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June 29, 2018

Via Federal Express and Email to tsirigotis.peter@epa.gov

Peter Tsirigotis
Director, Office of Air Quality Planning and Standards
U.S. Environmental Protection Agency
4930 Old Page Road
Durham, NC 27703

Re: National Emission Standards for Hazardous Air Pollutants for Coal- and Oil-Fired Electric Utility Steam Generating Units (the "Mercury and Air Toxics Standards"), EPA Docket ID No. EPA-HQ-OAR-2009-0234.

Dear Mr. Tsirigotis:

ADA Carbon Solutions, LLC ("ACS") understands that the U.S. Environmental Protection Agency ("EPA" or "Agency") may be re-evaluating the Mercury and Air Toxics Standards ("MATS" or "Rule")[1] and the underlying finding that regulation of hazardous air pollutants from coal- and oil-fired electric utility steam generating units ("power plants") under section 112 of the Clean Air Act is appropriate and necessary.[2] ACS offers this letter to inform EPA's analysis of these issues.

EPA should leave MATS in place unaltered, and should not disturb the Agency's "Supplemental Finding" that even after considering costs it remains appropriate and necessary to regulate power plants' hazardous air pollutant emissions.[3] EPA must recognize that any action EPA takes to undermine the Supplemental Finding could also undermine the legal foundation of the Rule. EPA should take no action against the Supplemental Finding or the Rule, which has now been in force for over three years and with which the electric power industry has now fully complied.

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1 77 Fed. Reg. 9304 (Feb. 16, 2012).

2 *Murray Energy Corporation v. EPA*, Docket No. 16-1127, ECF Doc. No. 1671687 (D.C. Cir. filed Apr. 18, 2017); *see also id.*, Order dated April 27, 2017, ECF Doc. No. 1672987 (holding cases in abeyance while EPA evaluates whether to reconsider the Supplemental Finding).

3 81 Fed. Reg. 24,420 (Apr. 25, 2016).

Both the electric power industry and the activated carbon industry have made substantial investments in reliance on the Rule, which was first published over six years ago and immediately provoked a market response. Since 2012, the Rule has provided the regulatory certainty needed to support the investments necessary not only to achieve compliance, but to increase efficiency and reduce compliance costs. Those investments will be jeopardized if EPA repeals or undermines the Rule or the Supplemental Finding, and any such action would not lead to significant cost savings for the electric power industry. The capital costs of complying with MATS already have been incurred, and repealing the Rule will not return those costs to the electric power industry. Further, as explained in this letter, costs avoided without the Rule—that is, the costs of operating and maintaining emissions controls and monitoring systems that have already been installed—would have a negligible impact on retail electricity prices. As implemented today, the Rule provides substantial, cost-effective health and environmental benefits by reducing emissions of mercury—a persistent neurotoxin—from the largest source category of those emissions.

MATS has been far less expensive for the electric power industry to meet than EPA had anticipated in 2012. In the end, the costs of the Rule do not suggest that regulation under section 112 is inappropriate in light of the substantial health and environmental benefits and the industrial investments that derive from the Rule.

MATS

MATS was announced in December 2011 and published in February 2012, more than six years ago. The Rule required existing coal- and oil-fired power plants to meet emissions limitations for mercury and other hazardous air pollutants by April 2015, or for sources that obtained a one-year extension, by April 2016. At this point, power plants have made and implemented their compliance decisions—whether to add controls, to switch from coal to natural gas as fuel, or to retire a unit—and those decisions will not be undone even if EPA repeals MATS.

When EPA promulgated MATS in 2012, the Agency satisfied a longstanding obligation to regulate hazardous air pollutant emissions from power plants under section 112 of the Clean Air Act. In December 2000, more than a decade earlier, the Agency had made its determination under section 112(n)(1)(A) of the Clean Air Act that regulating emissions of hazardous air pollutants from power plants under section 112 was "appropriate and necessary."[4] EPA reaffirmed its "appropriate and necessary" finding when it promulgated MATS in 2012.[5] Although the Rule itself was upheld against all legal challenges, the Supreme Court concluded that EPA had erred by not considering costs of compliance in evaluating whether regulation was "appropriate and necessary" within the meaning of section 112(n)(1)(A) and remanded the case to the D.C. Circuit without vacating the rule.[6] On remand the D.C. Circuit left MATS in place while EPA re-evaluated its finding. EPA conducted a formal notice and comment rulemaking and, in April 2016, EPA concluded in its Supplemental Finding that even after considering costs

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4 65 Fed. Reg. 79,825 (Dec. 20, 2000).

