 9393).

The EPA assumed use of Gulf Coast lignite in the model plant calculation because the mean Hg content is higher than that of Fort Union lignite and thus should be more challenging to control. The EPA also does not "admit that brominated ACI is the only feasible option for lignite coal EGUs" and the Agency discusses the use of other technologies such as injection of chemical additives. However, even if use of brominated ACI was the only feasible option for lignite coal EGUs, that would not be a reason to not finalize the more stringent Hg emission standard. There is no requirement that the EPA identify more than one control technology to meet a final promulgated emission standard. The EPA does not mandate the use of any particular control technology. Rather, the EPA promulgates numerical emission standards (or, at times, work practice standards) and affected sources may meet the standard using a variety of control technologies or strategies.

Comment 10: Commenters stated that the EPA also overlooked key factors associated with lignite fuel. In asserting that the proposed 1.2 lb/TBtu limit could be achieved with additional activated carbon injection, they argued that the Agency failed to account for the impacts of the higher sulfur content of lignite coal as compared to subbituminous coal, and that such higher sulfur content leads to additional SO_3, which is known to negatively impact the effectiveness of activated carbon.

Response 10: The impact of coal sulfur content and SO_3 is discussed in section V.D of the preamble.

Comment 11: Commenters stated that neither the 2023 Technology Review memo nor the 2023 Proposal provide specific factual evidence to refute the 2020 Final Action or the 2018 Technology Review memo findings that there are no new developments in practice, processes, or control technologies for reduction of Hg emissions in coal-fired power plants. They said without providing the specific evidence that was allegedly considered, the EPA "determined that available controls and methods of operation will allow lignite-fired EGUs to meet the same Hg emission standard that is being met by EGUs firing on non-lignite coals, and the costs of doing so are reasonable." (88 FR 24880). Commenters argued that without that evidence and data, the EPA's alleged "determination" is arbitrary and capricious.

Response 11: The EPA did not rely exclusively (or even mostly) on information obtained from the CAA section 114 information request. The EPA relied on a variety of data sources in developing the proposed Hg emission standards for EGUs burning lignite. This included historical coal analyses, results from demonstration tests (including those conducted by DOE and others), publicly available Hg emissions data, and data and information obtained from owners/operators of lignite-fired EGUs from EPA's limited CAA section 114 information survey. We have discussed the rationale for the final emission standards – including the data and

CHAPTER 9

9. Statutory and Executive Order Reviews

9.1 Executive Order 12866: Regulatory Planning and Review and Executive Order 13563: Improving Regulation and Regulatory Review

Comment 1: The commenters urged the EPA to convene an interagency process and complete a cumulative impact analysis of the reliability issues associated with its entire "power sector strategy" before finalizing this rule. The commenters stated convening an interagency process aligns with Executive Order 13563, signed by President Obama, reaffirmed in President Biden's Executive Order 14094, "Modernizing Regulatory Review."

The commenters said the EPA recently signed a memorandum of understanding (MOU) with the U.S. Department of Energy promising "interagency cooperation and consultation on electric sector resource adequacy and operational reliability." The commenters stated there is no information in the docket about how the agencies will or have worked together and with FERC, NERC, and other stakeholders toward this goal and no public meetings have been held to further the goals of the MOU.

The commenters further stated that as part of this interagency process, the EPA should complete a cumulative impacts analysis of the reliability impacts of its power sector strategy that is informed by direct expert consultation with FERC, NERC, RTOs, and other grid experts. The commenters stated as part of its plan to remake the power sector, EPA has promulgated or proposed six rulemakings, including the proposed MATS RTR at issue in these comments, the Clean Water Act Effluent Limitation Guideline proposal, the recently finalized Ozone Transport Rule, the proposed rulemaking to lower the NAAQS for PM, and most recently, the new GHG emissions guidelines for existing coal-fired electric generating units. The commenters said the EPA is also continuing to implement the 2015 Coal Combustion Residue rule and responding to facility requests to continue to operate certain surface impoundments under the Part A and Part B programs promulgated more recently. The commenters stated these decisions alone impact 55 GW of electric generating capacity in 19 states. They said because all these rules affect the power sector, coal generation, and reliability, the impact of one rule cannot be understood without understanding the impacts of all the others.

