ARGUED DECEMBER 10, 2013
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IN THE UNITED STATES COURT OF APPEALS
FOR THE DISTRICT OF COLUMBIA

WHITE STALLION ENERGY CENTER, LLC, et al., **Petitioners,** **v.** **U.S. ENVIRONMENTAL PROTECTION AGENCY,** **Respondent.**	**Case No. 12-1100** **(and consolidated cases)**

JOINT MOTION OF THE STATE, LOCAL GOVERNMENT, AND PUBLIC HEALTH RESPONDENT-INTERVENORS FOR REMAND WITHOUT VACATUR

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GLOSSARY

Air Toxics Rule	Mercury and Air Toxics Standards, Final Rule, *National Emission Standards for Hazardous Air Pollutants from Coal- and Oil-Fired Electric Utility Steam Generating Units and Standards of Performance for Fossil-Fuel-Fired Electric Utility, Industrial-Commercial-Institutional, and Small Industrial-Commercial-Institutional Steam Generating Units*, 77 Fed. Reg. 9304 (Feb. 16, 2012)
EGU	Electric Utility Steam Generating Unit, as defined in 42 U.S.C. § 7412(a)(8)
EPA	U.S. Environmental Protection Agency
HAP	Hazardous Air Pollutant
MACT	Maximum Achievable Control Technology
NO_x	Nitrogen Oxides
SO_2	Sulfur Dioxide
TMDL	Total Maximum Daily Load

INTRODUCTION

Pursuant to this Court's order of August 11, 2015 (Doc. 1567220), the State, Local Government,[1] and Public Health[2] Respondent-Intervenors respectfully move the Court to remand the Mercury and Air Toxics Standards ("Air Toxics Rule") to the Environmental Protection Agency ("EPA") without vacatur.

Under the principles and precedents that guide this Court's exercise of its remedial discretion, that is the only proper course. The legal flaw identified by the Supreme Court—EPA's failure to consider costs in connection with its finding that regulating emissions of hazardous air pollutants from power plants is "appropriate"—is one EPA can readily correct on remand without altering the substance of the Rule, and the Agency has committed to act promptly. Vacating the Rule would be profoundly disruptive, creating and exacerbating significant

[1] The Commonwealth of Massachusetts; the States of California, Connecticut, Delaware, Illinois, Iowa, Maine, Maryland, Minnesota, New Hampshire, New Mexico, New York, Oregon, Rhode Island, and Vermont, the District of Columbia; the Cities of Baltimore, Chicago, and New York; and the County of Erie, New York join this motion.

[2] The American Academy of Pediatrics, American Lung Association, American Nurses Association, American Public Health Association, Chesapeake Bay Foundation, Clean Air Council, Conservation Law Foundation, Environment America, Environmental Defense Fund, Izaak Walton League of America, National Association for the Advancement of Colored People, Natural Resources Council of Maine, Natural Resources Defense Council, Ohio Environmental Council, Pennsylvania's Future, Physicians for Social Responsibility, Sierra Club, and Waterkeeper Alliance join this motion.

hazards to public health and the environment and disrupting the administration of other vital air and water pollution control programs.

BACKGROUND

In the 1990 Clean Air Act Amendments, Congress directed EPA to control emissions of statutorily identified hazardous pollutants to the maximum degree achievable. 42 U.S.C. §§ 7412(b), 7412(c), 7412(d). For power plants, or electric generating units ("EGUs"), such regulation was made contingent upon a further study and findings, and Congress provided that EPA "shall regulate" EGUs "if the Administrator finds such regulation is appropriate and necessary after considering the results of the study." *Id*. § 7412(n)(1)(A).

After completing multiple scientific studies called for under the statute, EPA concluded in 2000 that regulation of hazardous air pollutant emissions from EGUs "is appropriate and necessary." 65 Fed. Reg. 79,825, 79,826 (Dec. 20, 2000). In 2012, noting that studies completed since the 2000 finding "confirm serious health risks from [hazardous air pollutant] exposure," 77 Fed. Reg. 9304, 9336 (Feb. 12, 2012), EPA reaffirmed its 2000 finding and promulgated emissions standards for EGUs, 77 Fed. Reg. at 9310-11, with compliance required by April 15, 2015.

In the rulemaking, EPA concluded that the statute was best interpreted as not allowing the Agency to evaluate the costs of regulation as part of the initial decision whether to regulate power-plant emissions of hazardous pollutants. *E.g.*,

77 Fed. Reg. at 9323-24. In its Regulatory Impact Analysis under Executive Orders 12,866 and 13,563, however, EPA found that, even excluding reductions in cancer risk and other important health and public benefits of the Rule that could not be assigned a monetary value, the Rule's benefits would be many times its costs. *See* 77 Fed. Reg. at 9305-06 (estimating annual costs of $9.6 billion and annual benefits of $33-90 billion).

Industry, states, and environmental groups filed petitions for review of the Rule, and this Court upheld the Air Toxics Rule in its entirety, rejecting a large number of statutory and record-based challenges. Granting certiorari on the cost issue alone, the Supreme Court concluded that EPA had unreasonably interpreted the statute as not allowing it to consider costs as part of the "appropriate and necessary" determination under section 7412(n)(1)(A). *Michigan v. EPA*, 135 S. Ct. 2699 (2015). It concluded that the statutory phrase requires "at least some attention to cost," and that EPA's interpretation implausibly "precludes the Agency from considering *any* type of cost—including, for instance, harms that regulation might do to human health or the environment." *Id*. at 2707. The Court further reasoned that EPA's decision to consider environmental impacts undermined its reading of the term "appropriate" to exclude cost. *Id.* at 2708. Citing *SEC v. Chenery Corp.*, 318 U.S. 80, 87 (1943), the Court rejected arguments that it could affirm on the basis of EPA's consideration of costs in the setting of emissions

standards or in the Regulatory Impact Analysis, pointing out that EPA itself had not relied upon these rationales. *Id*. at 2710-11. Accordingly, the Court reversed and remanded for further proceedings.

ARGUMENT

A. The Legal Standards that Guide the Court's Remedial Decision

This Court focuses on two factors in deciding whether agency regulations found to be flawed should be vacated or instead remanded without vacatur: (1) "the seriousness of the [rule's] deficiencies (and thus the extent of doubt whether the agency chose correctly)" and (2) "the disruptive consequences of an interim change that may itself be changed." *Allied-Signal, Inc. v. U.S. Nuclear Reg. Comm'n*, 988 F.2d 146, 150-51 (1993) (citing *Int'l Union, United Mine Workers of Am. v. Fed. Mine Safety & Health Admin.*, 920 F.2d 960, 967 (D.C. Cir. 1990)).

Under the first factor, the Court inquires whether, under the circumstances, the agency could "reach[] the same result" on remand. *Black Oak Energy, LLC v. FERC*, 725 F.3d 230, 244 (D.C. Cir. 2013); *see also, e.g.*, *Ass'n of Oil Pipe Lines v. FERC*, 281 F.3d 239, 248 (D.C. Cir. 2002) ("we do not vacate . . . because it is unclear whether the remanded issues will change FERC's cost data analysis sufficiently" to alter outcome); *Allied-Signal, Inc.*, 988 F.2d at 150-51 (simple remand proper due to "serious possibility that the Commission will be able to

substantiate its decision on remand"); *Sierra Club v. EPA*, 167 F.3d 658, 664 (D.C. Cir. 1999) (remanding where agency "may be able to explain" its decision).

Under the second factor, this Court has examined ways in which vacatur could disrupt public or private interests. *See, e.g.*, *EME Homer City Generation, L.P. v. EPA*, 795 F.3d 118, 132 (D.C. Cir. 2015) (finding that vacatur would interfere with emissions trading markets); *Sugar Cane Growers Co-op. of Fla. v. Veneman*, 289 F.3d 89, 97-98 (D.C. Cir. 2002). This Court has been particularly reluctant to vacate rules when doing so would disrupt regulatory requirements that protect public health and the environment. *See, e.g.*, *Nat'l Ass'n of Clean Water Agencies v. EPA*, 734 F.3d 1115, 1161 (D.C. Cir. 2013) (remanding without vacatur Clean Air Act emissions standards for hazardous pollutant emissions from sewage sludge incinerators despite finding multiple flaws in EPA's analysis); *Sierra Club*, 167 F.3d at 664 (remanding flawed Clean Air Act rule "rather than eliminate any federal control at all"); *Mississippi v. EPA*, 744 F.3d 1334, 1362 (D.C. Cir. 2013) (remanding so as not to "sacrifice" environmental protection from Clean Air Act rule); *Nat'l Lime Ass'n v. EPA*, 233 F.3d 625, 641 (D.C. Cir. 2000) (remanding hazardous air pollution regulations without vacatur). In *North Carolina v. EPA*, having initially vacated EPA's Clean Air Interstate Rule due to "fundamental flaws" so "deep" as to "'foreclose EPA from promulgating the same standards on remand,'" 531 F.3d 896, 929-30 (D.C. Cir. 2007), this Court opted for

remand because the rehearing submissions showed that "vacatur would at least temporarily defeat the enhanced protection of the environmental values covered by the EPA rule at issue," 550 F.3d 1176, 1178 (D.C. Cir. 2008).

B. EPA Can Readily Cure the Air Toxics Rule on Remand

This Court's decisions establish that remand without vacatur is favored when there is a reasonable prospect the agency may be able to justify "the same result," *Black Oak Energy*, 725 F.3d at 244, on remand.[3] Here, there is at the very least "a serious possibility," *Allied-Signal, Inc.*, 988 F.2d at 150-51, and "non-trivial likelihood," *WorldCom, Inc. v. FCC*, 288 F.3d 429, 434 (D.C. Cir. 2002), that EPA will, after considering cost on remand, conclude that it remains "appropriate" to regulate hazardous air pollutant emissions from power plants.

Michigan does not remotely suggest that EPA's error is incurable. The Court concluded that EPA had relied upon an unreasonable interpretation of the statute to foreclose consideration of cost, not that the Agency could not justify the substance of the regulations under a proper interpretation. 135 S. Ct. at 2707-11. Indeed, ruling only on EPA's proffered rationale, per *Chenery*, the Court explicitly

[3] *See, e.g.*, *Am. Farm Bureau Fed'n v. EPA*, 559 F.3d 512, 528 (D.C. Cir. 2009) (remanding where error was "in principle a curable defect"); *Ass'n of Oil Pipe Lines*, 281 F.3d at 248 (vacatur inappropriate where need for agency to change outcome "unclear"); *La. Fed. Land Bank Ass'n v. FCA*, 336 F.3d 1075, 1085 (D.C. Cir. 2003) (remanding where it was "not unlikely" that agency would be able to justify retaining challenged rule); *Fox Television Stations, Inc. v. FCC*, 280 F.3d 1027, 1048 (D.C. Cir. 2002) (remand warranted where "we cannot say with confidence that the [agency action] is likely irredeemable").

left open the possibility that the economic analyses EPA had already conducted in the rulemaking, if relied upon as the basis for its "appropriateness" determination, could suffice to discharge EPA's obligation to consider cost. *Id.* at 2710-11.[4] Moreover, the Court explicitly recognized EPA's discretion as to *how* to consider cost on remand. *E.g.*, 135 S. Ct. at 2711 ("It will be up to the Agency to decide (as always, within the limits of reasonable interpretation) how to account for cost.").

There are compelling reasons to conclude that EPA may well find that, considering costs, regulation of hazardous air pollutants from power plants is "appropriate." Although believing that the statute was best read to preclude consideration of costs in the listing decision, *e.g.*, 77 Fed. Reg. at 9327, EPA in fact did analyze costs at multiple stages of the regulatory process and explicitly found the Rule overwhelmingly cost-justified. For example, EPA explained that it "could not monetize some costs and important benefits, such as some [mercury] benefits and those for the [non-mercury hazardous air pollutants]," but that "[u]pon considering these limitations and uncertainties, it remains clear that the benefits of

[4] In *Chenery* itself, the Supreme Court, having in its first review determined that the SEC had "misconceived the law," 318 U.S. at 94-95, upheld the same agency policy based on the Commission's further analysis on remand, *SEC v. Chenery Corp.*, 332 U.S. 194, 209 (1947).

this rule . . . are substantial and far outweigh the costs." 77 Fed. Reg. at 9306; *see also id*. at 9305-06 (summarizing economic analysis).[5]

The extensive record concerning the public health and environmental harms from power-plant hazardous air emissions further indicates that EPA could readily conclude that, considering costs, regulation remains "appropriate." *See* 76 Fed. Reg. at 25,000-16 (discussing the extensive scientific research concerning the health impacts of toxic pollutants emitted by EGUs). Any cost-conscious test of "appropriateness" on remand will have to take into account these considerations, as well as the value, manifest throughout section 7412, that Congress placed on reducing risks from enumerated toxic pollutants. Given the significant reductions in pollution that the Rule achieves—both in absolute terms, and relative to the next-largest source categories—and given EPA's judgment that hazardous air

[5] In addition, EPA considered costs when setting the technology-based standards for the Air Toxics Rule. *See, e.g.*, 76 Fed. Reg. 24,976, 25,046 (May 3, 2011) (rejecting duplicate controls, such as multiple scrubbers, because cost was unreasonable); *id.* (rejecting coal-to-gas retrofit because it is "not cost-effective"); 77 Fed. Reg. at 9393 (discussing costs of standard for power plants burning low-rank virgin coal); *id*. at 9411-13 (discussing cost of sorbent injection technology and noting that "[s]enior technical staff from the EPA have carefully evaluated the key assumptions regarding the cost and operation of emission control technologies"). EPA also discussed other associated costs in the proposed and final versions of the Rule. *See, e.g.*, 76 Fed. Reg. at 25,051-52 (compliance and monitoring costs); *id*. at 25,053 (proposing emissions averaging for certain existing sources because less costly); *id*. at 25,075-78 (costs and benefits, costs by control measure); 77 Fed. Reg. at 9413 (electricity price impacts, job market effects, and other economic impacts); *id*. at 9416 (impacts on low-income consumers); *id*. at 9425-31 (cost, economic impacts, and benefits).

pollutant emissions from power plants pose "serious health risks," 77 Fed. Reg. at 9336, EPA could conclude that these public benefits are well worth the price.

Furthermore, in reviewing this complex rulemaking, this Court considered and rejected an extraordinary number of statutory and record-based challenges to the Rule in addition to the cost issue taken up by the Supreme Court in *Michigan*.[6] This detailed and judicially-vetted regulation should remain in place while EPA conducts its cost analysis on remand. The Agency's discrete analytical error identified by the Supreme Court can be corrected without dismantling a detailed regulatory architecture that has been reviewed and, in all other respects, upheld.

[6] *See*, among numerous other issues, 748 F.3d 1222, 1235-36 (D.C. Cir. 2014) (upholding reliance on delisting criteria in construing "appropriate and necessary"); 1242-43 (EPA permissibly considered cumulative hazards); 1243 (EPA properly regulated EGUs under subsection 7412(d)); 1244-45 (EPA properly determined to promulgate standards "for all listed HAPs emitted by EGUs," rather than "pick[ing] and choos[ing]"); 1245-47 (upholding finding "that mercury emissions posed a significant threat to public health"); 1246 (upholding Rule's minimum stringency levels); 1247 (EPA reasonably declined to classify EGUs as major sources and area sources); 1247-48 (rejecting industry challenges to calculation of maximum achievable control technology ("MACT") floor); 1248 (EPA properly prescribed MACT standards, rather than less stringent, health-based emission standards, for acid gases); 1248 (upholding EPA's denial of delisting petition); 1249 (rejecting challenges to EPA's analysis regarding risks from non-mercury EGU emissions); 1249-50 (rejecting arguments EPA should have promulgated separate standards for circulating fluidized bed EGUs); 1250-51 (rejecting multiple challenges to standards for lignite-fired units); 1251-55 (rejecting environmental petitioners' claim that Rule impermissibly diluted the required level of stringency by allowing emissions averaging); 1256-58 (dismissing challenges to EPA's decision not to adopt more stringent standards predicated on fuel switching from coal to natural gas).

C. Vacatur of the Air Toxics Rule Would be Extremely Disruptive

This Court has found it particularly appropriate to remand without vacatur where vacatur would "at least temporarily defeat" important public health and environmental protections. *See North Carolina*, 550 F.3d at 1178; *Nat'l Lime*, 233 F.3d at 635. Vacating the Air Toxics Rule would do just that: vacatur would seriously harm public health and the environment by allowing power plants to resume emitting (or continue to emit) large quantities of dangerous air pollutants until EPA promulgates a replacement rule and the compliance date for that rule arrives. That extended process would further delay long-overdue health and environmental benefits, potentially for years, during which lives would prematurely be lost, and public health damaged unnecessarily, as a result of preventable exposures to highly toxic air pollution.

1. The Air Toxics Rule Provides Vital Protection to Health and the Environment by Achieving Large Reductions in Harmful Pollution

Power plants are, by far, the Nation's largest source of numerous toxic air pollutants designated by Congress as meriting control under the Clean Air Act's most stringent program. 77 Fed. Reg. at 9310-11. These air toxics include mercury, chromium, arsenic, nickel, selenium, and the acid gases hydrogen fluoride, hydrogen cyanide, and hydrogen chloride. *See, e.g.*, 77 Fed. Reg. at 9310; 76 Fed. Reg. at 25,005-06. The product of a decades-long regulatory process, the Air Toxics Rule protects public health and the environment by cutting

emissions of these toxic pollutants, in turn decreasing neurotoxicity from mercury exposure, avoiding illnesses and thousands of premature deaths from exposure to fine particulate matter, avoiding acute and chronic respiratory distress in individuals exposed to power plant acid gases, and protecting wildlife and waterways from serious contamination, among other benefits. *See*, *e.g.*, 77 Fed. Reg. at 9306, 9310-11.

EPA estimated that by 2016, the Air Toxics Rule would reduce power-plant emissions of mercury by 75 percent, 77 Fed. Reg. at 9424, their emissions of hydrochloric acid gas by 88 percent, *id.*, and their emissions of non-mercury metals, such as arsenic, chromium, and nickel, which are known or suspected carcinogens, by 38 percent, 76 Fed. Reg. at 24,978, 25,015. EPA estimated that implementation of the Rule will produce annual particulate matter reductions of 52,000 tons as a result of controls to limit the toxic metals and acid gases emitted by coal- and oil-fired power plants. 77 Fed. Reg. at 9424 & tbl. 7.

Congress designated the air pollutants addressed in the Rule as "hazardous" for good reason. Mercury, for example, is a potent neurotoxin ingested by humans when they consume fish and seafood. *See* Exhibit 1, Declaration of Philippe Grandjean ("Grandjean Decl.") ¶¶ 7-8; Exhibit 2, Declaration of Paul J. Miller ("Miller Decl.") ¶ 5; 76 Fed. Reg. at 25,000. Methylmercury ingested by a pregnant woman can move across the placenta into the brain of a developing fetus

and inhibit normal nervous system development, even at levels observed in the general U.S. population. Grandjean Decl. ¶¶ 11, 14, 17, 25; Miller Decl. ¶ 5; 76 Fed. Reg. at 24,983, 25,000-01, 25,007. As EPA recognized, such exposure to methylmercury can lead to serious, life-long neurological harms, including impaired attention, fine motor function, language skills, visual spatial abilities, and verbal memory. 76 Fed. Reg. at 25,018.[7] In its decision in this case, this Court upheld EPA's findings concerning the health hazards of mercury as "amply supported." 748 F.3d at 1245-46.

2. Vacatur Would Cause Increased Emissions of Numerous Dangerous Air Pollutants and Thereby Harm Public Health and the Environment.

Vacating the Air Toxics Rule would cause immediate and irreversible harm. The majority of power plants have been in compliance with the Rule's emissions limits since April 2015, although a substantial number have obtained compliance extensions, many until April 2016.[8] If the Rule is vacated, many or most of the plants that have installed control technologies may decide to turn off some of those

[7] Mercury also presents serious environmental hazards. Fish-eating birds and mammals are harmed by high levels of mercury in their bodies. Miller Decl. ¶ 5; 77 Fed. Reg. at 9310; 76 Fed. Reg. at 25,012-13.