5 77 Fed. Reg. 9304 (Feb. 16, 2012).

6 *Michigan v. EPA*, 135 S. Ct. 2699 (2015).

in a variety of ways and other relevant factors, regulating hazardous air pollutant emissions from coal- and oil-fired power plants was "appropriate and necessary."[7]

The Costs Avoided by Rescinding MATS Would Be Very Small

As others reported to EPA at the time of the Supplemental Finding, the actual costs that the electric power industry incurred to comply with MATS were much lower than EPA had estimated when it promulgated the Rule. An analysis prepared by Andover Technology Partners in 2015 concluded that the true cost of complying with the Rule on an annualized basis was less than one-quarter of EPA's original cost estimate.[8] Part of what drove the lower costs were the substantial investments by ACS and others in the pollution control industry that enabled some power plants to comply with MATS using less capital-intensive emission controls than EPA had predicted.

At this point, more than six years after MATS was promulgated and more than three years after the Rule took effect, sources have made the investments in controls to comply, and these capital costs will not be saved if EPA repeals MATS. Thus, the only costs that are "avoidable" if MATS is rescinded are the costs associated with operating and maintaining controls and with monitoring to comply with the Rule.

A more recent analysis by James Staudt of Andover Technology Partners prepared in May 2017 analyzed those avoidable costs.[9] Andover Technology Partners performed a "bottom-up" analysis that identified the installations of pollution control technologies from 2014 through 2016 associated with MATS, and determined the related variable and fixed operating and maintenance costs of those controls. This included evaluating: (1) operating and maintenance costs for activated carbon injection for mercury control, which include the cost of using activated carbon, waste disposal, power consumption, and fixed operating and maintenance costs; (2) operating and maintenance costs of dry sorbent injection and lime injection systems installed to control acid gases, which include the cost of lime or trona, energy consumption, waste disposal, and

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7 81 Fed. Reg. 24,420 (Apr. 25, 2016).

8 Andover Technology Partners, Review and Analysis of the Actual Costs of Complying with MATS in Comparison to Predicted in EPA's Regulatory Impact Analysis, at 11, included as Exhibit 2 to Exhibit A of "Motion of Industry Respondent Intervenors to Govern Future Proceedings," *White Stallion Energy Center, LLC v. EPA*, D.C. Cir. Docket No. 12-1100, ECF Doc. No. 1574838 (filed Sept. 24, 2015), also attached as Exhibit 2 of Exhibit A to Comments of Calpine Corporation, Exelon Corporation, and Public Service Enterprise Group on EPA's Proposed Supplemental Finding (Jan. 15, 2016), EPA Docket ID No. EPA-HQ-OAR-2009-0234-20549, *available at* https://www.regulations.gov/document?D=EPA-HQ-OAR-2009-0234-20549; *see also* Declaration of James Staudt, Exhibit A to "Motion of Industry Respondent Intervenors to Govern Future Proceedings," *White Stallion Energy Center, LLC v. EPA*, ECF Doc. No. 1574838, at ¶¶ 14-15.

9 James E. Staudt, Andover Technology Partners, "Update of the Cost of Compliance with MATS – Ongoing Cost of Controls," White Paper (May 25, 2017), attached hereto as Exhibit 1.

fixed operating and maintenance costs; (3) operating and maintenance costs associated with chemical injection, which include the cost of oxidizing chemicals (such as bromine) and chemicals used to control reemission of mercury in wet scrubbers and fixed operating and maintenance costs; and (4) costs associated with monitoring of mercury and hydrochloric acid and increased frequency of particulate matter measurements. These are the only costs that would be "avoided" if MATS were not in effect.[10]

As explained in Exhibit 1, Dr. Staudt's updated analysis reveals that the costs that could be avoided if MATS were not in effect amount to only approximately $0.50 per megawatt hour, *i.e.*, $0.0005 per kilowatt hour. One-twentieth of a penny per kilowatt hour is very small relative to annual average retail electricity prices, which from 2014 through 2017 ranged from a low of $0.1027 per kilowatt hour in 2016 to a high of $0.1054 per kilowatt hour in 2017 (in nominal dollars).[11] In other words, the costs that are avoidable in the absence of the Rule amount to less than 0.5 percent of retail electricity rates, and therefore have a negligible impact on the cost of electricity.

Repealing MATS simply would not have a material effect on electricity prices or on the operating costs of fossil fuel-fired power plants.

Repealing MATS Would Cause Substantial Environmental and Economic Harm

At the same time, repealing MATS would impose substantial harm on public health and the environment, the pollution control industry, and the electric generators who have invested to comply.