Response 1: In parallel with the development of various rules that cover pollution from fossil fuel-fired electric generating units, the EPA has consulted a wide range of stakeholders, including other Federal agencies, reliability experts, and grid operators. To deepen this coordination, on March 9, 2023, EPA and DOE issued a Joint Memorandum of Understanding on Interagency Communication and Consultation on Electric Reliability to provide a framework for interagency cooperation and consultation on electric sector resource adequacy and reliability. The MOU outlines activities to monitor and share information to support the continued reliability of the electric system, including regular outreach and consultation with FERC, NERC, and other reliability and electricity grid-focused entities. There have been numerous events and engagements as part of the MOU effort, which have helped enhance linkages within the EPA and deepen our relationship with DOE. Perhaps most importantly, the MOU framework has allowed

a more robust and focused engagement with important stakeholders who are critical to ensuring that the grid operate efficiently and reliably. This process is not linked to any one regulatory effort or final action, but supports EPA's efforts to better understand the various the diverse set of perspectives. However, this process does not substitute for EPA's public comment process as part of individual regulatory efforts. Each regulatory effort includes technical support information and data related to resource adequacy and reliability, as it relates to that action. EPA plans release additional information on the Reliability MOU develops.

The final rule covers a small number of EGUs, and as shown in section 3.5.4 of the RIA for the final rule, the EPA does not project incremental changes in operational capacity to occur in response to the final rule. Because the EPA projects no incremental changes in existing operational capacity to occur in response to the final rule, the EPA does not anticipate this rule will have any implications for resource adequacy (see Resource Adequacy Analysis Technical Support Document, available in the docket). As EPA develops regulations, it reflects the cost of final actions and rules in the baseline. As such, the public has the ability to understand the incremental and cumulative impacts of various actions over time. For example, this action includes the costs and requirements of previously finalized efforts like the Final GNP and CCR actions. As future actions are finalized, those will include the requirements of this final action. While the EPA will continue to evaluate and isolate the potential impacts of final actions individually, the EPA also provides technical support information and data where relevant and as they relate to other regulations and the potential cumulative impacts.

For example, the EPA analyzed projected resource adequacy impacts of several recently finalized EPA rulemakings: the LDV, HDV and MDV (collectively "Vehicle Rules), Final 111 EGU Rules, ELG and MATS (collectively "Power Sector Rules") and found that, whether alone or collectively, these rules are unlikely to adversely affect resource adequacy. For further discussion, see Resource Adequacy Analysis: Vehicle Rules, Final 111 EGU Rules, ELG and MATS Technical Memo, available in the docket. Additionally, the EPA estimated the collective impacts of the vehicle rules, final 111 EGU rules, MATS and ELG. For further discussion of this modeling, see IPM Sensitivity Runs Memo, available in the docket.

FERC - NERC - Regional Entity Staff Report:

The February 2021 Cold Weather Outages in Texas and the South Central United States

Federal Energy Regulatory Commission
North American Electric Reliability Corporation
Regional Entities

FERC, NERC and Regional Entity Staff Report

The February 2021 Cold Weather Outages in Texas and the South Central United States

November 2021

FEDERAL ENERGY REGULATORY COMMISSION

NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

Regional Entities:

Midwest Reliability Organization, Northeast Power Coordinating Council, ReliabilityFirst Corporation, SERC Corporation, Texas Reliability Entity and Western Electricity Coordinating Council

I. Executive Summary

This report[1] describes the severe cold weather event occurring between February 8 and 20, 2021 and how it impacted the reliability of the bulk electric system[2] ("BES" or colloquially known as the grid) in Texas and the South Central United States (hereafter known as "the Event"). During the Event, extreme cold temperatures and freezing precipitation led 1,045 individual BES generating units,[3] (with a combined 192,818 MW of nameplate capacity) in Texas and the South Central United States to experience 4,124 outages, derates or failures to start. Each individual generating unit could, and in many cases, did, have multiple outages from the same or different causes. To provide perspective on how significant the generating unit outages were, including generation already on planned or unplanned outages, the Electric Reliability Council of Texas (ERCOT) averaged 34,000 MW of generation unavailable (based on expected capacity[4]) for over two consecutive days, from 7:00 a.m. February 15 to 1:00 p.m. February 17, equivalent to nearly half of its all-time winter peak electric load of 69,871 MW.

[1] This report is written for a reader who is already familiar with principles of energy markets, electric transmission system operations and generating unit operations. For readers who are not as familiar, the Team has linked to several resources which may be helpful:

[2] Bulk electric system generally means all transmission elements operated at 100 kV or higher and real power and reactive power resources connected at 100 kV or higher. This does not include facilities used in the local distribution of electric energy. *See* NERC Glossary of Terms at https://www.nerc.com/pa/Stand/Glossary%20of%20Terms/Glossary_of_Terms.pdf.

[3] A single generating unit can range from a 75 MW gas turbine, to a 1,000-MW-plus nuclear unit, to a wind farm with multiple wind turbines. For purposes of the report, only BES generating units were considered, i.e., those with a nameplate rating of 75 MW or higher.