[8] National Association of Clean Air Agencies, Survey on MATS Compliance Extension Requests (Aug. 11, 2015) (finding that approximately 40 percent of power plants have obtained an extension of the April 2015 deadline in relation to one or more of the emission limits).

controls, or to operate them less often. Miller Decl. ¶¶ 23-24.[9] Plants that received extensions and have not yet installed controls will continue to emit hazardous air pollutants at their current rates. Overall, if the Rule is vacated, power plants would emit tens of thousands of tons of hazardous air pollutants that would otherwise have been eliminated pursuant to the Rule, Exhibit 3, Declaration of Ranajit Sahu ("Sahu Decl.") ¶¶ 7-9, thereby elevating the public health risk, Exhibit 4, Declaration of Jonathan I. Levy ("Levy Decl.") ¶ 20; Exhibit 5, Declaration of Douglas W. Dockery ("Dockery Decl.") ¶ 24; Exhibit 6, Declaration of Amy B. Rosenstein ("Rosenstein Decl.") ¶¶ 31-32.

For example, reductions in local and regional mercury emissions can relatively rapidly—in the span of weeks to a few years—reduce mercury levels in freshwater fish and other biota, Miller Decl. ¶ 19, and major percentage reductions are observed within 5 to 20 years, Grandjean Decl. ¶ 28. EPA projected that the Rule would reduce power-plant mercury emissions by approximately 20 tons per year, 77 Fed. Reg. at 9424 tbl.7, but vacatur would undercut these reductions, resulting in approximately 12 to 14 tons per year of additional mercury emissions as compared to full implementation; in other words, approximately 60 to 70percent of the expected emissions-reduction benefit would be lost, Sahu Decl. ¶ 7. As a

[9] Indeed, in 2012 many coal-fired power plants turned off or limited operation of installed NO_X (nitrogen oxides) pollution controls, when they were not required to operate them for compliance with federal ozone requirements, because they could purchase less expensive pollution allowances. Miller Decl. ¶ 23.

result, vacating the Air Toxics Rule would create a risk that individuals who consume fish contaminated with mercury will face higher exposure levels than they would have had the Rule remained in place. Miller Decl. ¶ 20.[10] And some portion of the increased mercury levels resulting from vacatur would persist in environmental reservoirs, available for uptake by fish and eventual consumption by people, for decades. Grandjean Decl. ¶ 30.

Similarly, installing and operating the controls necessary to achieve the required acid gas emissions reductions under the Air Toxics Rule (measured by reductions in sulfur dioxide or hydrochloric acid gas as surrogates for the toxic acid gases), achieves very significant reductions in those pollutants, 77 Fed. Reg. at 9424 tbl. 7 (estimating that the Rule will reduce annual power-plant hydrochloric acid gas emissions from 45,000 to 6 tons), and in selenium, a toxic metal found in flue gas, yielding immediate health benefits, Rosenstein Decl. ¶¶ 29, 33-34 (discussing acid gases); 77 Fed. Reg. at 9380 (explaining that selenium is controlled as an acid gas). Conversely, vacating the Rule would result in additional hydrochloric acid emissions of approximately 24,000 to 30,000 tons each year (equal to approximately 61 to 75 percent of the expected emissions-

[10] A recent study has found a strong correlation between U.S. mercury air emissions and mercury levels in bluefish in mid-Atlantic waters ranging from Cape Cod to Cape Hatteras. Miller Decl. ¶ 18. Given that women living along the Atlantic coast have shown some of the Nation's highest mean mercury blood levels, *see id*., that finding further underscores the public health risks vacatur would create.

reduction benefit) as compared to the full implementation of the Rule by April 2016. Sahu Decl. ¶ 8. These increased acid gas emissions would expose people living near power plants (who are more likely to be members of a racial minority and more likely to live in poverty, 77 Fed. Reg. at 9444-46), to increased risk of acute respiratory distress, pulmonary edema, nervous system effects, exacerbation of allergic diseases, chronic bronchitis, and other adverse health effects during the period of delay, Rosenstein Decl. ¶¶ 23-24, 31-32. *See also* Sahu Decl. ¶ 8 (estimating an increase in emissions of other acid gases if the Rule is vacated).

Because the Rule requires the installation of air pollution controls that significantly reduce particulate matter, vacatur could also expose the public to greater quantities of that deadly pollutant.[11] *See* Sahu Decl. ¶ 9 (estimating an additional 30,000 to 37,000 tons per year of power-plant particulate matter pollution if the Air Toxics Rule is vacated as compared to full implementation of the Rule by April 2016); 77 Fed. Reg. at 9367 (particulate matter regulated as a surrogate for non-mercury toxic metals). Overwhelming scientific evidence confirms that incremental reductions in fine particulate matter, even at levels below the National Ambient Air Quality Standards promulgated pursuant to 42 U.S.C. § 7409, confer important incremental public health benefits, including

[11] Both the particulate matter standard—a surrogate for non-mercury metals—and the acid gas standard will yield reductions in human exposure to particulate matter. 77 Fed. Reg. at 9380. Acid gas emissions contribute to the formation of particulate matter in the atmosphere. Levy Decl. ¶ 7; Dockery Decl. ¶¶ 7, 12, 18.

reduced incidence of heart attack, stroke, and premature death. Dockery Decl. ¶¶ 10-11. Vacating the Rule while EPA revisits its "appropriate" determination to consider the costs of regulation could have substantial, irreversible public health impacts.

Particulate matter directly emitted from power plants invariably includes toxic metals, such as arsenic, chromium, and nickel, 76 Fed. Reg. at 25,021, 25,038, and power plants' share of some of these metals exceeds that of every other source category in the country combined, 77 Fed. Reg. at 9310. Although the science does not yet permit the precise quantification of the health harms caused by these emissions, Levy Decl. ¶ 9; Dockery Decl. ¶¶ 12-13, the metals at issue include known and probable carcinogens, 77 Fed. Reg. at 9310. The Rule's substantial reductions in particulate matter emissions containing these toxic metals will reduce the public's exposure to them and to the health risks they pose. *See* Grandjean Decl. ¶ 12; Dockery Decl. ¶ 24. Vacating the Rule could prolong and increase that exposure.

Vacating the Rule would not only cause public health harms from emissions from currently complying power plants that shut-off existing controls, but also from the huge quantities of mercury, non-mercury metals, and acid gases that would continue to be emitted by those power plants that have not yet complied with the Rule because they have obtained compliance extensions. *See* Sahu Decl.

¶¶ 7-9. For example, in 2014, Pennsylvania's four highest mercury-emitting power plants—all of which have obtained extensions of the Rule's compliance deadline—together emitted nearly 2000 pounds of mercury, Miller Decl. ¶ 26, representing 5 percent of the total 20-ton reduction in mercury emissions that the Rule will produce, 77 Fed. Reg. at 9424 tbl.7. Those emissions are of particular concern to the New England states, New Jersey, and New York because Pennsylvania's sources contribute significantly to mercury deposition in the region. Miller Decl. ¶ 25. Given that the control technologies those plants are proposing to install have been shown to reduce mercury emissions by 90 percent or more, delaying installation would allow them to emit significantly more mercury than they would if the Rule remained in place. *Id.* ¶ 28.

3. Vacatur Would Immediately Exacerbate Serious, Nationwide Water Contamination Problems, Compromise States' Ability to Protect Their Air and Water Resources, and Render Compliance with Other Regulatory Requirements More Difficult

Vacating the Air Toxics Rule would exacerbate pollution that contaminates waterbodies throughout the United States, and renders fish unsafe for human consumption. EPA's 2011 national-scale risk assessment completed in support of the Rule showed that, by 2016, power-plant emissions *alone* would cause exceedances of safe mercury levels in 10 percent of 3100 watersheds modeled, and would significantly contribute to exceedances of safe mercury levels in 29 percent of those watersheds. 77 Fed. Reg. at 9311, 9362. Already, as a result of mercury

pollution, all fifty states have put fish consumption advisories into effect,[12] and in some states, all, or nearly all, waters are unsafe for fish consumption due to mercury contamination.[13] The problem is so significant that it is difficult, especially for women who are or may become pregnant, to follow dietary recommendations for fish consumption without consuming unsafe levels of methylmercury. Grandjean Decl. ¶ 22.

Mercury contamination is significant enough to require the development of state-wide mercury "pollution budgets," known as "total maximum daily loads" ("TMDLs"), for mercury-polluted waterbodies in eight Northeastern states and four states in the Southeast and Midwest in order to meet federal Clean Water Act water quality standards. *See* 33 U.S.C. § 1313(d)(1) (requiring development of TMDLs for impaired waters).[14] Achieving many of those states' TMDL goals

[12] *See* EPA, *2011 National Listing of Fish Advisories*, EPA-820-F-13-058 4 (2013).
[13] *See*, *e.g.*, North Carolina Mercury Total Maximum Daily Load 20 (2012) ("North Carolina TMDL") (all state waters impaired for fish consumption due to mercury contamination); Statewide Michigan Mercury Total Maximum Daily Load: Public Review Draft 9 (2013) ("Michigan Draft TMDL") (all inland lakes and hundreds of river miles under mercury-related fish consumption advisories).
[14] Connecticut, Maine, Massachusetts, New Hampshire, New York, Rhode Island, and Vermont are implementing a regional mercury TMDL, while Florida, Michigan, Minnesota, New Jersey, and North Carolina are implementing or finalizing state-wide mercury TMDLs. *See* Northeast Regional Mercury Total Maximum Daily Load (2007) ("Northeast TMDL"); Final Report: Mercury TMDL for the State of Florida (2013); Michigan Draft TMDL, *supra* note 13; Minnesota Statewide Mercury Total Maximum Daily Load (2007) ("Minnesota TMDL"); Total Maximum Daily Load for Mercury Impairments Based on Concentration in

depends upon the nationwide reductions in mercury emissions from coal-fired power plants that the Air Toxics Rule will provide.[15]

The Air Toxics Rule is also important to state efforts to meet other health-protective Clean Air Act obligations. States are required to satisfy National Ambient Air Quality Standards, *see* 42 U.S.C. §§ 7409, 7410, for various pollutants that are affected by the Rule, in particular sulfur dioxide and particulate matter. Because the Rule will result in significant reductions in emissions of those pollutants, 77 Fed. Reg. at 9424 tbl 7, EPA guidance on compliance with air quality standards for them specifically contemplates incorporation of Air Toxics Rule reductions into state implementation plan submissions. *See* 80 Fed. Reg. 51,052, 51,062 (Aug. 21, 2015) (implementation schedule for 2016 round of SO_2 (sulfur dioxide) nonattainment designations designed to allow states to "account for SO_2 reductions that will occur over the next several years as a result of implementation of [other] requirements (such as the [Air Toxics Rule])"); 80 Fed. Reg. 15,340, 15,349-50 & n.47 (Mar. 23, 2015) (instructing states with moderate

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Fish Tissue Caused Mainly by Air Deposition to Address 122 HUC 14s Statewide (2009) (New Jersey); North Carolina Mercury TMDL, *supra* note 13.

[15] In the Northeast, the states' TMDL concludes that EPA action to "implement significant reductions from upwind out-of-region sources, primarily coal-fired power plants" is necessary to return fish methylmercury concentrations to safe levels. *See* Northeast TMDL, *supra* note 14, 44; Miller Decl. ¶ 9. *See also* Minnesota TMDL, *supra* note 14, 20-21, 45 (concluding that 30 percent of Minnesota's mercury deposition originates from out-of-state domestic sources and that federal regulation of those sources, including power plants, holds the most promise for reaching state's TMDL goals).

nonattainment areas for particulate matter to incorporate SO_2 reductions (a particulate matter precursor), such as those from the Rule, into nonattainment modeling).[16]

CONCLUSION

Because vacatur would "sacrifice clear benefits to public health and the environment while EPA fixes the [R]ule," *North Carolina*, 550 F.3d at 1178 (Rogers, J. concurring), this Court should remand the Air Toxics Rule to EPA without vacatur.

Respectfully submitted,

[16] Reducing sulfur dioxide emissions from coal-fired power plants is also important to state efforts to reduce regional haze and meet federal visibility goals in national parks and wilderness areas. *See* 42 U.S.C. § 7491; 64 Fed. Reg. 35,747 (Jul. 1, 1999) (regional haze rule); EPA, *General Principles for the 5-Year Regional Haze Progress Reports for the Initial Regional Haze State Implementation Plans* 8 (2013) ("[R]eductions in SO_2 and NOx emissions from EGUs are generally critical elements of each state's regional haze strategy."). As a result, many states' recent regional haze progress reports recognize that the Rule will help assure that regional haze goals are met. *See, e.g.*, State Implementation Plan Regional Haze Periodic Progress Report for the State of Florida 17 (2015) (Air Toxics Rule, along with other federal regulations, will provide "extra assurances" of the required "reasonable progress" toward national visibility goals); Regional Haze 5-Year Periodic Review State Implementation Plan for North Carolina Class I Areas 24 (2013) (same). *See also* Kentucky State Implementation Plan (SIP) Revision: Regional Haze 5-Year Periodic Report 2008-2013 for Kentucky's Class I Federal Area App. C-5, 4 (2014) ("The [Air Toxics Rule] … is one of the federal control measures . . . that is an important part of Kentucky's Regional Haze SIP.").

Dated: September 24, 2015

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[17] Pursuant to ECF-3(B) of this Court's Administrative Order Regarding Electronic Case Filing (May 15, 2009), counsel hereby represents that the other parties listed in the signature blocks have consented to the filing of this motion.

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ADDENDUM

Links for Certain Cited Governmental Documents

EPA, *General Principles for the 5-Year Regional Haze Progress Reports for the Initial Regional Haze State Implementation Plans* (2013):

http://www.4cleanair.org/Documents/haze_5year_4-10-13.pdf

EPA, *2011 National Listing of Fish Advisories*, EPA-820-F-13-058 (2013):

http://water.epa.gov/scitech/swguidance/fishshellfish/fishadvisories/loader.cfm?csModule=security/getfile&PageID=685927

Final Report: Mercury TMDL for the State of Florida (2013):

http://www.dep.state.fl.us/water/tmdl/docs/tmdls/mercury/Mercury-TMDL.pdf

Kentucky State Implementation Plan (SIP) Revision: Regional Haze 5-Year Periodic Report 2008-2013 for Kentucky's Class I Federal Area (2014):

http://air.ky.gov/SiteCollectionDocuments/Kentucky_Regional_Haze_5-Year_Periodic_Report_SIP%20Revision_Sept_2014.pdf

Minnesota Statewide Mercury Total Maximum Daily Load (2007):

http://www.pca.state.mn.us/index.php/view-document.html?gid=8507

National Association of Clean Air Agencies, Survey on MATS Compliance Extension Requests (Aug. 11, 2015):

http://www.4cleanair.org/sites/default/files/Documents/MATSextensionrequests-table-August-2015.pdf

North Carolina Mercury Total Maximum Daily Load (2012):

http://portal.ncdenr.org/c/document_library/get_file?uuid=aecb3619-c246-4b49-bfd8-fd5541775110&groupId=38364

Northeast Regional Mercury Total Maximum Daily Load (2007):

http://www.epa.gov/region1/eco/tmdl/pdfs/ne/Northeast-Regional-Mercury-TMDL.pdf

Regional Haze 5-Year Periodic Review State Implementation Plan for North Carolina Class I Areas (2013):

http://www.ncair.org/planning/haze/RH_Periodic_Review_SIP_narrative_05312013.pdf

State Implementation Plan Regional Haze Periodic Progress Report for the State of Florida (2015):

https://www.dep.state.fl.us/air/rules/regulatory/regional-haze-plan/FL-SIP-2015-02-Regional-Haze-Plan-Progress-Report.pdf

Statewide Michigan Mercury Total Maximum Daily Load: Public Review Draft (2013):

http://www.michigan.gov/documents/deq/wrd-swas-hgtmdl-draft_415360_7.pdf

Total Maximum Daily Load for Mercury Impairments Based on Concentration in Fish Tissue Caused Mainly by Air Deposition to Address 122 HUC 14s Statewide (2009):

http://www.nj.gov/dep/wms/bear/TMDL%20HG%20document%20final%20version%209-8-09_formated%20for%20web%20posting%20js.pdf

CERTIFICATE OF SERVICE

I hereby certify that copies of the foregoing Joint Motion of the State, Local Government, and Public Health Respondent-Intervenors for Remand Without Vacatur has been served through the Court's CM/ECF system on all registered counsel. I further certify that a copy has been served by first-class U.S mail on all counsel not registered in the Court's CM/ECF system.

DATED: September 24, 2015

/s/ TRACY L. TRIPLETT

Tracy L. Triplett

Exhibit 1: Declaration of Philippe Grandjean

ORAL ARGUMENT HELD DECEMBER 10, 2013
DECIDED APRIL 15, 2014

IN THE UNITED STATES COURT OF APPEALS
FOR THE DISTRICT OF COLUMBIA CIRCUIT

WHITE STALLION ENERGY CENTER, LLC, *et al.*, *Petitioners*, v. U.S. Environmental Protection Agency, *et al.*, *Respondents*.	Case No. 12-1100 (and consolidated cases)

DECLARATION OF PHILIPPE GRANDJEAN

I, Philippe Grandjean, hereby declare and state as follows:

1. I am an Adjunct Professor of Environmental Health at the Harvard T.H. Chan School of Public Health and a Professor and Chair of Environmental Medicine at the University of Southern Denmark. I have previously served as the Director of the Department of Occupational Medicine at the Danish National Institute of Occupational Health, and I have served for 30 years as Consultant in Toxicology for the Danish National Board of Health of the Danish Ministry of Health.

2. I have served on expert committees under the auspices of the World Health Organization, the International Agency for Research on Cancer, the European Commission, the European Food Safety Authority, the U.S. Environmental Protection Agency, and other organizations. In 1994, I was elected Fellow of the American Association for the Advancement of Science.

3. My research focuses on the health effects of exposures to environmental chemicals, including mercury and other pollutants, such as lead, arsenic, and a variety of organic chemicals. My efforts have concentrated on the effects of environmental pollutants on fetal development, and my main focus during the last 25-30 years has been on methylmercury. This research has been almost entirely financed by U.S. agencies, the European Commission, and the Danish Medical Research Council. I have published more than 500 scientific papers, of which more than half are in international scientific journals with peer review. I have also authored or edited 20 books, including textbooks in environmental health and risk assessment. In the new edition of the Handbook on the Toxicology of Metals,[1] I was the lead author of the chapter on epidemiological approaches to metal toxicology, and I contributed to the chapter on principles for prevention of toxic effects from metals. Earlier this year, I edited a special issue of a major journal with review articles on vulnerability to toxic chemicals during early development,

[1] HANDBOOK ON THE TOXICOLOGY OF METALS, Fourth Edition (2015).

based on a conference that I organized in Boston in 2014 with support from the World Health Organization and U.S. federal agencies.

4. In regard to methylmercury, I chaired the Working Group that evaluated methylmercury for the WHO's International Agency for Research on Cancer in 1994. I served on the Expert Panel on Mercury of the Agency for Toxic Substances and Disease Registry in 1998. I chaired the scientific committee for an international conference on mercury in 1998 and served as editor of the proceedings. I also served as an invited expert to the Food Advisory Committee on Methylmercury of the Food and Drug Administration in 2002, and I served as a member of the Global Mercury Assessment Working Group of the U.N. Environment Programme in 2002. I served on the Working Group on mercury and methylmercury in food of the European Food Safety Authority in 2003-2004. In addition, I have been invited to prepare chapters on mercury for major handbooks on public health and toxicology, and I am frequently invited to lecture on mercury at universities, governmental agencies, and international research conferences.

5. In most of the world, the major anthropogenic source of mercury emissions is energy production from fossil fuels, especially coal.[2] U.S. anthropogenic mercury emissions are estimated to be about 100 tons per year.[3]

[2] United Nations Envtl. Programme, Global Mercury Assessment at 9, 190 (Dec. 2002), *available at* http://www.unep.org/gc/gc22/Document/UNEP-GC22-INF3.pdf; European Food Safety Authority, Opinion of the Scientific Panel on

6. Increases in anthropogenic mercury emissions have driven major increases in mercury contamination of the natural environment. I was part of a study of the hair-mercury concentration in polar bears, a top marine carnivore. Compared to concentrations in hides from the preindustrial era, current-day levels are increased about 10-fold.[4] More recent data from a variety of sources, along with modeling studies, confirm this order of magnitude.

7. In the aquatic environment, mercury is methylated, mostly by microbiologically catalyzed reactions, to form methylmercury. Methylmercury is accumulated by fish and marine mammals and attains its highest concentrations in large predatory species at the top of the aquatic and marine food chains. By this means, methylmercury enters the human diet.