First, MATS provides substantial health and environmental benefits that could be lost or diminished if MATS is upended. Mercury is a persistent neurotoxin, and exposure to methylmercury can result in long-term neurological harms.[12] Before MATS was adopted, power plants contributed half of anthropogenic mercury emissions in the United States.[13] By requiring power plants to meet federal emission standards for mercury, MATS has reduced those emissions. Nevertheless, fish advisories (both recreational and subsistence fishing) remain commonplace, and more work is needed to make fisheries safe from mercury contamination and to eliminate the risk to humans from the consumption of mercury-contaminated fish. If MATS

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10 The analysis also determined the fixed and variable operating and maintenance costs associated with fabric filters (also known as baghouses) that were installed to control particulate matter (as a surrogate for non-mercury HAP metals). However, because sources cannot simply "turn off" fabric filters even in the absence of MATS, sources will incur these operating and maintenance costs regardless of whether EPA leaves the Rule in place, alters it, or repeals it. Therefore, these costs should not be included in assessing the avoidable costs if MATS were not in effect.

11 U.S. Energy Information Administration, Electricity Data Browser, http://www.eia.gov/electricity/data/browser (accessed June 8, 2018).

12 *See* 76 Fed. Reg. 24,976, 24,999-25,003, 25,006-11, 25,018 (May 3, 2011).

13 76 Fed. Reg. at 25,002; 77 Fed. Reg. at 9310.

were repealed, power plant owners could and would simply turn off their activated carbon injection systems or other mercury emission controls. Mercury emissions would increase, raising the risk of harm to human health and the environment from mercury, and reversing the effort to provide reductions necessary to protect Americans from the dangers of mercury consumption. MATS remains an effective and necessary rule to address serious health and environmental problems.

Second, both the electric power industry and the activated carbon industry have made substantial investments in response to MATS, and repealing MATS would jeopardize those investments and the jobs they support. The electric power industry invested billions of dollars to install controls to comply with MATS. The activated carbon industry invested over $750 million to build the manufacturing and logistics assets necessary to supply power plants with activated carbon for mercury control and to support research and development to provide better, more efficient activated carbon products. ACS is a leading provider of activated carbon products optimized for emission control in the electric power industry. ACS alone has invested over $350 million in activated carbon production capacity, including building the largest, most automated and most environmentally-friendly activated carbon plant for mercury capture in North America, located near Coushatta, Louisiana.

Activated carbon is made from coal, and the activated carbon industry's response to MATS resulted in the opening of two new coal mines—the Five Forks Mine in Louisiana owned by ACS and the Marshall Mine in Texas owned by Cabot Corporation, another activated carbon producer. Activated carbon manufacturing facilities that support the electric power industry are located in Wyoming, Texas, Oklahoma, Louisiana, Mississippi and Kentucky. These facilities collectively have operating budgets in the hundreds of millions of dollars and the investments made in response to MATS have provided good-paying jobs, while also supporting employment in mining, transportation, distribution and other industries, including in the coal industry. Repealing MATS would itself eliminate jobs or inhibit job creation.

The investments made by ACS and others in the activated carbon industry have resulted in new and improved activated carbon products that dramatically improve the efficiency of pollution control. Today, ACS sells products that are as much as 60 percent more efficient than those available when the MATS rulemaking began. As a result, power plants use much less activated carbon for mercury control than originally anticipated, leading to corresponding reductions in storage and logistics demands, waste production, and, above all, compliance costs. ACS sells products that allow power plants to maintain the ability to sell their fly ash, avoiding increased costs associated with waste disposal. Further, new products from ACS have enabled some power plants to avoid the high-capital investment of installing baghouses to comply with MATS.

If MATS is repealed now, members of the electric power industry and the pollution control industry may be unable to recover their substantial investments. It would punish the companies that invested to achieve compliance in a cost-effective manner. Further, given the long history of the MATS Rule, repealing MATS likely will make the pollution control industry skeptical about committing to future investments to support compliance with environmental rules before those rules are fully litigated and unless the pollution control industry can obtain reasonable comfort that EPA will not subsequently revoke the rule. Absent investments by the pollution control industry, the cost of compliance with environmental rules will increase. Moreover, the absence of comprehensive federal regulation of mercury and other hazardous air pollutants from power

plants would encourage states to adopt (or resurrect) their own restrictions, creating a patchwork of potentially inconsistent state regulatory programs.

The Costs of MATS are Reasonable

It is also important that EPA recognize that its conclusion that regulation under section 112(n)(1)(A) was appropriate and necessary was, and remains, valid. EPA should not potentially disrupt MATS by concluding that compliance costs somehow render regulation inappropriate.