[4] Expected capacity includes any expected seasonal capacity derates, and for intermittent resources (e.g., wind, solar resources), expected capacity is calculated based on weather conditions. For example, a 100 MW wind generation facility may be 20 MW, based on the variability of wind during the winter peak timeframe.

The Event was the fourth cold-weather-related event in the last ten years to jeopardize BES reliability,[5] and with a combined 23,418 MW of manual firm load shed,[6] the largest controlled firm load shed event in U.S. history. In each of the four BES events, planned and unplanned generating unit outages caused energy emergencies, and in 2011, 2014 and 2021 they triggered the need for firm load shed. The unplanned generation outages that escalated during the Event were more than four times as large as the previous largest event, in 2011 (65,622 MW versus 14,702 MW).

More than 4.5 million people in Texas lost power during the Event, and some went without power for as long as four days, while exposed to below-freezing temperatures for over six days.[7] At least 210 people died during the Event, with most of the deaths connected to the power outages, of causes including hypothermia, carbon monoxide poisoning, and medical conditions exacerbated by freezing conditions.[8] Among the deaths were a mother and her seven-year-old daughter,[9] and an 11-year-old boy who died in his bed,[10] who all died of carbon monoxide poisoning, and a 60-year-old disabled man who died of hypothermia.[11] A grandmother and three children trying to keep warm

---

[5] In February 2011, an arctic cold front impacted the southwest U.S. and resulted in 29,700 MW of generation outages, natural gas facility outages and emergency power grid conditions with need for firm customer load shed. Report on Outages and Curtailments During the Southwest Cold Weather Event of February 1-5, 2011: Causes and Recommendations (Aug. 2011) (https://www.ferc.gov/sites/default/files/2020-07/OutagesandCurtailmentsDuringtheSouthwestColdWeatherEventofFebruary1-5-2011.pdf) (hereafter, 2011 Report). In January 2014, a polar vortex affected Texas, central and eastern U.S., triggering 19,500 MW of generation outages, natural gas availability issues and resulted in emergency conditions including voluntary load management. NERC "*Polar Vortex Review*" (Sept. 2014), https://www.nerc.com/pa/rrm/January%202014%20Polar%20Vortex%20Review/Polar_Vortex_Review_29_Sept_2014_Final.pdf (hereafter Polar Vortex Review). And in January 2018, an arctic high-pressure system and below average temperatures in the South Central U.S. resulted in 15,800 MW of generation outages and the need for voluntary load management emergency measures. See South Central United States Cold Weather Bulk Electric Systems Event of January 17, 2018 (July 2019), https://www.ferc.gov/sites/default/files/2020-07/SouthCentralUnitedStatesColdWeatherBulkElectricSystemEventofJanuary17-2018.pdf (hereafter, 2018 Report).

[6] Manual firm load shed, often referred to as rolling or rotating blackouts, is when BES operators order a percentage of the demand or load to be temporarily disconnected, to avoid system instability or other system emergencies. Customers lost electric distribution service due both to manual firm load shed, as well as to weather-related unplanned outages (such as downed power lines). In addition to being the largest controlled firm load shed event in U.S. history, the Event was also the third largest in quantity of outaged megawatts (MW) of load after the August 2003 northeast blackout and the August 1996 Western Interconnection blackout.

[7] Paul Takashi, *I lost my best friend: How Houston's winter storm went from wonderland to deadly disaster*, Houston Chronicle (May 25, 2021), https://www.houstonchronicle.com/news/investigations/article/failures-of-power-series-part-2-blackouts-houston-16189658.php.

[8] Andrew Weber, *Texas Winter Storm Toll Goes Up to 210, Including 43 Deaths in Harris County*, Houston Public Media (July 14, 2021), https://www.houstonpublicmedia.org/articles/news/energy-environment/2021/07/14/403191/texas-winter-storm-death-toll-goes-up-to-210-including-43-deaths-in-harris-county/.

[9] ABC 13 Staff, *Carbon Monoxide "We tried our best to save them"*, ABC 13 Eyewitness News (February 17, 2021), https://abc13.com/houston-woman-and-daughter-die-from-carbon-monoxide-poisoning-mom-after-leaving-car-running-inside-garage-dangers-during-texas-winter-storn-storm-2021/10348847/

[10] KHOU Staff, *Autopsy Results Released for 11-Year-Old Who Died During the Texas Winter Freeze,* KHOU 11 News Channel (May 12, 2021) https://www.khou.com/article/news/local/conroe-police-autopsy-reveals-11-year-old-boy-died-carbon-monoxide-poisoning-houston-winter-storm/285-fbae9d3f-45cd-41bb-9047-33665fef8f18#:~:text=Autopsy%20results%20released%20for%2011,their%20mobile%20home%20lost%20power.