8. Freshwater fish, and seafood in general (including marine mammals), constitute the dominant sources of human mercury exposure. Methylmercury generally accounts for 70-90% of the total mercury content in fish and seafood. The mercury concentrations in edible tissues of various fish species cover a wide range, mostly between 0.05 and 1.400 μg/g (sometimes expressed as parts per

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Contaminants in the Food Chain on a request from the Commission related to mercury and methylmercury in food at 15, EFSA-Q-2003-030 (Feb. 2004), *available at* http://www.efsa.europa.eu/sites/default/files/scientific_output/files/main_documents/2985.pdf.

[3] 76 Fed. Reg. 24,976, 25,002 tbl.3 (May 3, 2011).

[4] R. Dietz, *et al.*, Trends in mercury in hair of Greenlandic polar bears (Ursus maritimus) during 1892-2001, *Envtl. Sci. Tech.* 40: 1120-5 (2006).

million, ppm). The concentration is influenced by the species, the age, and the size of the fish, and environmental factors, such as pH and redox potential of the water. Large predatory fish, such as pike, swordfish, and tuna, contain the highest average concentrations.[5]

9. Freshwater fish may contain high methylmercury concentrations as a result of local releases to the aquatic environment or from deposition of airborne mercury from point sources, such as coal-fired power plants. Extensive studies on environmental fate and transfers indicate that mercury is accumulated within reservoirs in the environment, specifically in sediments of fresh water and marine ecosystems. As a reservoir, this compartment stores up mercury from atmospheric inputs (both directly and via run off of contaminated surface soils into surface water) such that there is a significant association between atmospheric levels of mercury and the cumulative impact on these reservoirs.[6]

10. Increased exposures are seen in human subjects who frequently eat fish and seafood, in particular in those who eat species with high accumulation levels. Data suggest that only 1-2% of Americans consume fish or shellfish almost daily,

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[5] S.M. Silbernagel, *et al.*, Recognizing and Preventing Overexposure to Methylmercury from Fish and Seafood Consumption: Information for Physicians, *J. Toxicology* 983072 at 4 tbl.4 (2011), *available at* http://downloads.hindawi.com/journals/jt/2011/983072.pdf.

[6] H.M. Amos, *et al.*, Observational and Modeling Constraints on Global Anthropogenic Enrichment of Mercury, *Envtl. Sci. Tech.* 49: 4041-42 (2015), *available at* http://bgc.seas.harvard.edu/assets/es5058665.pdf.

but less frequent intakes, *e.g.*, among anglers consuming fish from polluted waterways, can result in high-level exposures.[7] Of particular concern is the fact that, on a body-weight basis, small children may receive a substantially higher exposure than adults.

11. Methylmercury is a neurotoxicant that causes toxic damage to the nervous system and, in particular, the brain.[8] Methylmercury can pass the placenta, and the developing brain is particularly vulnerable to such effects. If methylmercury toxicity occurs during fetal or early postnatal development, the damage is much more severe and more widespread than in adults, and the effects are likely to be permanent.

12. Other toxic elements are also emitted from coal-fired power plants in large quantities, including arsenic, lead, and cadmium, all of which are neurotoxic

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[7] K.R. Mahaffey, Mercury Exposure: Medical and Public Health Issues, 116 *Transactions of the Am. Clinical Climatological Ass'n* 127: 138-41 (2005), *available at* http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1473138/pdf/tacca116000127.pdf; L. Knobeloch, *et al.*, Fish consumption, advisory awareness, and hair mercury levels among women of childbearing age. *Envtl. Research* 97: 220 (2005); R.A. Lincoln, *et al.*, Fish Consumption and Mercury Exposure among Louisiana Recreational Anglers, *Envtl. Health Perspectives* 119: 245 (2011), *available at* http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3040613/pdf/ehp-119-245.pdf.

[8] Global Mercury Assessment, *supra* n.2, at iii-iv; Opinion of the Scientific Panel on Contaminants in the Food Chain on a request from the Commission related to mercury and methylmercury in food, *supra* n.2, at 82-108; M.R. Karagas, *et al.*, Evidence on the Human Health Effects of Low-Level Methylmercury Exposure, *Envtl. Health Perspectives* 120: 799, 801-03 (2012), *available at* http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3385440/pdf/ehp.1104494.pdf.

and contribute to the pandemic of developmental neurotoxicity.[9] The toxicity of each of these substances is supported by a large scientific literature. Like mercury, arsenic and lead easily cross the placental barrier and thereby expose the developing fetus, with impacts on neonatal and early childhood outcomes.

13. The first documentation of methylmercury neurotoxicity to the developing brain is from Japan, where apparently healthy mothers, who had eaten contaminated seafood, gave birth to children with severe congenital methylmercury poisoning. The fetus and the breast-fed child cannot metabolize and eliminate methylmercury.

14. The results from high-levels of contamination have long been clear, but a substantial base of scientific evidence and data now exists to show that methylmercury is also neurotoxic at low doses, in particular in regard to brain development.[10] Researchers, including myself, have studied the effects of methylmercury exposure from dietary intakes at lower and lower levels during the last 25 years.

15. In the Faroe Islands, where most of the methylmercury exposure comes from the meat of the pilot whale, we demonstrated that children exposed to

[9] P. Grandjean, *et al.*, Developmental neurotoxicity of industrial chemicals, *Lancet* 368: 2167 (2006).

[10] Global Mercury Assessment, *supra* n.2, at 38-42, 44-45, 48; Opinion of the Scientific Panel on Contaminants in the Food Chain on a request from the Commission related to mercury and methylmercury in food, *supra* n.2, at 82-108; Karagas, *supra* n.8, at 801-03.

methylmercury in utero exhibit decreased motor function, attention span, verbal abilities, memory, and other mental functions.[11] These effects are dose dependent: the greater the mercury exposure, the greater the effect. In our follow-up of these children at ages 14 and 22, we found that the deficits tend to be permanent.[12] We found that a doubling of the prenatal mercury exposure of a child, even at relatively low levels, resulted in a developmental delay of one to two months at the age of seven years, *i.e.*, at the age when the child is expected to enter school. Each delay corresponds to about 1.5 I.Q. points.

16. Like other fish-eating populations, the Faroese population is also exposed to other contaminants, such as polychlorinated biphenyls (PCBs),[13] which are emitted by coal-fired power plants from old equipment and regulated by the mercury and air toxics rule. We therefore examined whether PCBs can explain methylmercury-associated neurotoxicity. Although PCBs appear to exert a weak neurotoxic effect, this exposure does not explain the strong statistical associations with methylmercury exposure. We have also explored a large number of other

[11] P. Grandjean, *et al.*, Cognitive deficit in 7-year-old children with prenatal exposure to methylmercury, *Neurotoxicology & Teratology* 19: 417 (1997).
[12] F. Debes, *et al.*, Impact of prenatal methylmercury exposure on neurobehavioral function at age 14 years, *Neurotoxicology & Teratology* 28: 363, 540-44; F. Debes, *et al.*, Cognitive deficits at age 22 years associated with prenatal exposure to methylmercury at 5-9, *Cortex* (2015).
[13] P. Grandjean, *et al.*, Neurobehavioral deficits at age 7 years associated with prenatal exposure to toxicants from maternal seafood diet, *Neurotoxicology & Teratology* 34: 466, 466, 468 (2012).

cofactors that might conceivably play a role, but we have failed to find any likely explanation of the cognitive deficits other than developmental exposure to methylmercury due to the mother's seafood diet.

17. Our results are in accord with early data obtained from New Zealand,[14] and subsequent studies also generally accord with our findings. For example, the Project Viva study in Boston, where fish consumption is higher than average for the U.S., showed a mean maternal hair mercury concentration of 0.53 μg/g.[15] Even at these levels — much lower than in the Faroe Islands — the maternal hair mercury was associated with a reduction in children's cognition at 6 months of age and again at three years of age. This suggests that the association with cognitive impairment occurs at the low mercury concentrations seen in the general U.S. population, and hence constitutes a matter of serious public health concern.

18. We also have found evidence that mercury exposure compromises cardiovascular health. In the Faroe Islands study, children with increased mercury exposure had difficulty regulating their heartbeat via their autonomic nervous

[14] T. Kjellström, *et al.*, Physical and Mental Development of Children with Prenatal Exposure to Mercury from Fish. Stage II: Interviews and Psychological Tests at Age 6. Solna: National Swedish Environmental Protection Board, 1989.
[15] E. Oken, *et al.*, Maternal fish intake during pregnancy, blood mercury levels, and child cognition at age 3 years in a US cohort, *Am. J. Epidemiology* 167: 1171, 1174 (2008), *available at* http://aje.oxfordjournals.org/content/167/10/1171.full.pdf+html.

system and also had a tendency of increased blood pressure.[16] Recent epidemiological studies suggest that adverse cardiovascular effects may occur at exposures that are prevalent among people regularly eating seafood.[17] While fish oil may help prevent cardiovascular effects of mercury, interpretation of epidemiological studies can be complicated, as it must also take into account the precision of exposure estimates.[18] Although the full implications of these findings are not yet clear, they suggest that methylmercury can cause adverse effects in the adult population.

19. Mercury exposure also produces a range of other toxic effects reported in human populations.[19] For example, methylmercury may spur the development of degenerative disease of the nervous system, such as Parkinson's disease.[20]

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[16] N. Sorensen, *et al.*, Prenatal Methylmercury Exposure as a Cardiovascular Risk Factor at Seven Years of Age, *Epidemiology* 10: 370, 372-73 (1999), http://pdfs.journals.lww.com/epidem/1999/07000/Prenatal_Methylmercury_Exposure_as_a.6.pdf; P. Grandjean, *et al.*, Cardiac autonomic activity in methylmercury neurotoxicity: 14-year follow-up of a Faroese birth cohort. *J. Pediatrics* 144: 169, 171-72 (2004).

[17] E. Guallar, *et al.*, Mercury, Fish Oils, and the Risk of Myocardial Infarction, *New England J. Med.* 347: 1747, 1753 (2002), *available at* http://www.nejm.org/doi/pdf/10.1056/NEJMoa020157; J.K. Virtanen, *et al.*, Mercury, Fish Oils, and Risk of Acute Coronary Events and Cardiovascular Disease, Coronary Heart Disease, and All-Cause Mortality in Men in Eastern Finland, *Arteriosclerosis, Thrombosis, & Vascular Biology* 25: 228, 232 (2005), http://atvb.ahajournals.org/content/25/1/228.full.pdf+html.

[18] D. Mozaffarian, *et al.*, Mercury Exposure and Risk of Cardiovascular Disease in Two U.S. Cohorts, *New England J. Med.* 364: 1116, 1124 (2011), *available at* http://www.nejm.org/doi/pdf/10.1056/NEJMoa1006876.

[19] Karagas, *supra* n.8, at 803-04.

20. Substantial evidence exists that methylmercury chloride is carcinogenic to experimental animals.[21] In the absence of comprehensive epidemiological data, methylmercury is therefore considered a possible human carcinogen (class 2B). The U.S. Environmental Protection Agency has also classified methylmercury as a possible human carcinogen.

21. As already indicated, methylmercury exposure undermines the beneficial effects of seafood nutrients. Fish generally contains fatty acids (fish oil) that are beneficial to the cardiovascular system and are recommended as an important part of a varied diet. Mercury in fish can counteract those benefits.[22] This was demonstrated by the Project Viva study in Boston,[23] and was confirmed in a study in New York City.[24] Data from the Seychelles show that cognitive development in children is associated neither with maternal fish intake nor with methylmercury exposure, when examined one at a time. However, if both maternal fish intake and

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[20] M.S. Petersen, *et al.*, Increased prenatal exposure to methylmercury does not affect the risk of Parkinson's disease, *Neurotoxicology* 29: 591, 591 (2008).
[21] Int'l Agency for Research on Cancer, IARC Monographs on the Evaluation of Carcinogenic Risks to Humans, Volume 58 Beryllium, Cadmium, Mercury, and Exposures in the Glass Manufacturing Industry at 277-83 (1993), *available at* http://monographs.iarc.fr/ENG/Monographs/vol58/mono58.pdf.
[22] A.L. Choi, *et al.*, Negative confounding in the evaluation of toxicity: the case of methylmercury in fish and seafood, *Critical Reviews in Toxicology* 38: 877 (2008).
[23] Oken, *supra* n.15, at 1177-79.
[24] S.A. Lederman, *et al.*, Relation between Cord Blood Mercury Levels and Early Child Development in a World Trade Center Cohort, *Envtl. Health Perspectives* 116: 1085, 1090 (2008), *available at* http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2516590/pdf/ehp0116-001085.pdf.

mercury are included in the statistical analysis at the same time, then fish intake is clearly beneficial, and mercury has negative effects.[25] In other words, full benefits from fish and seafood diets require that methylmercury exposures are minimized, and estimates of the benefits of eating seafood, given current levels of mercury contamination, must take into account the negative impact of methylmercury.

22. Using the U.S. EPA reference dose of 0.1 μg/kg body weight, a 60 kg adult woman can ingest 42 μg of methylmercury during a week without exceeding this limit. If she follows the recommendation of many nutritionists and, *e.g.*, the American Heart Association, she will attempt to eat two fish dinners per week. Assuming that each serving is about seven ounces, then the two dinners will correspond to 420 grams of fish. In order to avoid exceeding the reference dose, she must therefore choose fish with an average mercury concentration of no more than 0.1 μg/kg. She could choose salmon, haddock, shrimp and similar types of seafood that are low in mercury. However, many freshwater fish and large marine species exceed this level, and consumers will therefore find it difficult to respect the nutritional recommendations while keeping below the mercury reference dose. Thus, current methylmercury contamination levels are clearly interfering with the desire to obtain health benefits from nutrients in freshwater fish and seafood. This

[25] J.J. Strain, *et al.*, Associations of maternal long-chain polyunsaturated fatty acids, methyl mercury, and infant development in the Seychelles Child Development Nutrition Study. *Neurotoxicology* 29: 776, 781-82 (2008).

unfortunate conclusion is meaningful in light of the ecological and modeling studies that show that mercury levels in marine food chains have increased by a factor of 10 above pre-industrial levels.[26]

23. Mercury contamination is the most frequent reason for freshwater fish advisories by U.S. states. According to the U.S. EPA National Listing of Fish Advisories, about three of four advisories warn anglers against consuming freshwater fish or costal seafood because of mercury contamination that affects about 16.4 million lake acres and 1.1 million river miles.[27] These advisories are usually specific to freshwater bodies or coasts, though sometimes statewide, and they devise limits on predatory fish consumption for children and women of child-bearing age.

24. The National Research Council recommended that EPA set a target maximum dose of 5.8 μg/L in cord blood (that reflects prenatal exposure). This conclusion was derived from results obtained by the Faroe Islands study that my colleagues and I performed. Since mercury is concentrated in fetal blood cells, maternal blood concentrations tend to be lower than cord blood concentrations.

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[26] R. Dietz, *et al.*, Anthropogenic contributions to mercury levels in present-day Arctic animals--a review, *Sci. Total Env't* 407: 6120, 6125-26 (2009); Amos, *supra* n.6, at 4040-42.

[27] U.S. Environmental Protection Agency, National Listing of Fish Advisories: Technical Fact Sheet 2011, EPA-820-F-13-058 (December 2013), *available at* *http://water.epa.gov/scitech/swguidance/fishshellfish/fishadvisories/technicalfs2011.cfm#table1*

Hence this translates into a maximum of 3.5 µg/L in the mothers' blood.[28] Data from the National Health and Nutrition Examination Survey show that about 16% of U.S. women of childbearing age have mercury concentrations in their blood at least that high.[29] This prevalence is noteworthy, given that few women consume the recommended two fish dinners per week. Hence, the current risk of excess methylmercury exposure is substantial within the U.S. population, and it has therefore become a public health priority to eliminate emissions that increase this risk. The most recent data indicate that considerable numbers of people in the U.S. have blood mercury concentrations above the level that corresponds to the U.S. EPA reference dose.[30] American women of reproductive age who eat average amounts of fish and seafood have an average blood-mercury concentration of about 1.4 µg/L, with higher concentrations at higher incomes and certain ethnic groups. This average corresponds to 40% of the RfD. Increased methylmercury exposures are seen in subjects who frequently eat fish and seafood, in particular in those who eat species with high accumulation levels. However, even less frequent intakes,

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[28] Mahaffey, *supra* n.7, at 144-46.
[29] *Id.* at 134 tbl.2.
[30] U.S. Environmental Protection Agency, Trends in Blood Mercury Concentrations and Fish Consumption Among U.S. Women of Childbearing Age at 21-22 & tbl.5, EPA-823-R-13-002 (July 2013), *available at* http://water.epa.gov/scitech/swguidance/fishshellfish/fishadvisories/upload/Trends-in-Blood-Mercury-Concentrations-and-Fish-Consumption-Among-U-S-Women-of-Childbearing-Age-NHANES-1999-2010.pdf.

e.g., among anglers consuming fish from polluted waterways, can result in high-level exposures.[31]

25. Moreover, now that scientific understanding of the harms of lower methylmercury exposures has increased, the scientific and public health community is unable to identify a level below which methylmercury is truly safe. In 2007 we recalculated the reference dose using the methods endorsed by the National Research Council,[32] while applying advanced statistical modeling. We found that the reference dose is twice as high as it should be.[33] Given the study results showing adverse effects associated with habitual exposures associated with common fish consumption,[34] an updated exposure limit would likely be even lower. Previous estimates of methylmercury toxicity, and associated adverse human health effects, should therefore be regarded as likely underestimates.

26. The societal costs of methylmercury toxicity can be quantified in terms of indirect costs. Thus, cognitive deficits expressed in terms of I.Q. decreases will result in a lower chance of completing high school and higher education, and will

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[31] Lincoln, *supra* n.7; L. Knobeloch, *et al.*, Methylmercury exposure in Wisconsin: A case study series, *Envtl. Research* 101: 113 (2006).
[32] Nat'l Research Council, *Toxicological effects of methylmercury* (2000), *available at* https://www.nap.edu/login.php?record_id=9899&page=https://www.nap.edu/download.php?record_id=9899.
[33] P. Grandjean, *et al.*, Total Imprecision of Exposure Biomarkers: Implications for Calculating Exposure Limits, *Am. J. Indus. Med.* 50: 712 (2007).
[34] Karagas, *supra* n.8, at 801-04; Oken, *supra* n.15, at 1175; Lederman, *supra* n.24, at 1090.

also lead to lower lifetime earnings. Trasande and colleagues estimated in 2005 that mercury exposure was associated with an $8.7 billion annual reduction in lifetime earnings due to lower I.Q. in children born in the U.S. in the year of exposure; of that, $1.3 billion was attributable to U.S. power plant emissions.[35] In a 2011 update, incorporating further supporting evidence, Trasande and Liu calculated lost earnings of $5.1 billion annually.[36] My own calculations are very similar.[37] These estimates capture only one narrow aspect of the adverse human health effects of power plant mercury emissions. Other impacts, including but not limited to other effects of lowered I.Q., other cognitive deficits, cardiovascular risk, and the negative health implications of reduced fish intake, would also have to be considered to reach a more comprehensive estimate of the societal cost of power plant mercury emissions.

27. Although the above are only partial estimates of the societal cost of power plant mercury exposures, they are more comprehensive than the estimate of lost earnings given by EPA in its Regulatory Impacts Analysis for the Mercury and

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[35] L. Trasande, *et al.*, Public Health and Economic Consequences of Methyl Mercury Toxicity to the Developing Brain, *Envtl. Health Perspectives* 113: 590, 594 (2005), *available at* http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1257552/pdf/ehp0113-000590.pdf.

[36] L. Trasande, *et al.*, Reducing The Staggering Costs Of Environmental Disease In Children, Estimated At $76.6 billion In 2008, *Health Affairs* 30: 863, 865 Exh. 1 (2011), *available at* http://content.healthaffairs.org/content/30/5/863.full.pdf+html.

[37] P. Grandjean, *et al.*, Calculation of mercury's effects on neurodevelopment. *Envtl. Health Perspectives* 120: A452 (2012), *available at* http://ehp.niehs.nih.gov/wp-content/uploads/2012/11/ehp.1206033.pdf.

Air Toxics Rule, which was only of lost earnings by children exposed in utero to mercury from freshwater fish caught by a recreational angler in the same household.[38] Further, in that analysis, when EPA found that mercury data was unavailable for a waterway frequented by recreational freshwater anglers, EPA very conservatively assumed that the mercury contributed by the waterway was zero, reducing already low exposure estimates by 44%.[39] In addition, while EPA's general approach to estimating the sensitivity of I.Q. to cord blood methylmercury was sound, its dose-response information from a 2007 study by Axelrad *et al.*,[40] is outdated and results in a severe underestimation of the costs.