Section 112(n)(1)(A) is an idiosyncratic provision that calls for EPA to make a one-time decision regarding power plant emissions; the consideration of cost under this section has no precedential bearing on other determinations EPA must make under the Clean Air Act or other statutes. EPA may consider costs in any number of ways, without being compelled to evaluate costs in the same way in future rulemakings. Moreover, in making the evaluation called for by section 112(n)(1)(A), EPA must consider all other relevant factors and not limit its evaluation to costs.

In the Supplemental Finding, EPA considered costs in several different ways that did not depend upon considering "co-benefits" of reducing non-hazardous air pollutants under the Rule. In its "preferred method," EPA: (1) evaluated annual compliance costs as a percent of revenue from the power sector's annual retail electricity sales; (2) compared annual capital expenditures to comply with MATS to the range of variation of the power sector's annual capital expenditures; and (3) evaluated the anticipated impact of the Rule's compliance costs on the retail price of electricity.[14] EPA also evaluated the projected impact on capacity and reliability, concluding that the Rule would not adversely affect reliability and resource adequacy.[15] Based on these considerations of costs, and evaluating them in the context of other relevant factors, EPA recognized that the costs were reasonable and that regulation was appropriate and necessary.

Importantly, EPA's cost analyses in the Supplemental Finding relied on EPA's 2012 estimate of $9.6 billion in annual compliance costs, which wildly overestimated the actual capital and operating costs of compliance with the Rule. Dr. Staudt's analysis in 2015 confirmed that expected compliance costs as of that time were less than one-quarter of EPA's original estimate. Dr. Staudt's more recent analysis of avoidable costs if MATS is repealed further demonstrates that compliance costs remain low and are substantially lower than EPA had anticipated.

Beyond that, if EPA were to look to more recent data on average retail electricity prices, it would see that MATS has not led to any large spike in prices. The nominal average retail electricity price in 2017 was $0.1054 per kilowatt hour compared with $0.1044 per kilowatt hour in 2014,[16] when sources likely started to install controls to address MATS. This is a modest increase of

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14 81 Fed. Reg. at 24,423-27; *see also* 80 Fed. Reg. 75,025, 75,033-35 (Dec. 1, 2015). EPA relied on a cost-benefit analysis that considered "co-benefits" as part of an alternative justification for the Supplemental Finding, but EPA's "preferred method" provides an independent basis for the "appropriate and necessary" determination.

15 81 Fed. Reg. at 24,424-25, 24,425-27; 80 Fed. Reg. at 75,035-36.

16 U.S. Energy Information Administration, Electricity Data Browser, http://www.eia.gov/electricity/data/browser (accessed June 8, 2018).

$0.0010 per kilowatt hour (less than 1 percent of the 2014 rate), and when adjusted for inflation, the *real* average retail electricity price in 2017 *decreased* as compared with 2014.[17]

As EPA concluded in its Supplemental Finding, the costs that the electric power industry have incurred and will incur to comply with MATS are reasonable in light of all relevant factors. That the costs are in fact significantly less than EPA anticipated in the Supplemental Finding only reinforces this conclusion. EPA's Supplemental Finding appropriately considered costs using supportable, well-established economic principles that EPA can readily defend in challenges to the Supplemental Finding. Any determination today that regulation is not "appropriate and necessary" would be vulnerable to judicial reversal in light of the substantial record, built over more than 20 years of research and study and throughout the more than 16 years of litigation leading to the Rule, of the substantial harms associated with mercury and other hazardous air pollutant emissions, the availability of controls to reduce those emissions, and the reasonable costs associated with employing those controls.

For all of these reasons, ACS urges EPA to keep MATS in place, and not to alter EPA's conclusion that regulation under section 112 is "appropriate and necessary." EPA's staff should reach out to me directly if we can be of further assistance.

Sincerely,

Brian Leen,
President and Chief Executive Officer

17 Measured in 2007 dollars (the standard EPA employed in the Supplemental Finding), the inflation-adjusted average retail electricity price in 2014 was $0.0935, and decreased to $0.0904 in 2017. Calculations were made using the U.S. Bureau of Economic Analysis Gross Domestic Product-Implicit Price Deflator, available at FRED, Federal Reserve Bank of St. Louis, https://fred.stlouisfed.org/series/GDPDEF (accessed June 8, 2018).