[11] Paul Takashi, *I lost my best friend: How Houston's winter storm went from wonderland to deadly disaster*, Houston Chronicle (May 25, 2021), https://www.houstonchronicle.com/news/investigations/article/failures-of-power-series-part-2-blackouts-houston-16189658.php.

using a wood-burning fireplace died in a house fire.[12] In cities including Austin, Houston and San Antonio, over 14 million people were ordered to boil drinking and cooking water, and multiple cities ordered water conservation measures, due to broken pipes and power outages (which lowered water pressure).[13] After the city of Denton, Texas, lost its gas supply, it was forced to cut power to nursing homes and water pumping stations.[14]

Analysts with the Federal Reserve Bank of Dallas estimated that the outages caused direct and indirect losses to the Texas economy of between $80 to $130 billion.[15] A separate Federal Reserve Bank of Dallas analysis described the effect on the petrochemical and refining sector as "hurricane-level," comparable to 2008's Hurricane Ike, with a 50 percent drop in February 2021 production as compared to January. It also predicted continuing effects on the supply chain through the end of 2021 as a result of the disruptions in February.[16]

A. Synopsis of Event

In the early morning hours of February 15, 2021, an arctic front moving through Texas and the South Central U.S. began to take its toll. As temperatures dropped, more and more generating units throughout Texas failed in ERCOT. The same front led to generating units to fail to a lesser extent in the South Central U.S. footprints of Midcontinent Independent System Operator (MISO) South and Southwest Power Pool (SPP).[17] Responding to the loss of generation, and to keep the electrical system from cascading outages and total blackout, the system operators at ERCOT began to issue orders for rotating outages of electricity to customers (known as manual firm load shed). ERCOT ultimately had to shed 20,000 MW of firm load at the worst point of the Event, with SPP and MISO

[12] Anna Bauman, *Grandmother, 3 Children Dead in Sugar Land Fire,* Houston Chronicle (Feb. 16, 2021), https://www.houstonchronicle.com/news/houston-texas/houston/article/Sugar-Land-fire-fatalities-15953492.php%20https://www.google.com/amp/s/abc13.com/amp/sugar-land-house-fire-children-killed-deadly/10352669

[13] Talal Ansari, *New Winter Storm Threatens Fragile Power Grids in Texas, Other Parts of U.S.*, The Wall Street Journal New (Feb. 22, 2021), https://www.wsj.com/articles/new-winter-storm-threatens-fragile-electrical-grids-in-texas-other-parts-of-u-s-11613588298; Elizabeth Findell, *Texas Cities Under Boil-Water Orders*, The Wall Street Journal (Feb. 19, 2021), https://www.wsj.com/articles/texas-cities-under-boil-water-orders-11613671450.

[14] Community Emergency Preparedness Committee, *City of San Antonio Community Emergency Preparedness Committee Report: A Response to the February 2021 Winter Storm* (Jun. 24, 2021), https://www.sanantonio.gov/Portals/5/files/CEP%20Report%20Final.pdf; Russell Gold, *Inside One Texas City's Struggle to Keep Power and Water Going,* The Wall Street Journal (Feb. 17, 2021), https://www.wsj.com/articles/texas-city-deals-with-no-power-no-water-during-big-chill-11613590412.

[15] Garrett Golding et al., *Cost of Texas' 2021 Deep Freeze Justifies Weatherization*, Dallas Fed Economics (Apr. 15, 2021), https://www.dallasfed.org/research/economics/2021/0415.

[16] Jesse Thompson, *Texas Winter Deep Freeze Broke Refining, Petrochemical Supply Chains*, Southwest Economy (Second Quarter 2021), https://www.dallasfed.org/research/swe/2021/swe2102/swe2102c (Texas holds nearly 75 percent of "basic U.S. chemical capacity," relied upon by global supply chains, and as much as 80 percent of this capacity was offline after the storm).

[17] See Figure 1 below for map of the Event Area: ERCOT, SPP and MISO South. Except for the figures regarding the entire MISO footprint in section II.B. below, the Team gathered data about and focused on MISO South, because the bulk of the manual load shed and unplanned generation outages experienced in MISO occurred in MISO South.

Regulatory Impact Analysis for the Final National Emission Standards for Hazardous Air Pollutants: Coal- and Oil-Fired Electric Utility Steam Generating Units Review of the Residual Risk and Technology Review

U.S. Environmental Protection Agency
Office of Air and Radiation
Office of Air Quality Planning and Standards
Research Triangle Park, NC 27711