28. Atmospheric mercury reductions on the scale promised by the mercury and air toxics rule would, if sustained, likely yield major percentage reductions in fish-tissue mercury within 5 to 20 years. Thus, studies have shown that sustained reductions in atmospheric mercury can yield substantial reductions in methylmercury levels in freshwater predator species within as little as five years.[41] Part of the explanation for this rapid effect is that recently emitted mercury is

[38] EPA, Regulatory Impact Analysis at 4-9 to 4-13, EPA-HQ-OAR-2009-0234-20131.
[39] *Id.* at 4-49.
[40] *Id.* at 4-31.
[41] Evers *et al.*, Biological Mercury Hotspots in the Northeastern United States and Southern Canada, *BioScience* 57: 29, 38-39 (2007).

generally thought to be more readily bioavailable than mercury that has been in the ecosystem for some time.[42]

29. The following chart presents the results of a Florida study that estimated major percentage reductions in fish-tissue mercury within 10 to 20 years of atmospheric mercury reductions on the scale promised by EPA's mercury and air toxics rule:

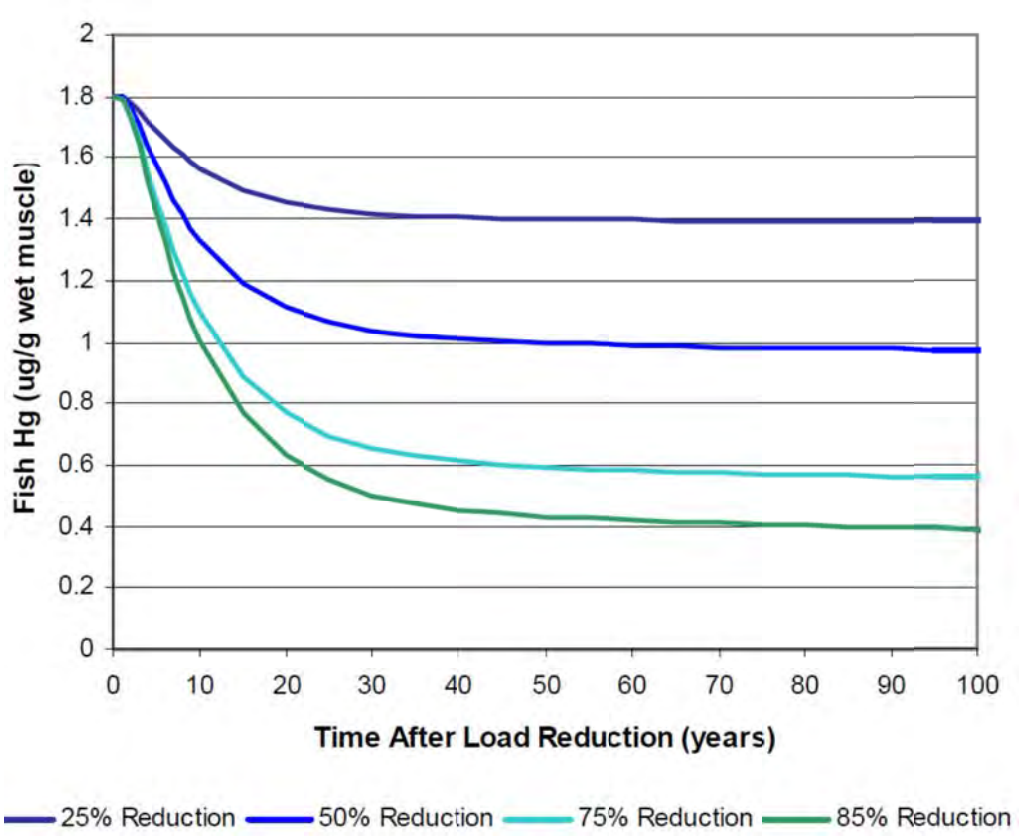


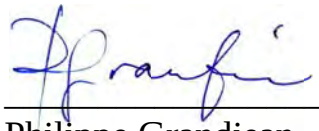
Figure 4. Estimated impacts of reductions in mercury (Hg) inputs into aquatic systems and reductions in fish mercury concentrations.[43]

[42] Gilmour *et al.*, Response of Methylmercury Loading to Changes in Hg Loading: A Comparison of Hg Isotope Addition Studies, STAR Mercury Fate and Transport Final Progress Review Workshop (2003).

[43] Atkeson *et al.*, Integrating Atmospheric Mercury Deposition and Aquatic Cycling in the Florida Everglades, Final Report (2003).

30. Another conclusion to be drawn from these studies is that a short term increase in atmospheric mercury load, like that associated with a change in mercury control requirements for coal-fired power plants, will produce increases in atmospheric and deposited mercury that will remain within critical environmental reservoirs, available for uptake by fish and eventual consumption by humans, for decades.

I declare under penalty of perjury that the foregoing is true and correct.



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Executed on 18 September, 2015.

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Academic degrees

1974, M.D., University of Copenhagen
1975, Diploma in basic medical research, University of Copenhagen
1979, D.M.Sc. (dr.med.), University of Copenhagen

Chronology of employment

1974-1975	Postgraduate training fellowship, University of Copenhagen
1975-1978	Research fellow, Institute of Hygiene, University of Copenhagen
1978-1980	Senior research fellow, University of Copenhagen Visiting fellow, Department of Community Medicine, Mount Sinai School of Medicine, New York
1980-1982	Director, Department of Occupational Medicine, Danish National Institute of Occupational Health
1982-Present	Professor of Environmental Medicine, Odense University
1983-Present	Consultant in Toxicology, National Board of Health
1994-2002	Adjunct Professor of Public Health (Environmental Health) and Neurology, Boston University School of Medicine, Boston
2003-Present	Adjunct Professor of Environmental Health, Harvard School of Public Health, Boston

Awards and honors

Prize essay in medicine, University of Copenhagen (1972)
Fulbright senior research scholarship (1978)
Keynote speaker, Odense University anniversary (1983)
Gitlitz Memorial Lecture, Association of Clinical Scientists, USA (1985)
Knight of the Dannebrog, awarded by the Queen of Denmark (1990)
The Dannin prize for medical research (1991)
Fellow, American Association for the Advancement of Science (1994)

Irish Congress Lecturer, Royal College of Physicians of Ireland and Irish Society of Toxicology (1996)
Knight of the Dannebrog, First Degree, awarded by the Queen of Denmark (2003)
'Mercury madness award' for excellence in science in the public interest from eight US environmental organizations (2004)
Emeritus Fellow, International Union of Pure and Applied Chemistry, IUPAC (2009)
Honorary Research Award, International Order of Odd Fellows (2010)
Science Communication Award, University of Southern Denmark (2012)

Editorial boards
American Journal of Industrial Medicine (1987-2017)
Applied Organometal Chemistry (1985-1991)
Arbejdsmiljø (Occupational Environment, in Danish, 1983-1990)
Archives of Environmental Health (European Editor, 1986-1992)
Archives of Toxicology (1987-Present)
Biomarkers (1996-2001)
Central European Journal of Occupational and Environmental Medicine (2015-Present)
Critical Reviews in Toxicology (1985-2012)
Danish Medical Bulletin (1994-2003)
Environmental Health (Editor-in-Chief, 2002-Present)
Environmental Health Perspectives (2003-Present)
Environmental Research (1981-1994 and 2014-Present, Associate Editor, 1995-2014)
Industrial Health (2000-2005)
International Journal of Hygiene and Environmental Health (2001-Present)
International Journal of Occupational and Environmental Health (1994-2011)
International Journal of Occupational Medicine & Environmental Health (1991-Present)
Journal of Clean Technology, Environmental Toxicology, and Occupational Medicine (1992-1998)
Journal of Environmental Medicine (1998-1999)
Naturens Verden (Natural Science, in Danish) (1987-1991)
Ugeskrift for Læger (Danish Medical Journal, in Danish) (1991-2007)

Scientific societies
American Association for the Advancement of Science (Fellow, 1994)
American Public Health Association
Collegium Ramazzini (Fellow, 1987; Member of the Council, 2005-2013)
Danish Medical Association
Danish Societies of Clinical Chemistry, Epidemiology, Occupational and Environmental Medicine, and Public Health
Faroese Society of Science and Letters
International Commission on Occupational Health
International Society for Environmental Epidemiology

Research support as Principal Investigator since 2000
2000-2006 NIEHS
Mercury associated neurobehavioral deficit in children
2001-2003 Nordic Arctic Research Programme (NARP)
Changing patterns of biomagnified pollutants in the northern marine environment
2001-2004 Danish Medical Research Council
Exposure asessment for endocrine disruptors
2002-2004 Danish Medical Research Council
Environmental epidemiology research

2003-2004 European Commission
Assessment of Neurobehavioral Endpoints and Markers of Neurotoxicant Exposures (ANEMONE)
2003-2005 Danish Medical Research Council
Research in hormone related substances
2003-2006 NIEHS ES 11687
Effects of perinatal disruptors in children
2003-2007 EPA STAR RD-83075801-0
Children's vulnerability to environmental immunotoxicant
2004-2011 NIEHS ES12199
Epidemiology of immunotoxicant exposure in children
2006-2011 NIEHS ES13692
Health effects of lifetime exposure to food contaminants
2006-2012 NIEHS ES14460
Three-generation human study of reproductive effects of marine food contaminants
2008-2012 Danish Council for Strategic Research
Environmental pollutant impact on antibody production against current and new childhood vaccines
2007-2013 NIEHS ES009797
Mercury associated neurobehavioral deficit in children

Major Current Funding as Principal Investigator
2011-2016 NIEHS ES012199
Epidemiology of immunotoxicant exposure in children
2012-2017 NIEHS ES021993 and NSF OCE-1321612
Immunotoxicity in Humans with Lifetime Exposure to Ocean Pollutants
2013-2018 NIEHS ES021477
Glucose Metabolism in Adults Prenatally Exposed to Diabetogenic Pollutants
2013-2018 NIEHS ES021372
Pollutant-related diabetes in the Nurses' Health Study II
2014-2016 NIEHS ES023376
Gut Microbiome in Adults with Early Life Exposures to Environmental Chemicals

Major committees, boards and elective offices
Danish:
Danish Medical Association: Member, Prevention Council (2011-2014)
Danish Medical Research Council: Consultant on environmental medicine (1985-1990); Member, Joint Research Council Committee on Environmental Research (1986-1991); Member of DMRC (1992-1998)
Danish Society of Community Medicine: Secretary (1977-1978)
Danish Society of Industrial Medicine: Board Member (1974-1983)
Ministry of Education: Member, Committee on Toxicology (1984-1986); Member, Committee on Environmental Education (1986-1987)
Ministry of the Environment: Member, Council on Environmental Chemicals (1983-1989); Member, Environmental Appeal Board (1986- 2010); Member, Environmental Research Council (1990-1992); Member, Advisory Committee on Pesticide Research (1995-2004); Member, Advisory Committee on Arctic Research (1996-2004)
Ministry of Health: numerous committee appointments; Chair, Committee on Risk Perception (2000-2001)
Ministry of Labour: Consultant on Occupational Health, Council on Occupational Safety and Health (1983-1993); Member, Occupational Health Council Research Committee (on behalf of the Danish Medical Research Council) (1984-1990 and 1999-2003)

Ministry of Research: Chair, Committee on Research at the Faroe Islands (1995-1996); Member, Committee on Scientific Dishonesty (2004-2006); Chair, Committee on Non-Ionizing Radiation(2004-2009)
Odense University (from 2000 University of Southern Denmark), elected offices: Chairman, Institute of Community Health (1982-1985; 1996-1999); Member of Executive Committee, Institute of Community Health (from 2000 Institute of Public Health) (1986-1995; 2000-2005); Member, Faculty Research Committee (1983-1985); Member, Curriculum Committee (1984-1986); Member, Faculty Council (1985-1993); Vice-Dean (1991-1993)

United States and international:
Academy of Finland: member of panel evaluating the National Institute of Public Health (1995), site visit of center of excellence (2001)
Agency for Toxic Substances and Disease Registry: Workshop Rapporteur, Neurobehavioral Test Batteries for Use in Environmental Health Field Studies (1992); Member, Expert Panel of Mercury (1998)
Association of Schools of Public Health in the European Region: Treasurer (1975-1977)
BioMedCentral: Member, Editors Advisory Group (2011-2013)
Boston Environmental Hazards Center: Consultant (1994-1999)
Collegium Ramazzini: President, International Conference, The precautionary principle: Implications for research and prevention in environmental and occupational health (2002); Member, Executive Council (2005-2013)
Commission of the European Communities: National Expert, Working Party on Environmental and Lifestyle-Related Diseases (1988-1990); ad hoc Consultant for evaluation of research applications; ad hoc Scientific Advisor on Risk Assessment (2009-Present); Member, Scientific Committee on Emerging and Newly Identified Health Risks; – Working group on Dental Amalgam (Human Health) (2012-2013)
European Environment Agency: Member, Scientific Committee (2012-2015)
European Food Safety Authority: Member, Panel on Contaminants in the Food Chain responsible for 85 opinions (2003-2009); Member of Working Groups on mercury, polychlorinated biphenyls, cadmium, lead, and benchmark dose Food Advisory Committee, U.S.FDA, Methylmercury: invited expert (2002)
INMA (Infancia y Medio Ambiente) Project Steering Committee: Member (2010-Present)
International Agency for Research on Cancer: Member of Task Group, Monographs on the Evaluation of Carcinogenic Risks to Humans, Vol. 47 (1988), Vol. 49 (1989), as chairman, Vol. 58 (1993), and as Subgroup chair, Vol. 100C (2009)
International Commission on Occupational Health: Danish Delegation Secretary (1982-90); Member, Scientific Committee on the Toxicology of Metals (1987-Present); Member of the Board (1990-1996)
International Programme on Chemical Safety: Member of Task Group, Environmental Health Criteria, Vol. 36 (1984) and 72 (1986)
International Society for Environmental Epidemiology: Councillor (1991-1994)
International Union of Pure and Applied Chemistry: Member, Subcommittee on the Toxicology of Nickel (1979-1989); Titular Member (1985-1991) and Chairman (1987-1991), Commission on Toxicology;
Chairman, Subcommittee on Risk Assessment (1985-1989)
Karolinska Institute (Stockholm, Sweden): Member of international evaluation panel on environmental medicine (1993)
Ministry for Scientific Policy (Belgium): Consultant on national research program on health hazards (1990 and 1994)
National Institutes of Health (USA): Member of Special emphasis panels (2009-Present)
NATO Priority Area Panel on Environmental Security: Member (1996-1997)

Norwegian Research Council: ad hoc reviewer (2001-2008); Chairman of Environment and Health Review Group (2009-2010); member of steering committee (2011-2015)
Society of Occupational and Environmental Health: Member, Governing Council (1990-1993)
Swedish Council for Work Life Research: Member, Priority Committee on Chemical Health Risks (1997-1998)
U.N.Environment Programme: Member, Global Mercury Assessment Working Group (2002)
U.S. Environmental Protection Agency: Member, SAB/SAP Endocrine Disruptor Screening Program Subcommittee (1998-1999); Member, Food Quality Protection Act (FQPA) Science Review Board (SRB)(1999-2003)
White House Office of Science and Technology Policy: Team leader and presenter, Workshop on Scientific Issues Relevant to Assessment of Health Effects from Exposure to Methylmercury (1998)
World Health Organization: Temporary Adviser or Consultant on numerous occasions, five times elected Rapporteur; Member, European Advisory Committee on Health Research (2011-2014)

Books

1. Grandjean P, ed. Standards setting. Copenhagen: Occupational Health Foundation, 1977, 210 pp.

2. Grandjean P, Nielsen T. Organiske blyforbindelser, forurening og toksikologi (Organolead compounds, pollution and toxicology, in Danish). Report No. SNV PM 879. Stockholm: Naturvårdsverket, 1977, 78 pp.

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Exhibit 2: Declaration of Paul J. Miller

IN THE UNITED STATES COURT OF APPEALS
FOR THE DISTRICT OF COLUMBIA

WHITE STALLION ENERGY CENTER, LLC, et al.,	
Petitioners,	
v.	**Case No. 12-1100 (and consolidated cases)**
U.S. ENVIRONMENTAL PROTECTION AGENCY,	
Respondent.	

DECLARATION OF PAUL J. MILLER, PhD.
DEPUTY DIRECTOR AND CHIEF SCIENTIST
NORTHEAST STATES FOR COORDINATED AIR USE MANAGEMENT

I, Paul J. Miller, state and declare as follows:

I. Purpose of this Declaration

1. I am the Deputy Director and Chief Scientist of the Northeast States for Coordinated Air Use Management ("NESCAUM"). NESCAUM is a nonprofit association of air quality agencies in the six New England states (Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont), New Jersey, and New York ("NESCAUM states"). NESCAUM provides scientific, technical, analytical, and policy support to the air quality and climate programs of those eight Northeast states. A fundamental component of our efforts is to assist our member

states in implementing national environmental programs required under the Clean Air Act and other federal legislation.

2. I provide this declaration on behalf of NESCAUM in support of the State, Local Governments, and Public Health Respondent-Intervenors' motion requesting that the Court remand the Mercury and Air Toxics Standards ("Air Toxics Rule"), 77 Fed. Reg. 9304 (Feb. 12, 2012), to EPA without vacating it because the Air Toxics Rule provides essential protection of public health and the environment from the serious harms posed by emissions of mercury and other air pollutants from coal-fired power plants.

II. Experience and Qualifications

3. My responsibilities at NESCAUM include providing technical, policy, and legal support for all NESCAUM initiatives. I have more than 20 years of experience in the fields of atmospheric science and environmental policy. I am familiar with the air pollutant emissions of coal- and oil-fired power plants, such as acid gases, mercury, and other heavy metals, the transport of those pollutants, and the technologies available to control those emissions. I have co-authored a number of institutional reports and peer-reviewed science journal articles on mercury pollution and power plant emissions.

4. I have previously been a Senior Research Fellow at Princeton University's Center for Energy and Environmental Studies, and a National

Research Council Associate at the Joint Institute for Laboratory Astrophysics, University of Colorado, Boulder. I hold a Bachelor of Science in Chemistry, with Highest Distinction, from Purdue University, and was awarded a Kent Fellowship from Yale University where I earned a Doctorate in Philosophy (Chemical Physics). My research involved investigating the photochemical physics of small molecules in the gas phase using laser spectroscopic techniques. I also hold a Juris Doctor from Stanford Law School, and currently apply my combined science and legal backgrounds in support of sound environmental policymaking among the NESCAUM states. My curriculum vitae is attached as Attachment A to this declaration.

III. Efforts by the States to Reduce the Risks to Public Health and the Environment from Mercury Emissions

5. Mercury is a persistent, bioaccumulative, and neurotoxic pollutant. The major route of exposure to mercury in humans is through consumption of fish in which methylmercury, a particularly toxic form of mercury, has become concentrated through bioaccumulation. Women of child bearing age are of special concern because methylmercury ingested by a mother can move across the placenta into the brain of a developing fetus. In young children and fetuses, methylmercury inhibits the normal development of the nervous system, an effect

that may occur even at low exposure levels.[1] Birds, such as common loons, and mammals, such as otters, that eat fish have also been shown to suffer adverse effects from high concentrations of mercury in their bodies.[2]

6. In light of the dangers posed by mercury contamination, the NESCAUM states have for more than fifteen years aggressively regulated in-region mercury releases to the air. Starting in the 1990s, those states imposed strict limits on mercury emissions from municipal waste combustors and medical waste incinerators, and stringent limits on mercury emissions from coal-fired power plants followed in the mid-2000s.[3] Today, all of the NESCAUM states with coal-fired power plants located in their borders, and many other states, have placed limits on mercury emissions from coal-fired power plants, and many of those emission limits are well below that required by the Air Toxics Rule.