EXHIBIT 1

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

Update of the Cost of Compliance with MATS – Ongoing Cost of Controls

White Paper

By

James E. Staudt, Ph.D.
Andover Technology Partners
May 25, 2017

Purpose

The purpose of this effort is to estimate annual operating costs associated with MATS. In effect, what the impact would be in terms of operating costs if MATS was rescinded. These operating costs include:

1. Operating and maintenance costs associated with ACI – this includes the cost of activated carbon as well as any energy used for the systems, waste disposal and maintenance costs.
2. Operating and maintenance costs associated with DSI - this includes the cost of lime or trona as well as any energy used for the systems, waste disposal and maintenance costs.
3. Operating and maintenance costs associated with chemical injection – this would include the costs associated with bromine (or other oxidizing chemicals) as well as chemicals used to control reemission of mercury in wet scrubbers
4. Operating and maintenance costs associated with fabric filters – this will include the costs associated with the energy demand associated with the increased pressure drop across the device, periodic replacement of filter media, and other maintenance or operating labor or materials. It is worth noting that were MATS rescinded, these costs would not go away because the fabric filter cannot be simply "turned off" in the manner that ACI, DSI or the chemical addition can. Rescinding MATS would therefore have no impact on these costs.
5. Operating and maintenance costs associated with monitoring Hg and HCl and increased frequency of PM measurements

Although there were some scrubber and ESP upgrades performed for MATS, these generally do not result in an increase in operating or maintenance costs.

The methodology for this effort will also differ from the methodology used in the past.[1] In that earlier effort Andover Technology Partners (ATP) examined how the United States Environmental Protection Agency (EPA) overestimated the cost of compliance with MATS when they issued the final rule. While EPA provided information about the MW of capacity retrofit in various means, EPA only provided limited detail of the components of the cost. Moreover, EPA's analysis included costs associated with changes in the fuels used in the generation fleet. As a result, the method used to assess how much EPA overestimated the cost of controls was by necessity using their estimated total cost as a starting point and then backing out various cost components per the actual installations and using the cost methodology used by EPA that is described in the documentation for the integrated planning model.

If the previous method examined cost from a "top-down" approach that started with the total cost estimated by EPA, in this effort the operating costs will be built up from a "bottom up" approach. This is done by looking at the total installations of various technologies and determining the associated operating cost. This approach will not examine any costs associated with changes in the fleet fuel mix that might be attributable to MATS. First, because the cost of natural gas is so much less than the expected cost of natural gas when MATS was promulgated, it is likely that MATS had a very small impact

[1] Declaration of James E. Staudt, Ph.D., CFA, United States Court of Appeals for the District of Columbia Circuit, White Stallion Energy Center, LLC, et al, v United States Environmental Protection Agency, Case No. 12-1100, Argued December 10, 2013, Decided April 15, 2014, Declaration submitted September 24, 2015.

on decisions to increase use of natural gas for power generation. Also, this is a question whose answer is almost indeterminable because many different factors influence fuel switching and plant retirement decisions. Another impact is the effect of retirements. While there were a substantial number of coal retirements during the time period leading up to the MATS compliance dates and even coincident with MATS dates, most of these facilities were uneconomical even without MATS and were destined for retirement.

Also, in examining the impact of MATS versus state rules requiring mercury control it was determined that only those facilities that installed Hg controls in 2014 through 2016 would be regarded as being subject to MATS as opposed to a state rule. Therefore, facilities that installed mercury controls either before or after that period are not included in this estimate.

For the purpose of this effort it will be assumed that all MATS control technology was installed in the years 2014 through 2016. Installations prior to 2014 were likely the result of state regulations, consent decrees, or other requirements. It is possible that some installations during 2014-2016 were in response to requirements other than MATS, such as state regulations; however, it is likely that the large majority of the installations in those years were for MATS compliance. In any event, EIA Form 860 data indicates that most facilities installed technology for MATS compliance from 2014-2016 and very few facilities installed mercury controls in 2013. The results of an analysis of EIA form 860 Environmental Association, EIA form 860 generator data and EIA Form 923 unit generation data are shown in Table 1. The 2016 generation is the 2016 generation associated with the facilities installed with a particular technology in a given year and will be used to help estimate variable operating costs associated with that equipment. In making estimates of future cost it is assumed that all of the associated facilities continue to operate at a level similar to that of 2016, except for those where announcements to retire by 2018 were made.

Operating and Maintenance Costs Associated with ACI installed for MATS Compliance

Operating costs for ACI include variable operating costs associated with sorbent consumption (VOMR), waste disposal, if needed (VOMW), power consumption (VOMP) and fixed operating and maintenance costs (FOM). Variable operating costs for sorbent consumption for any application will vary based upon the conditions. Table 2 shows estimated VOMR for activated carbon for a range of applications.

The costs therefore range from under 0.10 mill/kWh to under 1.0 mill/kWh. The most costly conditions are those where there is SO_3 conditioning or high sulfur coal. These, fortunately, are not the most common situations. The more common situations utilize lower treatment rates, resulting in costs on the order of 0.60 mills/kWh or less.

Variable operating costs will also include disposal costs for waste. Activated carbon will increase the amount of fly ash that must be disposed of. Generally, it does not adversely impact fly ash sales because suppliers have developed "concrete friendly" carbons and are also able to utilize much lower treatment rates than in the past. Trends have been for increases in fly ash utilization, despite the increased use of activated carbon. In fact, in 2015 52% of coal combustion products (CCPs) were

reutilized.[2] If fly ash is sold there is no impact on the cost of waste disposal. If fly ash is disposed of it will increase the cost of disposal in proportion to the carbon used. If disposal cost is $50/ton ($0.025/lb) and carbon costs around $1/lb, disposal cost is roughly 2.5% of the cost of purchasing the carbon. In light of the increased utilization of fly ash that will mitigate the likelihood of disposal, this assumption is a conservative one.

Table 1. Installation of control technologies associated with MATS from 2014-2016 and associated generation in 2016. Developed from EIA data – Forms 860 and 923

Year	Tech	number	Capacity (MW)	2016 Generation (MWh)	Capital Cost ($1000)
2014	ACI	21	8,470	34,337,506	222,988
2015	ACI	88	39,608	183,651,033	496,218
2016	ACI	88	38,256	186,905,590	322,191
Total	ACI	197	86,333	404,894,129	1,041,397
2014	LIJ	1	641	3,384,917	2,307
2015	LIJ	2	1,398	8,369,775	1,646
2016	LIJ	5	2,065	9,400,899	17,000
Total	LIJ	8	4,104	21,155,591	20,953
2014	DSI	1	477	2,469,155	81,240
2015	DSI	9	2,918	11,504,817	179,155
2016	DSI	14	6,176	24,552,813	94,201
Total	DSI	24	9,571	38,526,785	354,596
2014	OT	1	151	62,319	11,800
2015	OT	18	5,983	32,928,191	26,227
2016	OT	12	3,648	8,752,470	303,387
Total	OT	31	9,782	41,742,980	341,414
2014	BP	9	4,614	25,387,390	402,076
2015	BP	11	4,539	21,010,362	495,120
2016	BP	11	6,833	32,147,754	420,248
Total	BP	31	15,986	78,545,506	1,317,444

ACI = activated carbon injection
LIJ = Lime injection
DSI = Dry sorbent injection
OT = Other
BP = Pulse jet baghouse

[2] American Coal Ash Association, "Coal Ash Recycling Reaches 52 Percent As Production and Use Trends Shift", October 12, 2016, https://www.acaa-usa.org/Portals/9/Files/PDFs/News-Release-Coal-Ash-Production-and-Use-2015.pdf

Table 2. The variable operating cost of sorbent for current, state of the art, commercial carbons.[3]

Coal-Fired Site	Product	AQCS	Fuel	DSI	FGC	% Removal Hg	mill/Kwh
1	DARCO® Hg-LH EXTRA SP	SCR/FF	Low Chlorine Subbit.	None	None	94	0.086
2	DARCO® Hg-LH EXTRA SP	CS-ESP	Local W.Subbit	None	None	80	0.222
3	DARCO® Hg-LH EXTRA SP	CS-ESP	Local W.Subbit	None	None	80	0.244
4	DARCO® Hg-LH EXTRA SP	CS-ESP	Low Chlorine Subbit.	None	None	87	0.328
5	DARCO® Hg-LH EXTRA TR	CS-ESP/wFGD	High Sulfur Bit.	Calcium-based	None	82	0.375
6	DARCO® Hg-LH EXTRA TR	CS-ESP	PRB/Bit. Blend	Sodium-based	None	88	0.663
7	DARCO® Hg EXTRA	CS-ESP	Low Chlorine Subbit.	None	SO_3 (6ppm)	90	0.789
8	DARCO® Hg-LH EXTRA SR	CS-ESP	PRB	None	SO_3 (7ppm)	90	0.872
9	DARCO® Hg EXTRA SR	SNCR/ESP/wFGD	High Sulfur Bit.	None	None	96	0.980

Other variable operating costs include energy, estimated as about $0.01/MWh of generation from the Sargent & Lundy study on mercury control. [4]

Fixed operating costs for operation and maintenance are estimated at 1.4% of capital cost, including overhead, per the Sargent & Lundy study.