7. Despite those efforts, mercury contamination of surface waters continues to be a significant problem throughout the Northeast. Today, approximately 1.7 million acres of lakes, ponds, and reservoirs, and 56,000 miles of rivers and streams, located in the NESCAUM states are considered impaired

[1] Salonen, et al., Mercury Accumulation and Accelerated Progression of Carotid Atherosclerosis: A Population-Based Prospective 4-year Follow-Up Study in Men in Eastern Finland, 148 *Atherosclerosis* 265-273 (2000); 76 Fed. Reg. 24,976, 24,983, 25,000-01, 25,007 (May 3, 2011).
[2] Driscoll, et al., Mercury Contamination in Forest and Freshwater Ecosystems in the Northeastern United States, 57 *BioScience* 18-28 (2007); 77 Fed. Reg. at 9310; 76 Fed. Reg. at 25,000.
[3] The NESCAUM states and others have also implemented programs to reduce mercury releases to water and waste streams, such as use of dental amalgam separators and restrictions on the sale and disposal of mercury-added products, such as thermometers.

because of mercury.[4] Due to that widespread mercury contamination, each of the NESCAUM states has set an EPA-approved total maximum daily load ("TMDL") for mercury pursuant to the federal Clean Water Act. *See* 33 U.S.C. § 1313(d)(1) (requiring development of TMDLs for impaired waters).[5]

8. Due to efforts that began in the late 1960s, most of the direct discharges of mercury into the Nation's waters have now been identified and controlled. As a result, the primary source of mercury entering U.S. aquatic ecosystems today comes from atmospheric deposition.[6] At specific locations within the NESCAUM region, sixty to eighty percent of that deposition has been attributed to North American mercury emission sources.[7] At the regional scale, NESCAUM modeling for the year 1998 estimated that nineteen percent of the

[4] Impaired waterbodies were determined from the most recent (Current Year) data available in state summaries for Massachusetts, New Hampshire, New York, Rhode Island, Vermont, and New Jersey, available at EPA's "National Summary of State Information," http://iaspub.epa.gov/waters10/attains_nation_cy.control (visited September 8, 2015). Information for Connecticut and Maine was taken from each state's 2012 Integrated Water Quality Monitoring and Assessment Report: Connecticut - http://www.ct.gov/deep/lib/deep/water/water_quality_management/305b/2012_iwqr_final.pdf; Maine - http://www.maine.gov/dep/water/monitoring/305b/2012/report-final.pdf.

[5] New Jersey established a state-level TMDL in 2009 (*see* EPA Region 2 Decision Letter, Review of Total Maximum Daily Load (TMDL) for Mercury Impairments Caused Mainly by Air Deposition in 122 HUC 14s Statewide, New Jersey (NJ), September 29, 2009, http://www.epa.gov/waters/tmdldocs/FinalNJMercuryTMDLApproval9-25.pdf), and the New England states and New York jointly adopted a TMDL in 2007 (*see* Northeast Regional Mercury Total Maximum Daily Load, October 24, 2007 ("Northeast TMDL"), https://www.neiwpcc.org/mercury/mercury-docs/FINAL%20Northeast%20Regional%20Mercury%20TMDL.pdf.

[6] U.S. Geological Survey Circular 1395, Mercury in the Nation's Streams—Levels, Trends, and Implications 65 (2014), http://pubs.usgs.gov/circ/1395/.

[7] Seigneur et al., Global Source Attribution for Mercury Deposition in the United States, 38 *Environ. Sci. Technol.* 555-569 (2004).

mercury deposition within New England and New York came from mercury emission sources in states outside of this region;[8] that percentage likely underestimates the current contribution from such states because the modeling predates the implementation of state-based mercury emission limits on waste incinerators and power plants in the NESCAUM states.[9]

9. Domestic coal-fired power plants are a significant contributor to the NESCAUM region's deposition.[10] Thus, the regional mercury TMDL for the New England states and New York concludes that in order to meet the ninety-eight percent reduction in atmospheric mercury deposition required to return fish methylmercury concentrations to safe levels "significant reductions from upwind out-of-region sources, primarily coal-fired power plants" are necessary.[11]

[8] Northeast TMDL, *supra* note 5 at 22, Table 6-2 (1,207 kg/yr for "Rest of U.S. Sources") and *supra* note 5 at 28 (6,506 kg/year total "nonpoint source load" atmospheric deposition).
[9] King et al., Reducing Mercury in the Northeast United States, *EM* 9-13 (May 2008), http://www.nescaum.org/documents/reducing-mercury-in-the-northeast-united-states/ne-mercury-progress-em-200805.pdf.
[10] NESCAUM, Sources of Mercury Deposition in the Northeast United States 1 (March 2008) ("NESCAUM 2008 Report"), http://www.nescaum.org/documents/nescaum-sources-of-hg-depo-in-northeast_2008-final.pdf; Memorandum from Marc Houyoux and Madeleine Strum, Emission Inventory and Analysis Group, U.S. EPA, Emissions Overview: Hazardous Air Pollutants in Support of the Final Mercury and Air Toxics Standard 5-6 (Dec. 1, 2011) (coal-fired power plants accounted for fifty percent of the Nation's mercury emissions in 2005 and were projected to account for forty-two percent in 2016).
[11] Northeast TMDL, *supra* note 5, at vi (setting a 90th percentile reduction in fish mercury concentrations as the TMDL target), ix, Table ES-1 (section entitled "Overall Reductions to Meet TMDL") (concluding that a 98.2 percent reduction in anthropogenic atmospheric deposition is required to reach the 90th percentile reduction), 44 (noting the need for national coal-fired power plant emissions reductions to meet TMDL target).

IV. The Transport, Deposition, and Bioaccumulation of Mercury Emitted to the Air

10. Coal combustion at power plants releases three forms, or species, of mercury through a smokestack plume – 1) gaseous elemental mercury, 2) gaseous oxidized mercury (also called "reactive gaseous mercury"), and 3) mercury bound to particles. Natural mercury sources also exist, but anthropogenic sources, of which coal-fired power plants are a major component, account for about two-thirds of the total global mercury atmospheric burden.[12]

11. Transport through the air is the primary method by which mercury is distributed across the environment. The distance mercury travels from its emission source depends upon its form and weather patterns. Oxidized mercury and particle-bound mercury are relatively soluble in water and more chemically reactive than elemental mercury, hence they have much shorter transport lifetimes (i.e., distances). Measurements in stack plumes at coal-fired power plants have found that a significant portion of total emitted mercury is in the oxidized and particle-bound forms. The combination of the specific forms of mercury found in coal combustion plumes and their shorter transport distances result in enhanced local and regional mercury deposition (e.g., in rainfall) near coal-fired power

[12] Anon., The Madison Declaration on Mercury Pollution, 36 *Ambio* 62–65 (2007).

plants.[13] For example, during summertime measurements of rainfall collected within one kilometer of several coal-fired power plants in Ohio, forty-two percent of the average atmospheric mercury wet deposition was attributed to the adjacent coal-fired power plant.[14] This local deposition amount is much higher than regional estimates of deposition in New England and New York described in paragraph 8 above, and is not well captured by regional modeling (the model used by NESCAUM has a nominal resolution of thirty-six kilometers[15]) or by mercury wet deposition monitors in the national Mercury Deposition Network (siting criteria require mercury monitors to be at least twenty kilometers away from large mercury emitting sources[16]).

12. Once deposited, reactive gaseous mercury can be readily methylated to biologically toxic methylmercury form.[17] Methylated mercury builds up (bioaccumulates) in fish when it enters aquatic ecosystems. Fish acquire most of their methylmercury loading through their diet. Mercury bioaccumulates in fish

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[13] White et al., Spatial Variability of Mercury Wet Deposition in Eastern Ohio: Summertime Meteorological Case Study Analysis of Local Source Influences, 43 *Environ. Sci. Technol.* 4946-4953 (2009) (and studies therein referenced on pages 4946-4947).
[14] *Id.* at 4952.
[15] NESCAUM, Modeling Mercury in the Northeast United States 26 (October 2007), http://www.nescaum.org/documents/mercury-modeling-report_2007-1005b_final.pdf/.
[16] National Atmospheric Deposition Program (NADP), NADP Site Selection and Installation Manual 14 (version 1.9, revised November 2014), http://nadp.sws.uiuc.edu/lib/manuals/NADP_Site_Selection_and_Installation_Manual_2014_11.pdf.
[17] Harris et al., Whole-Ecosystem Study Shows Rapid Fish-Mercury Response to Changes in Mercury Deposition, *PNAS* 16586–16591 (2007); Munthe *et al.*, Recovery of Mercury-Contaminated Fisheries, 36 *Ambio* 33-44 (2007).

(as well as birds and mammals) at higher levels of the food web as they eat plankton and smaller fish at lower levels of the food web.[18] Terrestrial songbirds that do not eat fish can also have elevated mercury levels through consuming spiders that in turn captured aquatic insects (e.g., mosquitoes) exposed to elevated levels of environmental mercury.[19] Spatial patterns of mercury in mosquitoes, in fact, have been proposed as a sensitive indicator of atmospheric mercury deposition to aquatic systems.[20]

13. The manner in which an ecosystem responds to changes in mercury deposition depends upon the site-specific physical, chemical, and biological characteristics of the waterbody and surrounding watershed, and the form of deposited mercury. Mercury conversion to biologically toxic methylmercury is most efficient in warm, shallow, organic-rich sediments in lakes and wetlands, low-oxygen waters, and soil drying and re-wetting locations.[21] Because of these differences, water bodies having different characteristics can respond differently to changes in mercury deposition.

14. Whole-ecosystem field experiments encompassing a lake and its watershed have demonstrated that it is the most recent mercury directly deposited

[18] Kidd et al., Bioaccumulation and Biomagnification of Mercury through Food Webs, *in Environmental Chemistry and Toxicology of Mercury*, 455-499 (Liu et al. eds., 1st ed. 2012).
[19] Cristol et al., The Movement of Aquatic Mercury Through Terrestrial Food Webs, 320 *Science* 335 (2008).
[20] Hammerschmidt and Fitzgerald, Methylmercury in Mosquitoes Related to Atmospheric Mercury Deposition and Contamination, 39 *Environ. Sci. Technol.* 3034-3039 (2005).
[21] Madison Declaration, *supra* note 12 at 65.

into the lake which rapidly builds up in fish.[22] Those experiments also showed that changes in the amount of mercury deposited on the lake surface were directly proportional to changes in the amount of mercury appearing in fish within weeks of the deposition change.[23] These are important findings because they demonstrate that limiting mercury emissions from local and regional sources can have near-immediate benefits in reducing mercury levels in fish, thus reducing mercury exposure for people who eat the fish.

V. Local and Regional Mercury Levels Can Respond Relatively Rapidly to Changes in Emissions from Coal-Fired Power Plants and Other Sources

15. Numerous studies appearing in the peer-reviewed science literature have tied local and regional mercury levels in the environment to nearby anthropogenic mercury emission sources. Elevated mercury levels downwind of coal-fired power plants have been measured in Illinois,[24] New York,[25] Florida,[26] Indiana,[27] and Ohio.[28] In a study where there was no enhanced mercury deposition

[22] Harris et al., *supra* note 17, at 16587.; Orihel et al., Experimental Evidence of a Linear Relationship between Inorganic Mercury Loading and Methylmercury Accumulation by Aquatic Biota, 41 *Environ. Sci. Technol.* 4952-4958 (2007).
[23] Orihel et al., *supra* note 22, at 4955.
[24] Gratz et al., Assessing the Emission Sources of Atmospheric Mercury in Wet Deposition across Illinois, 448 *Sci. Total Envt*. 120-131 (2013).
[25] Wang et al., Effect of the Shutdown of a Large Coal-Fired Power Plant on Ambient Mercury Species, 92 *Chemosphere* 360-367 (2013).
[26] Sherman et al., Investigation of Local Mercury Deposition from a Coal-Fired Power Plant Using Mercury Isotopes, 46 *Environ. Sci. Technol.* 382-390 (2012).
[27] Hatcher and Filippelli, Mercury Cycling in an Urbanized Watershed: The Influence of Wind Distribution and Regional Subwatershed Geometry in Central Indiana, USA, 219 *Water Air Soil Pollut.* 251-261 (2011).

measured downwind of a group of coal-fired power plants, it was found that the coal being burned had a very low mercury content.[29] This illustrates the impact mercury pollution controls can have on reducing local and regional mercury deposition as there is little practical difference between burning low mercury content coal and burning higher mercury content coal with pollution controls.

16. Additional examples of local mercury deposition being tied to local sources include historical coal combustion used for residential heating and industrial processes,[30] municipal and medical waste incinerators burning mercury-contaminated waste,[31] metal smelters,[32] and a cement kiln emitting mercury from petroleum coke and limestone used in the manufacturing process.[33]

17. Changing trends and spatial patterns of local and regional mercury emissions are reflected in spatial mercury relationships observed in fish, birds, and

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[28] White et al., *supra* note 13 at 4952. ; Keeler et al., Sources of Mercury Wet Deposition in Eastern Ohio, U.S.A., 40 *Environ. Sci. Technol.* 5874-5881 (2006).
[29] Martin et al., Local Deposition of Mercury in Topsoils around Coal-Fired Power Plants: Is it Always True? 21 *Envtl. Sci. and Pollution Res.* 10205-10214 (2014).
[30] Engstrom and Swain, Recent Declines in Atmospheric Mercury Deposition in the Upper Midwest, 31 *Environ. Sci. Technol.* 960-967 (1997).
[31] Hutcheson et al., Temporal and Spatial Trends in Freshwater Fish Tissue Mercury Concentrations Associated with Mercury Emissions Reductions, 48 *Environ. Sci. Technol.* 2193-2202 (2014); Han et al., Reduced Mercury Deposition in New Hampshire from 1996 to 2002 Due to Changes in Local Sources, 156 *Environ. Poll.* 1348-1356 (2008); Manopolos et al., Sources of Speciated Atmospheric Mercury at a Residential Neighborhood Impacted by Industrial Sources, 41 *Environ. Sci. Technol.* 5626-5633 (2007); Dvonch et al., Use of Elemental Tracers to Source Apportion Mercury in South Florida Precipitation." 33 *Environ. Sci. Technol.* 4522-4527 (1999).
[32] Olmez et al., Canadian and U.S. Sources Impacting the Mercury Levels in Fine Atmospheric Particulate Material Across New York State." 32 *Environ. Sci. Technol.* 3048-3054 (1998).
[33] Rothenberg et al, Wet Deposition of Mercury within the Vicinity of a Cement Plant Before and During Cement Plant Maintenance, 44 *Atmos. Envt.* 1255-1262 (2010).

other fauna in the environment. As a fundamental matter, mercury concentrations in wild fish populations are linked to atmospheric mercury deposition, two-thirds of which is from anthropogenic sources.[34] Decreases in mercury levels in fish tissue associated with local and regional decreases in anthropogenic mercury emissions have been measured in freshwater largemouth bass and yellow perch in Massachusetts[35] and in yellow perch in Wisconsin.[36] Decreasing trends in mercury concentrations in the growing feathers of great egrets and white ibises have been observed in Florida at the same time mercury emissions were decreasing from local waste incinerators.[37] Mercury levels in the blood of loon chicks captured in Wisconsin showed a decreasing trend at the same time atmospheric mercury deposition and mercury levels in yellow perch in local lakes were declining.[38]

18. A recent study finds strong correlation of decreasing mercury in a commercially important ocean fish (bluefish) in the Mid-Atlantic bight, defined as the continental shelf waters from Cape Cod, Massachusetts, to Cape Hatteras,

[34] Hammerschmidt and Fitzgerald, Methylmercury in Freshwater Fish Linked to Atmospheric Mercury Deposition, 40 *Environ. Sci. Technol.* 7764-7770 (2006).
[35] Hutcheson et al., *supra* note 31 at 2196.
[36] Hrabik and Watras, Recent Declines in Mercury Concentration in a Freshwater Fishery: Isolating the Effects of De-Acidification and Decreased Atmospheric Mercury Deposition in Little Rock Lake, 297 *Sci. Total Envt*. 229-237 (2002).
[37] Frederick et al., Wading Birds as Bioindicators of Mercury Contamination in Florida, USA: Annual and Geographic Variation, 21 *Envtl. Toxicol. Chem.* 163-167 (2002).
[38] Fevold et al., Bioaccumulation Patterns and Temporal Trends of Mercury Exposure in Wisconsin Common Loons, 12 *Ecotoxicol*. 83-93 (2003).

North Carolina, with decreasing U.S. mercury air emissions.[39] This finding extends to ocean fish what has been previously seen with freshwater fish and their relatively rapid responses to decreases in local and regional mercury emissions. The authors of this study conclude that if bluefish are representative of other marine predators, then the fish-consuming public has benefited from a decrease in the amount of mercury consumed due to decreases in mercury emissions occurring in the eastern United States. That is particularly true given that, as they note, women living in Atlantic coastal areas have shown higher mean mercury blood levels than other U.S. women of child-bearing age.

19. These studies demonstrate that the species of mercury emitted by coal-fired power plants (reactive gaseous and particulate-bound mercury) and other mercury emission sources can and do deposit close to the emission sources. In turn, that mercury accumulates in fish and other biota much more rapidly than the elemental mercury that makes up the global mercury pool. They also demonstrate that reductions in local and regional mercury emissions can translate relatively rapidly—in the span of weeks to a few years—into reductions in mercury levels in fish and other biota.[40]

[39] Cross et al., Decadal Declines of Mercury in Adult Bluefish (1972–2011) from the Mid-Atlantic Coast of the U.S.A., 49 *Environ. Sci. Technol.* 9064–9072 (2015).
[40] *See also* Evers et al., Biological Mercury Hotspots in the Northeastern United States and Southeastern Canada, 57 *BioScience* 29-43 (2007).

20. Thus, any delay in the coal-fired power plant mercury reductions required by the Air Toxics Rule creates a risk that more mercury will be deposited to the environment and that people who consume mercury-contaminated fish will be exposed to higher mercury levels than would be the case had the Air Toxics Rule had remained in place continuously.

VI. Without the Air Toxics Rule, Many Coal-Fired Power Plants Will Have an Economic Incentive Not to Install or to Operate Installed Mercury Controls

21. There are a variety of control technologies that are currently being used by power plants to remove mercury. Mercury can be removed by controls used primarily to remove other power plant pollutants. Such pollution controls include fabric filters and electrostatic precipitators to remove particulate matter, which encompasses particle-bound mercury; wet or dry flue gas desulfurization ("scrubbing") to remove sulfur dioxide (SO_2), which can also capture mercury either in the scrubber or in conjunction with other downstream controls; and selective catalytic reduction to remove nitrogen oxides (NO_X), which allows for more effective capture of oxidized mercury downstream.[41]

22. Other methods of mercury control are used by power plants solely to remove mercury. Activated carbon injection adsorbs and converts gaseous

[41] NESCAUM, Control Technologies to Reduce Conventional and Hazardous Air Pollutants from Coal-Fired Power Plants 19, 20-21 (March 31, 2011) ("NESCAUM 2011 Report"), http://www.nescaum.org/documents/coal-control-technology-nescaum-report-20110330.pdf/.

mercury to particle mercury that can be captured downstream by a particulate matter control device.[42] The addition of halogens, such as calcium bromide, to flue gas increases the oxidized mercury that is more readily captured by a downstream scrubber or particulate matter control device.[43] Unlike scrubbers, particulate matter controls, and selective catalytic reduction, these mercury-specific controls can be turned off without affecting a power plant's ability to control other air pollutants, such as SO_2 and NO_X, that a plant may be required to reduce under other federal and state requirements.

23. As with any pollution control technology, there is a financial cost associated with the installation and operation of the controls used to remove mercury from power plant emissions. As a result, there is an economic incentive for power plants both to avoid initial installation and, even after installation, not to operate pollution controls absent an enforceable obligation to do so under a permit, regulation, or court order. For example, analysis of emissions data by the Ozone Transport Commission has shown that power plants do turn off installed pollution controls when they are not obligated to operate them. Specifically, the Ozone Transport Commission's analysis shows that in 2012, numerous coal-fired power plants equipped with post-combustion NO_X emission controls, in particular selective catalytic reduction controls, stopped or limited operation of those controls

[42] *Id.* at 19-20
[43] *Id.* at 20.

and instead chose to achieve compliance with the federal Clean Air Interstate Rule by purchasing NO_X emissions allowances, presumably because it was less expensive to do so.[44] A specific example is the coal-fired Montour Power Plant in Pennsylvania, where a company spokesperson stated that in recent years it has become much cheaper to buy allowances than run its already installed NO_X controls.[45]

24. Thus, there is reason to expect that even the many coal-fired power plants that have already met the April 2015 Air Toxics Rule compliance deadline by installing mercury controls, and which are not located within the eleven states[46] that require mercury controls under state law, will not operate or will limit operation of their mercury controls if the Air Toxics Rule is not in effect. This is particularly true for controls specific to mercury reduction, like activated carbon injection and halogen (e.g., bromine) addition, that cost money to operate and that

[44] *See* Statement from the Ozone Transport Commission Requesting the Use and Operation of Existing Control Devices Installed at Electric Generating Units (June 13, 2013), http://www.otcair.org/upload/Documents/Formal%20Actions/Statement_EGUs.pdf.
[45] J.M. O'Neill, *N.J. Air Quality Takes a Hit*, The Record (Bergen County, NJ), May 17, 2015, *available at* http://www.northjersey.com/news/n-j-air-quality-takes-a-hit-1.1336654 (quoting a company spokesperson, "[t]oday, the cost of using installed controls far exceeds the cost of obtaining allowances in the trading market.").
[46] *See* 5 COLO. CODE REGS. § 1001-8:B.VIII.c (first phase compliance by Jan. 1. 2012); CONN. GEN. STAT. § 22a-199(b)(1) (compliance by Jul. 1, 2008); DEL. ADMIN. CODE, tit. 7, § 1146-6.1 (first phase compliance by Jan. 1, 2009); ILL. ADMIN. CODE tit. 35, § 225.230(a) (compliance by Jul. 1, 2009); MD. CODE REGS. tit. 26, § 11.27.03.D (first phase compliance by Jan. 1, 2010); 310 MASS. CODE REGS. § 7.29(5)(a)(3)(e) (first phase compliance by Jan. 1, 2008); MONT. ADMIN. R. 17.8.771(1)(b) (compliance by Jan. 1, 2010); N.H. REV. STAT. ANN. § 125-O:11-18, I. (compliance by Jul. 1, 2013); N.J. ADMIN. CODE § 7:27-27.7(a) (compliance by Dec. 15, 2007); N.Y. COMP. CODES R. & REGS. tit. 6, § 246.6(c) (first phase compliance by Jan. 1, 2010); OR. ADMIN. R. 340-228-0606(1) (compliance by Jul. 1, 2012).

can be readily turned off without affecting compliance with other non-mercury pollution control obligations. Given that the majority of the Nation's coal-fired power plant capacity is located in states without state-based mercury controls—such as Indiana, Pennsylvania, Ohio, West Virginia, and Texas—uncontrolled mercury emissions in the event of full or partial vacatur of the Air Toxics Rule could be substantial.

25. Uncontrolled mercury emissions from Pennsylvania's coal-fired power plants are of particular concern to the NESCAUM states because Pennsylvania has numerous coal-fired power plants and contributes significantly to mercury deposition in the NESCAUM states, due to its proximity to the region and prevailing weather patterns.[47]

26. I have examined the 2014 mercury emissions data reported by coal-fired power plants located in Pennsylvania to EPA in the Toxics Release Inventory ("TRI") database.[48] As shown in the table below, the four Pennsylvania coal-fired power plants with the largest mercury emissions in 2014, as reported on the TRI database, emitted nearly 2000 pounds of mercury.

[47] NESCAUM 2008 Report, *supra* note 10, at 18 (showing that Pennsylvania contributed approximately twenty-two percent of all U.S. domestic mercury deposition in New York and the six New England states, even prior to when the NESCAUM states began to reduce their own power plant mercury emissions).

[48] The TRI database can be downloaded from the following link: http://www2.epa.gov/toxics-release-inventory-tri-program/download-trinet .

Table 1. Mercury emissions and Air Toxics Rule compliance approaches for top four mercury-emitting coal-fired power plants in Pennsylvania.

	2014 Mercury Emissions (lbs from stack)[a]	MATS Rule Compliance Date[b]	Proposed Mercury Control Approach[c]
Bruce Mansfield Station	748	April 16, 2016 (units 1, 2, and 3)	Flue gas desulfurization re-emission control systems, selective catalytic reduction improvements, and activated carbon injection on all three units.
Homer City Generating Station	557	April 16, 2016 (units 1, 2, and 3)	Flue gas desulfurization systems and selective catalytic reduction on units 1, 2, and 3, with activated carbon injection on units 1 and 2. Possible activated carbon injection or other mercury control technology under evaluation for unit 3.
Conemaugh Power Plant	525	October 16, 2015 (units 1 and 2)	Selective catalytic reduction and flue gas desulfurization upgrades on both units.
Brunner Island Steam Electric Station	125	April 16, 2015 (units 1, 2, and 3)	Calcium bromide chemical additive system, sorbent injection system, and flue gas desulfurization re-emission inhibitor injection system on all three units.

[a] Emissions data were obtained from EPA's Toxics Release Inventory database, available at "Download TRI.NET," http://www2.epa.gov/toxics-release-inventory-tri-program/download-trinet (downloaded August 27, 2015).

[b] Extension information was obtained from extension request approvals issued by the Pennsylvania Department of Environmental Protection. *See* Attachment B.

[c] Mercury control information was obtained from EPA's National Electric Energy Data System (NEEDS) v.5.15, available at "EPA's Power Sector Modeling Platform v.5.15," http://www.epa.gov/powersectormodeling/psmodel514.html (downloaded September 3, 2015) and from individual plan extension request letters, included in Attachment B. In some cases, the proposed mercury control approach is contingent upon further evaluation of controls.

27. All four of those coal-fired power plants have sought and obtained from the Pennsylvania Department of Environmental Protection extensions of the April 2015 compliance deadline, three until April 2016, and one until October 2015. Each power plant's extension request includes an extension of time to install and operate mercury controls. Attached as Attachment B are copies of the extension requests and approvals for each of those plants obtained from the Pennsylvania Department of Environmental Protection. Absent a stay or vacatur of the Air Toxics Rule, those plants will be required to install those controls by their respective extension deadlines.

28. Vacating the Air Toxics Rule solely with regard to coal-fired power plants that have obtained extensions could still result in the same nearly 2000 pounds of mercury emissions from these Pennsylvania plants, because those emissions come from power plants with compliance extensions. Given that the technologies the plants are proposing to install—activated carbon injection, calcium bromide sorbent injection systems, and flue gas desulfurization and selective catalytic reduction systems—have been shown to reduce mercury emissions by ninety percent or more when optimized for mercury reduction,[49] the

[49] NESCAUM 2011 Report, *supra* note 41, at 19-21 & Table 8; NESCAUM, Technologies for Control and Measurement of Mercury Emissions from Coal-Fired Power Plants in the United States: A 2010 Status Report 1-15, 3-1 (July 2010), http://www.nescaum.org/documents/hg-control-and-measurement-techs-at-us-pps_201007.pdf.

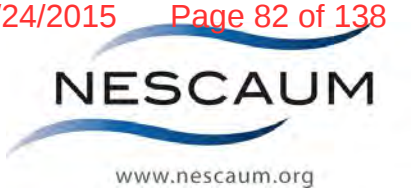
failure to operate such control technologies would result in a significant increase in mercury emissions over those that would occur under the Air Toxics Rule.

I declare that to the best of my knowledge, under the penalty of perjury under the laws of the United States, that the foregoing is true and correct.

Executed on September 23, 2015, at Boston, Massachusetts.

Paul J. Miller

ATTACHMENT A



DR. PAUL J. MILLER, PH.D., J.D.

Northeast States for Coordinated Air Use Management (NESCAUM)
89 South Street, Suite 602
Boston, MA 02111
Tel: 617-259-2016; Fax: 617-742-9162
pmiller@nescaum.org

PROFESSIONAL EXPERIENCE

NESCAUM (Boston, MA)
Deputy Director & Chief Scientist 2006 – present

- Oversee all aspects of NESCAUM's work on air quality, climate, and energy issues.
- Provide legal analyses of air quality, climate, and energy issues.
- Contribute to a wide range of initiatives synthesizing the science and policy of climate and energy, air pollution transport, acid rain, regional haze, mercury, population exposure to air pollution, and other air issues.

Commission for Environmental Cooperation (Montreal, QC)
Air Quality Program Coordinator 2000 – 2005

- Oversaw air quality programs fostering cooperation among the three NAFTA countries of Canada, Mexico, and the United States.
- Developed the first-ever tri-national air emissions inventory of North American power plants.
- Supported creation of Mexico's first comprehensive national air emissions inventory.

NESCAUM (Boston, MA)
Science and Policy Analyst 1996 – 2000

- Provided technical and policy support for multi-state regional air quality efforts.

Princeton University (Princeton, NJ)
Center for Energy & Environmental Studies, Visiting Fellow 1996 – 1997

- Investigated potential of coal gasification with fuel cells for district heating in China.

W. Alton Jones Foundation (Charlottesville, VA)
Senior Energy Fellow 1993 – 1996

- Developed initiatives to promote fuel cells and renewable energy.

Joint Institute for Laboratory Astrophysics, University of Colorado (Boulder, CO)
National Research Council Associate 1988 – 1990

- Investigated the chemical and physical properties of gas-phase molecules using laser techniques.

Brookhaven National Laboratory (Upton, NY)
Dept. of Chemistry, Technical Collaborator 1987 – 1988

- Research using the National Synchrotron Light Source to investigate chemical and physical properties of small gas-phase molecules.

EDUCATION

Stanford Law School, Stanford University (Stanford, CA)
J.D. (1993)

Yale University (New Haven, CT)
Chemical Physics, Ph.D. (1988); M. Phil. (1985); M.S. (1984)
Kent Fellow

Purdue University (West Lafayette, IN)
B.S. Chem. (1983)
Phi Beta Kappa, graduated with highest distinction

ARTICLES & REPORTS

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- **P. Miller**, *The Long and Short of It: A National Ozone Standard for Farm and Forest*, EM (September 2011)
- J.G. Su, G. Allen, **P.J. Miller**, & M. Brauer, *Spatial Modeling of Residential Woodsmoke across a Non-urban Upstate New York Region*, Air Quality, Atmosphere and Health, doi: 10.1007/s11869-011-0148-1 (July 2011)
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- P.M. Dehmer, **P.J. Miller** & W.A. Chupka, *Photoionization of N_2 $X\,^1\Sigma_g^+$, $v''=0$ and 1 near Threshold. Preionization of the Worley-Jenkins Rydberg Series,* 80 J. Chemical Physics 1030 (1984)

TALKS

- *States' Experience and Perspectives with CA Mobile Source Programs*, Symposium on California's Development of its Phase 2 Greenhouse Gas Emission Standards for On-Road Heavy-Duty Vehicles, California Air Resources Board Staff Symposium, Diamond Bar, California (April 22, 2015)
- *What Does the Science Say about Future NOx Control Policy to Reduce Ozone?*, Air Quality Applied Sciences Team (AQAST) 7th Semi-Annual Meeting, Harvard University, Cambridge, Massachusetts, USA (June 18, 2014)
- *Rhode Island's Greenhouse Gas Inventory*, presentation to the Rhode Island Executive Climate Change Council, Providence, Rhode Island, USA (March 20, 2014)
- *Transport Science and the Law*, Air Quality Applied Sciences Team (AQAST) 5th Semi-Annual Meeting, University of Maryland, College Park, Maryland, USA (June 5, 2013)
- *Regional Perspective on NOx Control: Northeast United States*, International Workshop on NOx Total Emissions Control, Kunming, Yunan, China (September 25, 2012)
- *Overview of Electric System Reliability Scenarios under Pending EPA Rules*, Duke University, Nicholas Institute, Workshop on Environmental Regulations, Regulatory Uncertainty, and Least Cost Planning for Electric Utilities, Durham, North Carolina, USA (September 29, 2011)
- *Upwind/Downwind Transport Linkages for "New" Ozone NAAQS*, Mid-Atlantic/Northeast Visibility Union (MANE-VU) Board Meeting, Manchester, Vermont, USA (September 15, 2011)
- *Using the Tools On-Hand: Addressing Greenhouse Gases under the Clean Air Act*, 18th Section Fall Meeting: The American Bar Association Environment, Energy, and Resources Law Summit, New Orleans, Louisiana, USA (September 30, 2010)
- *U.S. Transboundary Air Pollution and Climate Change Developments*, Upwind – Downwind Conference 2010, Hamilton, Ontario, Canada (February 22, 2010)

- *Short-lived vs. Long-lived Climate Forcers: Policy Implications*, Meeting of the International Air Quality Advisory Board to the International Joint Commission, Roosevelt-Campobello International Park, New Brunswick, Canada (July 29, 2009)
- *The Globalization of Smog: Northeast U.S. State Strategies*, The Learning Forum on Emerging Issues in Air Quality, Ontario Ministry of the Environment, Toronto, Ontario, Canada (May 12, 2009)
- *Regional Cooperation by U.S. Northeast States*, Special Meeting of the Organization of American States, Washington, DC, USA (February 23, 2007)
- *Northeast States and Shared Air Pollution Problems*, Shared Air Summit, Ontario Ministry of the Environment, Toronto, Ontario, Canada (June 26, 2006)
- *Update on NESCAUM Air Activities*, Meeting of the International Air Quality Advisory Board to the International Joint Commission, Boston, Massachusetts, USA (June 16, 2006)
- *Mercury Emission Inventory & Modeling Update*, New England Governors/Eastern Canadian Premiers Mercury Task Force, Montreal, Quebec, Canada (June 1, 2006)
- *Atmospheric Models and the Law*, Boston Bar Association, Boston, Massachusetts, USA (April 24, 2006)
- *NA Information for Sustainable Energy Decision Making*, Border Energy Forum XII, Santa Fe, New Mexico, USA (October 14, 2005)
- *The North American Picture of Mercury from Power Plants*, Air & Waste Management Association's 98th Annual Conference and Exhibition, Minneapolis, Minnesota, USA (June 23, 2005)

ADDITIONAL SELECTED ACTIVITIES

- Invited Testimony for Hearing of the U.S. House of Representatives Subcommittee on Environment, Committee on Space, Science, and Technology, *Reality Check Part II: The Impact of EPA's Proposed Ozone Standards on Rural America*, Washington, DC (April 29, 2015)
- Brief for Experts in Air Pollution Control and Air Quality Regulation as *Amici Curiae* in support of Respondents, *Michigan v. Environmental Protection Agency,* before the U.S. Supreme Court, Nos. 14-46, -47, -49 (decided June 29, 2015) (*re:* Utility MATS Rule)
- Brief for Atmospheric Scientists and Air Quality Modeling Experts as *Amici Curiae* in support of Petitioners, *Environmental Protection Agency v. EME Homer City, L.P.,* before the U.S. Supreme Court, 134 S. Ct. 1584 (decided April 29, 2014) (*re:* Cross-State Air Pollution Rule)
- Member, New York State Energy Research and Development Authority (NYSERDA) Research Plan Working Group: Air Quality and Health Effects (2013)
- External Advisor, Office of the Auditor General (OAG) of Canada, re: *Canada's Climate Change Commitments: Part I – Kyoto Protocol Implementation Act* (December 2011)
- Peer Reviewer, *National Acid Precipitation Assessment Program Report to Congress: An Integrated Assessment* (2011)
- Member, *EM* magazine Editorial Advisory Committee, Air & Waste Management Association (2009-2011)
- Reviewer, *2004 Canadian Acid Deposition Science Assessment*, Chapter 2: Emissions of Pollutants Related to Acid Deposition in North America (2004)

- Chair, Air Pollution Abatement Policies and Strategies, IUAPPA 2001: 12th World Clean Air Congress and Exhibition, Seoul, South Korea (Aug. 30, 2001)
- Member: American Geophysical Union

ATTACHMENT B

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION
WASTE, AIR, RADIATION AND REMEDIATION

March 20, 2013

Raymond L. Evans, P.E.
Vice President, Environmental
FirstEnergy
76 South Main Street
Akron, OH 44308

Re: MATS Extension Requests for the Bruce Mansfield and Hatfield Stations

Dear Mr. Evans:

This letter is to notify you that the Pennsylvania Department of Environmental Protection (DEP) has reviewed your January 28, 2013 and February 27, 2013 compliance extension requests for the Bruce Mansfield and Hatfield Stations related to the requirements under the Mercury and Air Toxics Standard (40 CFR Part 63 Subpart UUUUU) also known as MATS.

Allegheny Energy Supply Company, LLC and FirstEnergy Generation (collectively FE) have requested one year extensions of compliance to April 16, 2016 in order to complete MATS air quality control systems and renovations to achieve MATS compliance based on the information received in your January 28 and February 27 letters.

FE's extension requests to comply with the MATS requirements until April 16, 2016 for Bruce Mansfield Units 1, 2, and 3 and Hatfield Units 1, 2, and 3 are approved by DEP based upon the timelines identified in your January 28, 2013 letters for all of the units. If FE is unable to meet the timelines identified in those letters, you should provide written notice to DEP, as soon as possible, but no later than five business days after becoming aware of the delays. This notice must explain the delay and propose a revised compliance schedule in order to meet the April 16, 2016 MATS extension date.

If FE wishes to request an extension of compliance beyond April 16, 2016 that request must be sent to the Administrator of the U.S. Environmental Protection Agency.

If you need further assistance, please contact Dean Van Orden, Acting Director of the Bureau of Air Quality, by e-mail at dvanorden@pa.gov or by telephone at 717.783.9264.

Sincerely,

Vincent J. Brisini
Deputy Secretary

cc: Reiley Ramsmith Van Orsdel Epps

FirstEnergy

76 South Main Street
Akron, Ohio 44308

Raymond L. Evans, P.E.
Vice President, Environmental

330-761-4482
Fax: 330-384-5433

February 27, 2013

The Honorable Michael Krancer
Secretary
Pennsylvania Department of Environmental Protection
Rachel Carson State Office Building
P.O. Box 2063
Harrisburg, Pennsylvania 17105-2063

Dear Secretary Krancer:

Allegheny Energy Supply Company, LLC and FirstEnergy Generation, LLC (collectively, FE) submit additional descriptive material and information in support of a one-year compliance extension until April 16, 2016 for Units 1, 2, and 3 at the Hatfield Station and Units 1, 2, and 3 at the Bruce Mansfield Plant with regards to requirements under the Mercury and Air Toxics Standard (40 CFR 63 Subpart UUUUU[1], also known as MATS).

FE has been diligently working on MATS compliance planning, engineering, and testing over the past eighteen months for its fleet of eight generating stations consisting of twenty-two generating units. Our overall plan represents a future investment of $975 million dollars in air quality control (AQC) improvements for these facilities to ensure compliance with MATS. The plan requires the addition of new and renovated equipment at these facilities for mercury, particulate, and acid gases.

Optimizing and supplementing AQC equipment requires careful planning and execution prior to and during extended planned unit outages due to the large scope of these projects. In addition, the planned outages must be preapproved by the regional transmission organization, PJM, to avoid potential impacts on transmission system reliability (planned outages during the summer months of June through August are prohibited by PJM).

Historically FE has performed up to four boiler, turbine, and generator outages per year. These outages are typically between 56 and 70 days in length and allow sufficient time for performance of AQC installations and renovations.

Currently, FE faces the potential of performing six major MATS AQC installation and renovation outages in the spring of 2015 due to the MATS compliance deadline. In addition, MATS AQC installation and renovation projects for 2014 are already behind schedule due to

[1] This letter requests a one-year extension for all dates and deadlines (except the notification requirements in 40 C.F.R. §63.10030) applicable to the Bruce Mansfield Plant and Hatfield Station under Part 63, including all dates associated with performance tests, recordkeeping and reporting, and emissions averaging (40 C.F.R. § 63.10009).

inadequate time to engineer, permit, procure, and construct, potentially shifting additional outages to the spring of 2015. All MATS AQC installation and renovation projects will require a substantial number of plan approvals and air, water, and solid waste permits prior to the start of construction. FE is requesting a MATS one-year extension for Hatfield Units 1, 2, and 3 and Bruce Mansfield Units 1, 2, and 3 to mitigate the resource and timing constraints on its fleet in 2015 due to this large scope of additional MATS AQC installations and renovations.

Bruce Mansfield Plant

Bruce Mansfield Units 1 and 2 are equipped with first-generation AQC equipment consisting of venturi wet flue gas desulfurization (FGD) scrubbers for particulate and sulfur dioxide control (six modules each), selective catalytic reduction technology (SCR-two parallel trains) for nitrogen oxide control, and sodium bisulfate injection for sulfur trioxide control. Bruce Mansfield Unit 3 is equipped with first-generation AQC equipment consisting of four 95-percent efficient electrostatic precipitators, five horizontal wet flue gas desulfurization scrubbers, selective catalytic reduction systems (two parallel trains), and sulfur trioxide control systems using sodium bisulfate injection.