Using these factors and the information in Table 1, the costs for operating ACI systems is estimated to be:

Table 3. Operating costs for ACI systems installed for MATS compliance

VOMR	$242,936,000	**FOM**	$14,580,000	**Total VOM + FOM**
VOMW	$6,073,000			
VOMP	$4,049,000			
VOMTotal	$253,058,000		$14,580,000	$267,638,000
			Cost in $/MWh	$0.66

Operating and Maintenance Costs for DSI Systems installed for MATS compliance

EIA Form 860 shows both lime injection systems (LIJ) and DSI systems. DSI systems potentially include trona as well as lime injection systems. The average cost of the LIJ systems in EIA Form 860 are significantly lower than those of the DSI systems ($5/kW compared to $37/kW), suggesting that the LIJ systems were primarily used for SO3 control while many of the DSI systems were for HCl control.

VOMR is estimated by assuming roughly 2 lb of lime reagent per lb of total acid gas (using SO2 since it is usually present in much larger quantities than HCl), an average 2lb SO2/MMBtu coal, average heat rate

[3] Fessenden, J., Satterfield, J., "Cost Effective Reduction of Mercury Using Powder Activated Carbon Injection", March 2, 2017

[4] Sargent & Lundy, "IPM Model – Updates to Cost and Performance for APC Technologies Mercury Control Cost Development Methodology Final", March 2013, Project 12847-002, Systems Research and Applications Corporation

of 10,500 Btu/kWh, and a cost of activated lime equal to $125/ton. [5] It should be noted that for units that fire coal from the Powder River Basin (PRB), the lime consumption would be much less and in many cases no lime would be necessary to be added – the DSI system is added primarily as a precaution.

Variable operating costs will also include disposal costs for waste. DSI will increase the amount of fly ash that must be disposed of. Generally, it does not adversely impact fly ash sales because the most commonly used reagent is lime, which will generally improve fly ash marketability. If fly ash is disposed of, it will increase the cost of disposal in proportion to the lime used. Disposal cost is estimated at $50/ton. Since 52% or more of the industry's coal ash is recycled, it is reasonable to assume that 48% of the facilities need to dispose of waste.

Other variable operating costs include energy, estimated as about $0.39/MWh from the Sargent & Lundy study on DSI. [6]

Fixed operating costs for operation and maintenance are estimated at 1.4% of capital cost, including overhead, per the Sargent & Lundy study. The Sargent & Lundy study includes two additional operators for a DSI system. This is not correct. DSI systems are simple systems that generally do not require additional operators.

Using these factors, the costs for operating DSI and LIJ systems is estimated to be:

Table 3. Operating costs for DSI and LIJ systems installed for MATS compliance

VOMR	$78,333,000	**FOM**	$5,257,000	**Total VOM + FOM**
VOMW	$32,228,000*			
VOMP	$23,276,000			
VOMTotal	$133,837,000		$5,257,000	$139,094,000
Total cost $/MWh				$2.33
* assumes 48% of facilities dispose of waste				

This is a very conservatively high estimate of cost because in many cases not as much reagent is needed because sulfur and HCl content may be low, as in the case of PRB fuel. Moreover, many of these systems are likely to be primarily for SO_3 control rather than HCl control and therefore use much lower reagent treatment rates. Also, the additional calcium may actually make the fly ash more attractive for beneficial reuse, lowering the waste disposal costs.

[5] Treatment rate from: Fitzgerald, H., "Hydrated Lime DSI - Solution for Acid Gas Control (SO3, HCl, and HF)", MARAMA /ICAC SO2/HCl CONTROL TECHNOLOGIES WEBINAR, July 19, 2012
Also, USGS Minerals Yearbook, shows 2014 cost of lime of $122/metric ton, or about $110 per short ton. $125/short ton is than assumed in this evaluation.

[6] Sargent & Lundy, "IPM Model – Updates to Cost and Performance for APC Technologies, Dry Sorbent Injection for SO2 Control Cost Development Methodology – Final", March 2013, Project 12847-002, Systems Research and Applications Corporation

Operating and Maintenance Costs for Other technologies installed for MATS compliance

EIA Form 860 includes a category of "other" for other technologies. Most are listed as used for mercury control. Because of the capital cost of many of these technologies (averaging $35/kW) this may include chemical addition, but likely also includes ESP and FGD upgrades. ESP and FGD upgrades do not entail any additional operating or maintenance costs. Chemical additives do. Hg oxidation and scrubber additives for mercury control were estimated in the 2015 ICAC Market forecast[7] to be in the range of $80-$100 million for the years 2018-2019. For the purpose of this work, we will assume a cost of $90 million per year. Energy used for chemical addition systems are minimal.