The performance of this existing AQC equipment in removing mercury, particulate, and acid gases has been repeatedly tested. Results of these tests indicate that additional AQC equipment is required to achieve continuous compliance with the MATS limits. Mercury emissions during the testing ranged between 2.88 to 4.49 lbs/TBtu on the three units, which are between two to four times greater than the MATS mercury limit. Filterable particulate emissions varied between 0.022 and 0.033 lbs/mmBtu versus the limit of 0.03 lbs/mmBtu for Units 1 and 2, while Unit 3 performed in the range of 0.004 to 0.010 lbs/mmBtu. The existing filterable particulate emission limit for the 3 units is 0.1 lbs/mmBtu; thus additional reductions are required. Sulfur dioxide emissions ranged between 0.20 and 0.43 lbs/mmBtu for the three units versus the allowable MATS sulfur dioxide limit of 0.20 lbs/mmBtu as a surrogate for hydrochloric acid.

Our current MATS compliance plan includes AQC equipment renovations for Bruce Mansfield Units 1 and 2 FGD systems that include the removal and replacement of the existing mist eliminators and perforated tray with a new design to improve flow distribution, replacement and addition of FGD spray nozzles, installation of a vertical partition wall within each FGD module to improve flow distribution, and changes to the venturi plumb bob at the inlet of the scrubber to achieve better control of particulate emissions.

Our current MATS compliance plan includes AQC equipment renovations for Bruce Mansfield Unit 3 FGD modules that include the installation of two reoriented spray headers, replacement of the reaction tank agitators, installation of tank screens in each module for the recycle pump suction lines, replacement of each module drain system, and replacement and addition of spray nozzles.

All Mansfield FGD modules will receive new pH control systems to improve sulfur dioxide removal and to better control mercury re-emissions.

These renovations to the FGD systems will improve sulfur dioxide and particulate removal efficiencies. The nature and scope of this work requires that the work be performed during planned unit outages of 50 to70 days in duration to allow safe and efficient execution of the planned FGD renovations.

Our current Mercury control plan installs two new systems on all three Bruce Mansfield Units. The first, a mercury re-emissions control system for the FGD modules, will include chemical storage tanks, transport lines, and chemical injection system.

Testing of the FGD module inlets and outlets demonstrates there is significant re-emission of mercury occurring in the scrubber modules of each unit. The re-emission chemicals are intended to prevent the chemical reduction of mercury.

In addition, activated carbon injection systems will be installed; including storage tanks, transport lines, and ACI injection systems. The activated carbon will be injected downstream of the air heaters on all three units. Capture of the activated carbon will occur in the FGD system of Bruce Mansfield Units 1 and 2, while the electrostatic precipitator will capture the activated carbon on Bruce Mansfield Unit 3.

Finally, further mercury removal will be achieved by installation of large particle ash screens on the SCR trains for all three Bruce Mansfield Units to achieve improved oxidation of mercury in the SCRs. Previously, the SCR catalyst layers would be blocked by large particle ash; thus resulting in poor oxidation of mercury in the flue gas stream by the SCR. All of the planned work for mercury control requires planned unit outages for the installation of duct penetrations, injection lances, and the large particle ash screens.

Overall particulate compliance for Bruce Mansfield Units 1, 2, and 3 will be achieved through an averaging plan which requires all three units to achieve improved removal of particulate. Bruce Mansfield Units 1 and 2 will improve particulate removal through the scrubber improvements described above. Bruce Mansfield Unit 3 particulate removal will be improved by replacing all existing transformer rectifier sets with new, high-frequency transformer rectifier sets, in addition to increasing the number of field sections in each of the four precipitator modules.

Finally, additional particulate removal will be accomplished through installation of new economizer ash-removal systems for all three units. These removal systems will reduce particulate loading on Units 1 and 2 venturi scrubbers and the Unit 3 electrostatic precipitator.

The current MATS AQC project schedule for Bruce Mansfield Plant shows that completion of the individual MATS AQC projects is significantly behind the current scheduled outage completion date of October 21, 2014 for Unit 3 and the current scheduled outage completion date of May 23, 2015 for Unit 1. Both of these outages would need to be completed by those currently scheduled dates in order to achieve compliance by the MATS deadline of April 16, 2015.

Hatfield Station

Hatfield Units 1, 2, and 3 are equipped with AQC equipment consisting of limestone forced oxidation wet flue gas desulfurization (FGD) scrubbers for sulfur dioxide control (one module each) and first-generation electrostatic precipitators for particulate control.

The performance of this AQC equipment in removing mercury, particulate, and acid gases has been repeatedly tested. Results of these tests indicate that additional AQC equipment is required to achieve continuous compliance with the MATS limits. Mercury emissions during the testing ranged between 3.70 to 6.70 lbs/TBtu on the three units, which are between three to six times greater than the mercury MATS limit. Filterable particulate emissions varied between 0.013 and 0.071 lbs/mmBtu versus the MATS limit of 0.03 lbs/mmBtu. The existing filterable particulate emission limit for the three units is 0.1 lbs/mmBtu; thus additional reductions are required. Sulfur dioxide emissions ranged between 0.03 and 0.047 lbs/mmBtu for the three units, below the allowable MATS sulfur dioxide limit of 0.20 lbs/mmBtu as a surrogate for hydrochloric acid.

Our current MATS compliance plan for Hatfield Station Units 1, 2, and 3 includes two mercury control systems. The first, a mercury re-emissions control system for the FGD modules, will include chemical storage tanks, transport lines, and chemical injection systems. Testing of the FGD module inlets and outlets demonstrates there is significant re-emission of mercury occurring in the scrubber module of each unit. The re-emission chemicals are intended to prevent the chemical reduction of mercury.

In addition, activated-carbon injection systems will be installed; including storage tanks, transport lines, and ACI injection systems. The activated carbon will be injected downstream of the air heaters on all three units. Capture of the activated carbon will occur in the electrostatic precipitators of each unit.

In order to optimize the ACI system mercury collection, a dry sorbent injection (DSI) system will be installed following the economizer to reduce SO3 to less than 5 ppm using hydrated lime. This system includes storage tanks, transport lines, and DSI injection systems. All of the planned work for mercury control requires planned unit outages for the installation of duct penetrations, injection lances, and the large particle ash screens.

Our current MATS compliance plan also includes electrostatic precipitator equipment renovations for Hatfield Units 1, 2, and 3 requiring the removal of all internal wires and plates and replacement with new pipe and spike electrodes and rigid frame design. In addition, all precipitator transformer rectifier sets will be replaced with high-frequency transformer rectifier sets. Finally, casing repairs and expansion joint replacement will be preformed to prevent air in-leakage.

These precipitator renovations will improve particulate removal efficiencies. The nature and scope of this work requires that the work be performed during planned unit outages of 50 to70 days in duration to allow safe and efficient execution of the planned precipitator renovations.

Also currently planned, is removal of the vintage 1995 presumptive NO_x RACT coal burners and installation of new, low-NO_x burners and over-fired air systems capable of cofiring natural gas to reduce particulate loading on the electrostatic precipitator, as well as mercury and acid gases. Installation of these new burners will also result in significant reduction of annual NO_x emissions from Hatfield Units 1, 2, and 3.

The current project schedule for the Hatfield Station shows that completion of the individual MATS AQC projects is significantly behind the MATS deadline of April 16, 2015 for Units 1, 2, and 3. The three-year compliance schedule is not sufficient time to complete installation of MATS AQC systems and renovations to achieve final compliance with MATS based on the above information.

Accordingly, FE requests written approval by PADEP of a one-year extension, to April 16, 2016, of the compliance date for MATS for Bruce Mansfield Units 1, 2, and 3 and Hatfield Units 1, 2, and 3.

If you should have any questions, please contact me.

Sincerely,

By hand delivery
cc: VBrisini, PADEP

Greg

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION
SOUTHWEST REGIONAL OFFICE

December 13, 2013

Vimal Chauhan, Vice-President
Homer City Generation, LP
1750 Power Plant Road
Homer City, PA 15748

Re: MATS Extension Request for Homer City Generating Station

Dear Mr. Chauhan:

This letter is to notify you that the Pennsylvania Department of Environmental Protection (DEP) has reviewed your November 5, 2013 compliance extension request related to the requirements under the Mercury and Air Toxics Standard (40 CFR Part 63 Subpart UUUUU), also known as MATS, for the Homer City Generating Station. Homer City Generation, LP has requested a one year extension of compliance to April 16, 2016 in order to complete the construction of flue gas desulfurization systems on Units 1 and 2, and to conduct testing and possible installation of additional mercury controls on Unit 3.

Homer City Generation, LP's extension request to comply with the MATS requirements until April 16, 2016 for the Homer City Generating Station Units 1, 2, and 3 is approved by DEP based upon the timelines identified in your November 5, 2013 letter. If Homer City Generation, LP is unable to meet the timeline identified in the November 5, 2013 letter, you should provide written notice to DEP as soon as possible but no later than five (5) business days after becoming aware of the delays. This notice must explain the delay and propose a revised compliance schedule in order to meet the April 16, 2016 MATS extension date. If Homer City Generation, LP wishes to request an extension of MATS compliance beyond April 16, 2016, that request must be sent to the administrator of the U.S. Environmental Protection Agency.

If you have questions regarding this matter, please do not hesitate to contact me at 412.442.4161.

Sincerely,

Mark A. Wayner, P.E.
Environmental Program Manager
Air Quality

RECEIVED
DEC 19 2013
DIVISION OF AIR QUALITY PERMITS

cc: File 32-00055
D.O. (T. Norris)
K. Ramamurthy
EPA Region III (H. Vyas)

Homer City Generation, L.P.
1750 Power Plant Road
Homer City, PA 15748

November 5, 2013

Mr. Mark Wayner
Air Program Manager
PADEP Southwest Regional Office
400 Waterfront Drive
Pittsburgh, PA, 15222

Re: Request for a One-Year Extension of the Compliance Deadline for the Mercury and Air Toxics Standards and of the Expiration Date of the Plan Approval for the Installation of the Flue Gas Desulfurization Units

Dear Mr. Wayner:

Pursuant to Clean Air Act section 112()(i)(3)(B), Homer City Generation, L.P. ("Homer City" or the "Station") hereby requests a one-year extension of the compliance deadline for the National Emissions Standards for Hazardous Air Pollutants ("NESHAP") from Coal- and Oil-Fired Electric Utility Steam Generating Units, better known as the Mercury and Air Toxics Standards ("MATS") for all three of its electric generating units. 77 Federal Reg. 9304 (February 16, 2012). As discussed below, we request a one-year extension to complete (1) the construction, tie-in and shakedown of the state-of-the-art Flue Gas Desulfurization ("FGD") systems for Units 1 and 2; and (2) the possible installation of an activated carbon injection ("ACI") system on Unit 3, if emission testing scheduled to take place next Spring indicate that such technology is needed to meet MATS. If this extension is granted, the MATS compliance deadline for Homer City would be April 16, 2016.

Section 112(i)(3)(B) authorizes Title V permitting authorities to grant, on a case-by-case basis, compliance extensions for NESHAPs of up to one year if needed for the installation of controls. EPA has taken the position that a "fourth year [compliance window for MATS] should be broadly available to enable a facility owner to install controls within 4 years," and that when facilities are installing pollution controls to meet MATS, permitting agencies "should be able to quickly make determinations as to when extensions are appropriate." *Id.* at 9410. EPA also has made clear that permitting authorities "have the discretion to use [their] extension authority to address a range of situations in which installation schedules may take more than 3 years, including staggering installations" of pollution control equipment. *Id.*

As you know, Homer City is in the process of installing FGDs on Units 1 and 2, at a cost of approximately $750 million. The FGDs are a major component of the Station's MATS compliance strategy for Units 1 and 2. Construction on the two units commenced following the Department's issuance of Plan Approval No. PA-32-00055H on April 2, 2012. The Station's intention is to complete tie-in of the units by the end of the third quarter of 2015, and then to use the next 180 days to shakedown the units. Tie-in of the units will be staggered, so that both units are not down simultaneously and the lessons learned tying in the first unit can be applied to the second. Homer City would like to extend the MATS compliance deadline to coincide with the completion of the shakedown of the FGDs on Units 1 and 2.

Given the proposed tie-in schedule, we also request an extension of the plan approval expiration date from April 2, 2015 to April 2, 2016. This extension would afford the Station sufficient time to complete construction and tie-in of the units, and would harmonize the plan approval with a MATS compliance extension.

Homer City has been anticipating that Unit 3 will be able to comply with MATS limits with its existing suite of pollution control technology, i.e., selective catalytic reduction, wet scrubber, and electrostatic precipitator. However, recent information suggests the possibility that the addition of activated carbon injection ("ACI") or some other technology may be necessary to ensure Unit 3's compliance with MATS. To analyze this issue further, the Station has scheduled a series of emission testing after next Spring's planned outage to determine whether ACI and/or a special mercury catalyst will be necessary to comply with MATS.

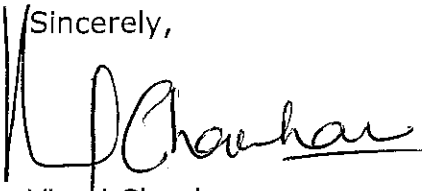
If the testing reveals that ACI or some other control technology will be required for Unit 3, the Station will have to move forward with engineering, permitting, and installing the technology. Although the Station has not developed a detailed timeline and construction schedule, and likely will not be in the position to do so until additional testing and engineering evaluations are undertaken, it anticipates that this process from engineering through shakedown could take as long as two years to complete. Under such a timeline, there is a possibility that Unit 3 would not be in a position to comply with MATS until April 2016, and thus would need a one-year extension of the MATS deadline. For planning purposes, Homer City would prefer to secure a MATS extension now, rather than await the outcome of next Spring's testing, as time will be tight if ACI or some other technology is required.

Given the Department's extensive knowledge of and involvement with the FGD project, and our recent discussions about the mercury testing that the Station plans to undertake next Spring, we trust that this letter provides you with sufficient information to act on both a one-year MATS compliance deadline extension request and our request to extend the expiration date of the plan approval until April 2,

2016. If you need additional information, however, please let us know and we will do our best to provide it promptly.

We appreciate your attention to important matter, and look forward to hearing from you soon.

Sincerely,



Vimal Chauhan
Vice President
Homer City Generation, L.P.

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION
SOUTHWEST REGIONAL OFFICE

April 25, 2014

Brian W. Green, Senior Air Quality Specialist
GenOn Northeast Management Co.
121 Champion Way
Canonsburg, PA 15317

Re: Request for Area Source Boiler MACT Compliance Date Extension
Air Quality TVOP-32-00059
Conemaugh Power Plant
W. Wheatfield Township, Indiana County

Dear Mr. Green:

This letter is to notify you that the Pennsylvania Department of Environmental Protection (DEP) has reviewed your March 18, 2014 compliance extension request for the Conemaugh Power Plant Units 1 and 2, related to the requirements under the Mercury and Air Toxics Standard (40 CFR Part 63 Subpart UUUUU), also known as MATS.

GenOn Northeast Management Co. has requested a six month extension of compliance to October 16, 2015 in order to comply with MATS by completing construction, testing, tuning and optimizing the SCR and FGD Upgrade Projects as outlined in your March 18, 2014 letter.

GenOn Northeast Management Co.'s extension request to comply with the MATS requirements until October 16, 2015 for the Conemaugh Power Plant Units 1 and 2 is approved by DEP based upon the information identified in your March 18, 2014 letter. If GenOn Northeast Management Co. is unable to meet the timeline identified in the March 18, 2014 letter, you should provide written notice to DEP as soon as possible but no later than five (5) business days after becoming aware of the delays. This notice must explain the delay and propose a revised compliance schedule in order to meet the October 16, 2015 MATS extension date. If GenOn Northeast Management Co. wishes to request an extension of MATS compliance beyond April 16, 2016, that request must be sent to the administrator of the U.S. Environmental Protection Agency.

If you have questions regarding this matter, please do not hesitate to contact me at 412.442.4161.

Sincerely,

Mark A. Wayner, P.E.
Regional Manager
Air Quality Program

cc: File TVOP-32-00059
Harrisburg (K. Ramamurthy)
Operations (T. Norris)
EPA (H. Vyas)

121 Champion Way
Canonsburg, PA 15317
brian.w.green@nrgenery.com
(724) 597-8219

March 18, 2014

VIA OVERNIGHT DELIVERY

Mr. Mark Wayner
Southwest Region Air Program Manager
PA Department of Environmental Protection
400 Waterfront Drive
Pittsburgh, PA 15222-4745

Re: Conemaugh Power Plant (Permit No. TV-32-00059)
Units 1 and 2 (TVOP Source ID Nos. 031 and 032)
Revised Mercury and Air Toxics Standards (MATS) Extension Request

Dear Mr. Wayner:

Per conversations and feedback from PADEP regional and central office staff, GenOn Northeast Management Company ("GenOn"), operator of Conemaugh Power Plant ("Conemaugh"), is submitting this revised request for a Mercury and Air Toxics Standards (MATS) Extension for Conemaugh Units 1 and 2 to the Pennsylvania Department of Environmental Protection's ("DEP" or "Department") for consideration and approval. This revised request amends the original request (submitted via letter from Keith Schmidt to Mark Wayner on January 2, 2014) by changing the exemption duration to six months. This request also includes additional detail on the control subsystems with the potential to require optimization tuning. Please recall that GenOn submitted a Plan Approval Application for the installation of a Selective Catalytic Reduction ("SCR") system in December 2010. The Department issued a Plan Approval in March of 2012. GenOn also submitted a Request for Determination ("RFD") in September 2011 for a Flue Gas Desulfurization ("FGD") Upgrade Project, which included installation of absorption trays and a fines reinjection system. Concurrence from the DEP that the project did not require a Plan Approval was received in December of 2011. Combined, these two emission control projects ("Projects") are critical for Conemaugh to comply with MATS, specifically the MATS mercury ("Hg") emission limits.

In the submittals described above, GenOn projected Project completion in Fall 2014. Currently the Projects remain on schedule, but GenOn is concerned that period between completion and the MATS compliance date of April 16, 2015 may be insufficient to fully test, tune and optimize the FGD Upgrades to effectively capture the increased concentration of oxidized or ionic Hg that will result from the catalyst layer installed in the SCR system.

MATS Rule and Compliance Extension Provision

On February 16, 2012, the Federal Environmental Protection Agency ("EPA") issued the NESHAP for Coal- and Oil-fired Electric Utility Generating Units [40 CFR Part 63 Subpart UUUUU], ("subpart UUUUU"). 77 Fed. Reg. 9304. MATS requires compliance by April 16, 2015. Pursuant to 112(i)(3)(B) of the Clean Air Act ("CAA"), Title V permitting authorities were granted the ability to extend the 3 year compliance deadline up to one additional year as noted below:

> **CAA *112(i)(3)(B)***
>
> *The Administrator (or a State with a program approved under subchapter V of this chapter) may issue a permit that grants an extension permitting an existing source up to 1 additional year to comply with standards under subsection (d) of this section if such additional period is necessary for the installation of controls.*

Further, EPA has stated:

> **77 Fed. Reg. 9410**
>
> *The EPA believes that although most units will be able to fully comply within 3 years, the fourth year that permitting authorities are allowed to grant for installation of controls is an important flexibility that will address situations where an extra year is necessary. That fourth year should be broadly available to enable a facility owner to install controls within 4 years if the 3-year time frame is inadequate for completing the installation.*

While GenOn does not expect to need the compliance extension for construction, testing and tuning or "shakedown" and optimization will likely continue at least six months beyond the April 16, 2015 compliance date and, accordingly, shakedown and optimization should be considered part of "installation of controls". Additionally, the SCR system under construction will not be equipped with a bypass; if the Projects, particularly the FGD Upgrades, perform as designed and the initial commissioning effort is successful, Conemaugh Units 1 and 2 will meet the MATS emission limits on or shortly after the MATS compliance date. However, it is GenOn's concern that Conemaugh could be in the unenviable position of having installed the required controls, but still in the process of testing and tuning as of April 16, 2015. This scenario would necessitate a last-minute compliance extension request. Based on extensive pre-construction diagnostic testing, Conemaugh will require both the SCR for mercury oxidation and the FGD Upgrades to limit mercury reemission to comply with MATS mercury limits on a continuous basis.