While the total capital cost of "OT" items is $342 million, most of that cost is likely to be associated with technologies other than chemical addition (scrubber or ESP upgrades, perhaps). In any event, FOM cost will be assumed to be 1.4% of total capital cost, similar to ACI or DSI. The costs are shown in Table 4.

Table 4. Operating and Maintenance costs for Chemical Addition

VOM	$90,000,000
FOM	$4,780,000
TOTAL	$94,780,000
$/MWh	$2.19

Operating and Maintenance Costs for Baghouses installed for MATS compliance

There are no reagents used with baghouses (aka. "fabric filters"). Baghouses require some labor from operators and also require power and periodic replacement of filter media. Total VOM and FOM are estimated as $0.42/MWh and $0.68/kW-year, respectively. [8] Costs are shown in Table 5. It is important to recognize, however, that if MATS is rescinded, these costs will not go away because a fabric filter, unlike the other technologies, cannot simply be turned off without also turning off the rest of the associated boiler.

Table 5. Operating and Maintenance costs for Fabric Filters

VOM	$32,989,000
FOM	$10,870,000
TOTAL	$43,859,000
$/MWh	$0.56

[7] Institute of Clean Air Companies, 2015 Annual Market Study, pp 19-20. Available at www.icac.com
[8] Sargent & Lundy, "IPM Model – Updates to Cost and Performance for APC Technologies, Particulate Control Cost Development Methodology – Final", March 2013, Project 12847-002, Systems Research and Applications Corporation, pg 8

Operating and Maintenance Costs of Hg CEMS

Operating costs of Hg CEMS include the labor and materials for operating and maintaining the equipment as well as the cost of Relative Accuracy Test Audits and other compliance requirements of the CEMS. This was estimated as roughly $100,000 per year in a 2010 NESCAUM Report. At the end of 2016 there were 664 coal units in the United States operating that generated 1,158,929,439 MWh of electricity. Of them, 233 units among 84 plants had common chimneys. The total number of common chimneys was 111 for the 233 units. Therefore, there are a total of 542 chimneys in the US coal fleet that must be monitored. This means that the total ongoing cost of monitoring is roughly $54 million across the coal fleet for a total cost of $0.05/MWh. This cost estimate likely overestimates the cost because many facilities already had requirements imposed upon them by state Hg control regulations.

Operating and Maintenance Costs of HCl monitoring

Scrubbed units for the most part can demonstrate compliance with the HCl requirements of MATS maintaining adequately low SO_2 emission rates. Therefore, for most scrubbed units there is no additional monitoring need for HCl. For units that are not equipped with scrubbers, stack testing of HCl is necessary. Based upon a sort of 2016 AMPD data, at the end of 2016 there were 266 unscrubbed coal utility or small power producer units that generated 252,190,593 MWh of electricity. Of these, 165 units had individual chimneys and 101 units had common chimneys. Those 101 units had among them 39 common chimneys, resulting in a total of 204 chimneys for all of the unscrubbed units.

It is assumed that the cost of monitoring HCl is similar to that of Hg at $100,000/year per chimney. Therefore, the ongoing operating cost of monitoring HCl emissions is $20.4 million in total. Dividing that by the 2016 generation for those units results in $0.08/MWh

Operating costs associated with increased PM measurement frequency

For those facilities that do not already have a PM CEMS due to Consent Decree or other requirement, facilities will need to increase PM measurement frequency to quarterly. Some facilities may already have quarterly measurement requirements that are imposed by the state. Others may only have annual requirements. It is not possible to determine the incremental cost of increased PM measurement due to MATS frequency industrywide because of the use of PM CEMS under Consent Decrees and other factors. However, like Hg and HCl measurement costs, it will be substantially less than the cost of controls and likely less than the incremental cost of HCl measurement and reporting.

Total operating costs for all MATS technologies

Total operating costs for all MATS technologies for all 664 coal units, including fabric filters is as shown in Table 6 and totals roughly $620 million. If fabric filter operating costs are removed, the total operating costs are roughly $576 million.

Table 6. Total Operating Costs for MATS technologies.

ACI	$267,638,000
DSI	$139,094,000
OT	$94,780,000
FF	$43,859,000
Hg CEMS	$54,200,000
HCl monitoring	$20,400,000
Total	$619,971,000

The total cost (including FF cost) divided by total 2016 generation for all 664 units results in a cost of $0.53/MWh. If FF costs are excluded, the cost per MWh is $0.50/MWh. It is reasonable to exclude FF costs because a fabric filter (or, baghouse) cannot be turned off without turning off the power plant. Therefore these costs would not go away if MATS were rescinded or relaxed.