The Conemaugh FGD Upgrades Project completed preliminary Hg Performance Test post FGD Upgrades on Conemaugh Unit #2 in December 2013. The preliminary testing was conducted utilizing Carbon Traps in an effort to assess achievement of contractual performance guarantees. In short, the preliminary test results indicate sufficient capture of ionic Hg but also show a significant increase of elemental Hg across the FGD indicating re-emission, reduction of oxidized to elemental Hg, levels that are consistent with pre upgrade levels. The preliminary Hg Performance test appears flawed in that: 1) the % ionic, the soluble and readily captured Hg

species, at the inlet to the absorbers is significantly higher than it was in prior test which likely explains the re-emission levels and 2) the reinjection of fines to the Absorbers was insufficient and will require significant operational tuning of the installed equipment. At this point the FGD Upgrades Project Team, the FGD Upgrades Vendor, and Conemaugh Station recognize the need to optimize the Dewatering/Fines Reinjection System and ensure proper operating condition of the FGD balance of plant equipment prior to Final Performance Testing of Conemaugh Unit #2 (and subsequently Conemaugh Unit #1). To that end a revised project schedule was developed. The revised schedule is attached for your information (see Attachment D).

This request focuses on the MATS Hg limits, because Conemaugh, as currently configured, can demonstrate continuous compliance with acid gas limits, through either i) hydrogen chloride ("HCl") surrogate of 0.002 lbs/MMBtu, or ii) the sulfur dioxide ("SO_2") surrogate of 0.2 lb/MMBtu, and the non-mercury metals limit, through the filterable particulate matter ("PM") surrogate of 0.03 lb/MMBtu.

Schedule and Compliance Extension Request

To further highlight Conemaugh's commitment to completion of the Projects, GenOn has included an update to the schedule of the Projects. The FGD upgrades have been completed on two of the five absorber modules, but the full efficacy of those upgrades for Hg removal cannot be evaluated until the SCR is in service to oxidize the Hg to be removed in the FGD and ensure Hg captured in the upgraded FGD is not reemitted. Also included in this submittal are the required Request for Waiver of the Initial Performance Test and Request for Waiver of Recordkeeping and/or Reporting Requirements. Please note that the Request for Waiver of the Initial Performance Test is not a request for exemption from the initial test required by the SCR Plan Approval (PA-32-00059E, §E Condition #002). That test program includes testing for Hg, which will be completed within 180-days of startup of the SCR as required.

Attachments

The following forms and informational attachments are included in this request.

Attachment A	Request for MATS Compliance Extension Form
Attachment B	Request for Waiver of the Initial Performance Test
Attachment C	Request for Waiver of Recordkeeping and/or Reporting Requirements
Attachment D	Revised Project Schedule
Attachment E	Copy of Cover Letters for FGD Upgrade RFD and SCR Plan Approval Application

GenOn respectfully requests that the six month extension and waivers be granted. If you have any questions, comments or require further information, please contact me or Keith Schmidt at (724) 597-8193 (keith.schmidt@nrgenergy.com).

Sincerely,

Brian W. Green
Senior Air Quality Specialist

Attachments

CC: Mark Gorog, DEP
Vince Brisini, DEP

ATTACHMENT A

Request for MATS Compliance Extension Form

Request for Extension of Compliance

THIS IS A SAMPLE NOTIFICATION FORM, WHICH CAN BE USED BY FACILITIES AT THEIR DISCRETION TO MEET COMPLIANCE WITH 40 CFR 63 Subpart A, §63.9(c) and/or §63.6(i)

Applicable Rule: 40 CFR Part 63, Subpart A — National Emission Standards for Hazardous Air Pollutants for Source Categories, Subpart A — General Provisions. Request for extension of compliance is being made in accordance with §63.9(c) and/or §63.6(i).

NOTE: Until an extension of compliance has been granted by the Administrator (or State with an approved permit program), the owner or operator of an affected source subject to a part 63 standard shall comply with all applicable requirements of that standard (§63.6(i)(1).

Requests for extension of compliance *with a relevant standard are due not later than* ***120 days prior to the affected source's compliance date*** *[as specified in §63.6(b) and (c)] except as noted below. Emissions standards established under this part may specify an alternative date (e.g., other than 120 days) for the submittal of requests for an extension of compliance if alternatives are appropriate for the source categories affected by those standards. Please check the relevant standard for alternative submittal dates. (§63.6(i)(4)(i)(B))*

- *An owner or operator of an existing source unable to comply with a relevant standard established under this part pursuant to section 112(f) of the Act may request that the Administrator grant an extension allowing the source up to 2 years after the standard's effective date to comply with the standard. The Administrator may grant such an extension if he/she finds that such additional period is necessary for the installation of controls and that steps will be taken during the period of the extension to assure that the health of persons will be protected from imminent endangerment. All such requests for an extension of compliance with a relevant standard are due not later than* ***90 calendar days after the effective date*** *of the relevant standard. (§63.6(i)(4)(ii), §63.6(i)(3)*

- *An owner or operator of an existing source that has installed BACT or technology required to meet LAER [as specified in (§63.6(i)(2)(ii)] prior to the promulgation of a relevant emission standard in this part may request that the Administrator grant an extension allowing the source 5 years from the date on which such installation was achieved, as determined by the Administrator, to comply with the standard. The Administrator may grant such an extension if he or she finds that the installation of BACT or technology to meet LAER controls the same pollutant (or stream of pollutants) that would be controlled at that source by the relevant emission standard. All such requests for an extension of compliance with a relevant standard are due not later than* ***120 days after the promulgation date*** *of the standard. (§63.6(i)(5), §63.6(i)(2)(ii))*

- *An owner or operator of an affected source may submit a compliance extension request if the existing source demonstrates that it has achieved a reduction in emissions of hazardous air pollutants in accordance with the provisions of subpart D, Regulations Governing Compliance Extensions for Early Reductions of Hazardous Air Pollutants. The early reduction program is not discussed here, please see Subpart D for further information (§63.6(i)(2)(i))*

SECTION I
GENERAL INFORMATION

A. Print or type the following information for each facility for which you are requesting an extension of compliance (§63.9(b)(2)(i)-(ii))

Operating Permit Number (OPTIONAL)	Facility I.D. Number (OPTIONAL)
32-00059	

Responsible Official's Name/Title: John A. Balog/ General Manager – Conemaugh

Street Address: 1442 Power Plant Road

City	State	ZIP Code
New Florence	PA	15944

Facility Name (if different from Responsible Official's Name): Conemaugh Power Plant

Facility Street Address (If different than Responsible Official's Street Address): Same as Responsible Official's

Facility Local Contact Name	Title	Phone (OPTIONAL)

City	State	ZIP Code

B. Indicate the relevant standard or other requirement that is the basis for this request for this compliance extension request:

40 CFR Part 63 Subpart UUUUU - Mercury and Air Toxics Standards (MATS)

C. I am eligible to apply for a compliance extension for the following reasons: (check all that apply)

☑ I am unable to comply with the relevant standard and need additional time for the installation of controls (§63.6(i)(4)(i)(A))

☐ I installed best available control technology (BACT) or lowest achievable emission rate (LEAR) prior to promulgation of the relevant standard (§63.6(i)(2)(ii))

☐ I am participating in an early reductions program (63.6(i)(2)(i)). If you check this box, this is the **END OF FORM**. Please see Subpart D for further instruction.

D. Are you submitting this compliance extension request less than times indicated on page 1 for submitted an extension request? (§63.6(i)(4)(i)(C))

☐ Yes ☑ No

If you answered yes, state the reasons why additional time is needed and the date when you first learned of the problems. (§63.6(i)(4)(i)(C))

Reasons why additional time is needed

Date (mm/dd/yy) first learned of the problems

E. Are you requesting a waiver of the initial performance test required under the applicable relevant standard in conjunction with this request for an extension of compliance? (§63.7(h)(3)(i)-(iii))

☑ Yes ☐ No

If you answered yes, you must submit the application for a waiver of the initial performance test together with this request for an extension of compliance. The application for waiver shall include information justifying the request for a waiver, such as the technical or economic infeasibility, or the impracticality, of the affected source performing the required test. (§63.7(h)(3)(i)-(iii))

F. Are you requesting a waiver of recordkeeping and/or reporting requirements under the applicable relevant standard in conjunction with this request for an extension of compliance? (§63.10(f)(3))

☑ Yes ☐ No

If you answered yes, you must submit the application for a waiver of recordkeeping and/or reporting requirements together with this request for an extension of compliance. The application for waiver should include whatever information you consider useful to convince the Administrator that a waiver of recordkeeping and/or reporting is warranted. (§63.10(f)(3))

G. If you are unable to comply based on the need for additional time to install controls, ***complete Sections II. and III.***

If you have installed BACT or LEAR, ***complete Sections II, III, and N.***

SECTION II
CERTIFICATION *(Note: you may edit the text in this section as deemed appropriate)*

Based upon information and belief formed after a reasonable inquiry, I, as a responsible official of the above-mentioned facility, certify the information contained in this request is accurate and true to the best of my knowledge.

Name of Responsible Official (Print or Type)	Title	Date (mm/dd/yy)
John A. Balog	General Manager - Conemaugh	3/18/2014

Signature of Responsible Official

John A Balog

Note: Responsible official is defined under §63.2 as any of the following: the president, vice-president, secretary, or treasurer of the company that owns the plant; the owner of the plant; the plant engineer or supervisor; a government official if the plant is owned by the Federal, State, city, or county government; or a ranking military officer if the plant is located on a military installation.

SECTION III
COMPLIANCE SCHEDULE INFORMATION

A. Describe the controls that will be installed at your facility to ensure compliance with the relevant standard. (§63.6(i)(6)(i)(A))

Selective Catalytic Reduction and Flue Gas Desulfurization Upgrades

B. Describe your compliance schedule by specifying the date by which you will complete each of the following steps toward achieving compliance: (§63.6(i)(6)(i)(B)(1)-(2))

1. Specify the date by which on-site construction, installation of emission control equipment, or a process change is to be initiated. (§63.6(i)(6)(i)(B)(1))

Activity that will be initiated						Date (mm/dd/yy)
☐	On-site construction	✓	Installation of emission control equipment	☐	Process change	3/30/2012

Comments (Optional)

2. Specify the date by which final compliance is to be achieved. (§63.6(i)(6)(i)(B)(2))

Date (mm/dd/yy)

October 16, 2015

SECTION IV
ADDITIONAL SUPPORTING INFORMATION

Note: complete this section only if you installed BACT or technology required to meet LAER prior to the promulgation of the applicable relevant emission standard.

Provide additional information (e.g., illustrative text, diagrams, manufacturer's specifications) to demonstrate to the Administrator's satisfaction that the installation of BACT or technology to meet LAER controls the same pollutant (or stream of pollutants) that would be controlled at that source by the relevant emission standard. (§63.6(i)(6)(ii))

Narrative discussion

Indicate any attachments you are including as supporting information:

☐ Diagrams
☐ Manufacturer's specifications
☐ Other (describe below)

Description of other attachments

END OF FORM - Please make sure that a Responsible Official signs Section II prior to submitting the form to your EPA Regional Office or your State Air Permitting Agency, as applicable.

ATTACHMENT B

Request for Waiver of the Initial Performance Test

ATTACHMENT B

Conemaugh Power Plant (TVOP# 32-00059)
Title V Operating Permit ID Nos. 031 (Conemaugh Unit 1) and 032 (Conemaugh Unit 2)

Request for Waiver of the Initial Performance Test

40 CFR 63 Subpart UUUUU requires compliance and performance tests to demonstrate compliance as specified below:

§ 63.9984 When do I have to comply with this subpart?

(b) If you have an existing EGU, you must comply with this subpart no later than April 16, 2015.

(f) You must demonstrate that compliance has been achieved, by conducting the required performance tests and other activities, no later than 180 days after the applicable date in paragraph (a), (b), (c), (d), or (e) of this section.

Affected sources requesting an extension from Part 63 requirements have the ability to petition the Administrator for a waiver of performance test requirements:

40 CFR §63.7 Performance testing requirements.

(h) Waiver of performance tests.

(1) Until a waiver of a performance testing requirement has been granted by the Administrator under this paragraph, the owner or operator of an affected source remains subject to the requirements of this section.

(2) Individual performance tests may be waived upon written application to the Administrator if, in the Administrator's judgment, the source is meeting the relevant standard(s) on a continuous basis, or the source is being operated under an extension of compliance, or the owner or operator has requested an extension of compliance and the Administrator is still considering that request.

(3) Request to waive a performance test.

(i) If a request is made for an extension of compliance under § 63.6(i), the application for a waiver of an initial performance test shall accompany the information required for the request for an extension of compliance. If no extension of compliance is requested or if the owner or operator has requested an extension of compliance and the Administrator is still considering that request, the application for a waiver of an initial performance test shall be submitted at least 60 days before the performance test if the site-specific test plan under paragraph (c) of this section is not submitted.

(ii) If an application for a waiver of a subsequent performance test is made, the application may accompany any required compliance progress report, compliance status report, or excess emissions and continuous monitoring system performance

ATTACHMENT B

report [such as those required under § 63.6(i), § 63.9(h), and § 63.10(e) or specified in a relevant standard or in the source's title V permit], but it shall be submitted at least 60 days before the performance test if the site-specific test plan required under paragraph (c) of this section is not submitted.

(iii) Any application for a waiver of a performance test shall include information justifying the owner or operator's request for a waiver, such as the technical or economic infeasibility, or the impracticality, of the affected source performing the required test.

GenOn Northeast Management Company ("GenOn") requests a waiver from Mercury and Air Toxics Standards ("MATS") performance test requirements for Title V Operating Permit ID Nos. 031 (Conemaugh Unit 1) and 032 (Conemaugh Unit 2), (the "Units"). This waiver request accompanies the MATS Extension request. Records of the MATS Initial Notification of Applicability and all exemption and waiver requests will be maintained as required by regulation.

GenOn requests a waiver from MATS performance test requirements to allow for testing, tuning and optimization of installed controls to achieve MATS compliance. As stated in the cover letter of the MATS Extension request, Project completion schedule will provide very little time to gain experience to achieve mercury reductions on a continuous basis to demonstrate MATS compliance.

GenOn requests DEP grant Conemaugh a waiver from MATS performance test requirements during the requested six month compliance extension.

CERTIFICATION

Based upon information and belief formed after a reasonable inquiry, I, as a responsible official of the above-mentioned facility, certify that the statements contained in this request are true, accurate and complete to the best of my knowledge.

Name of Responsible Official, Title

John A. Balog, General Manager - Conemaugh

Signature of Responsible Official, Date

John A Balog 3/18/2014

ATTACHMENT C

Request for Waiver of Recordkeeping and/or Reporting Requirements

ATTACHMENT C

Conemaugh Power Plant (TVOP# 32-00059)
Title V Operating Permit ID Nos. 031 (Conemaugh Unit 1) and 032 (Conemaugh Unit 2)

Request for Waiver of Recordkeeping and/or Reporting Requirements

40 CFR 63 Subpart UUUUU requires reporting and recordkeeping as specified below:

§ 63.10031 What reports must I submit and when?

(a) You must submit each report in Table 8 to this subpart that applies to you. If you are required to (or elect to) continuously monitor Hg and/or HCl and/or HF emissions, you must also submit the electronic reports required under appendix A and/or appendix B to the subpart, at the specified frequency.

(b) Unless the Administrator has approved a different schedule for submission of reports under § 63.10(a), you must submit each report by the date in Table 8 to this subpart and according to the requirements in paragraphs (b)(1) through (5) of this section.

(1) The first compliance report must cover the period beginning on the compliance date that is specified for your affected source in § 63.9984 and ending on June 30 or December 31, whichever date is the first date that occurs at least 180 days after the compliance date that is specified for your source in § 63.9984.

(2) The first compliance report must be postmarked or submitted electronically no later than July 31 or January 31, whichever date is the first date following the end of the first calendar half after the compliance date that is specified for your source in § 63.9984.

(3) Each subsequent compliance report must cover the semiannual reporting period from January 1 through June 30 or the semiannual reporting period from July 1 through December 31.

(4) Each subsequent compliance report must be postmarked or submitted electronically no later than July 31 or January 31, whichever date is the first date following the end of the semiannual reporting period.

(5) For each affected source that is subject to permitting regulations pursuant to part 70 or part 71 of this chapter, and if the permitting authority has established dates for submitting semiannual reports pursuant to 40 CFR 70.6(a)(3)(iii)(A) or 40 CFR 71.6(a)(3)(iii)(A), you may submit the first and subsequent compliance reports according to the dates the permitting authority has established instead of according to the dates in paragraphs (b)(1) through (4) of this section.

(c) The compliance report must contain the information required in paragraphs (c)(1) through (4) of this section.

(1) The information required by the summary report located in 63.10(e)(3)(vi).

(2) The total fuel use by each affected source subject to an emission limit, for each calendar month within the semiannual reporting period, including, but not limited to, a description of

the fuel, whether the fuel has received a non-waste determination by EPA or your basis for concluding that the fuel is not a waste, and the total fuel usage amount with units of measure.

(3) Indicate whether you burned new types of fuel during the reporting period. If you did burn new types of fuel you must include the date of the performance test where that fuel was in use.

(4) Include the date of the most recent tune-up for each unit subject to the requirement to conduct a performance tune-up according to § 63.10021(e). Include the date of the most recent burner inspection if it was not done every 36 (or 48) months and was delayed until the next scheduled unit shutdown.

(d) For each excess emissions occurring at an affected source where you are using a CMS to comply with that emission limit or operating limit, you must include the information required in § 63.10(e)(3)(v) in the compliance report specified in section (c).

(e) Each affected source that has obtained a Title V operating permit pursuant to part 70 or part 71 of this chapter must report all deviations as defined in this subpart in the semiannual monitoring report required by 40 CFR 70.6(a)(3)(iii)(A) or 40 CFR 71.6(a)(3)(iii)(A). If an affected source submits a compliance report pursuant to Table 8 to this subpart along with, or as part of, the semiannual monitoring report required by 40 CFR 70.6(a)(3)(iii)(A) or 40 CFR 71.6(a)(3)(iii)(A), and the compliance report includes all required information concerning deviations from any emission limit, operating limit, or work practice requirement in this subpart, submission of the compliance report satisfies any obligation to report the same deviations in the semiannual monitoring report. Submission of a compliance report does not otherwise affect any obligation the affected source may have to report deviations from permit requirements to the permit authority.

(f) As of January 1, 2012, and within 60 days after the date of completing each performance test, you must submit the results of the performance tests required by this subpart to EPA's WebFIRE database by using the Compliance and Emissions Data Reporting Interface (CEDRI) that is accessed through EPA's Central Data Exchange (CDX) (www.epa.gov/cdx). Performance test data must be submitted in the file format generated through use of EPA's Electronic Reporting Tool (ERT) (see http://www.epa.gov/ttn/chief/ert/index.html). Only data collected using those test methods on the ERT Web site are subject to this requirement for submitting reports electronically to WebFIRE. Owners or operators who claim that some of the information being submitted for performance tests is confidential business information (CBI) must submit a complete ERT file including information claimed to be CBI on a compact disk or other commonly used electronic storage media (including, but not limited to, flash drives) to EPA. The electronic media must be clearly marked as CBI and mailed to U.S. EPA/OAPQS/CORE CBI Office, Attention: WebFIRE Administrator, MD C404-02, 4930 Old Page Rd., Durham, NC 27703. The same ERT file with the CBI omitted must be submitted to EPA via CDX as described earlier in this paragraph. At the discretion of the delegated authority, you must also submit these reports, including the confidential business information, to the delegated authority in the format specified by the delegated authority.

(1) Within 60 days after the date of completing each CEMS (SO2 , PM, HCl, HF, and Hg) performance evaluation test, as defined in § 63.2 and required by this subpart, you must submit the relative accuracy test audit (RATA) data (or, for PM CEMS, RCA and RRA data) required by this subpart to EPA's WebFIRE database by using the Compliance and Emissions Data Reporting Interface (CEDRI) that is accessed through EPA's Central Data Exchange (CDX) (www.epa.gov/cdx). The RATA data shall be submitted in the file format generated through use of EPA's Electronic Reporting Tool (ERT) (http://www.epa.gov/ttn/chief/ert/index.html). Only RATA data compounds listed on the ERT Web site are subject to this requirement. Owners or operators who claim that some of the information being submitted for RATAs is confidential business information (CBI) shall submit a complete ERT file including information claimed to be CBI on a compact disk or other commonly used electronic storage media (including, but not limited to, flash drives) by registered letter to EPA and the same ERT file with the CBI omitted to EPA via CDX as described earlier in this paragraph. The compact disk or other commonly used electronic storage media shall be clearly marked as CBI and mailed to U.S. EPA/OAPQS/CORE CBI Office, Attention: WebFIRE Administrator, MD C404-02, 4930 Old Page Rd., Durham, NC 27703. At the discretion of the delegated authority, owners or operators shall also submit these RATAs to the delegated authority in the format specified by the delegated authority. Owners or operators shall submit calibration error testing, drift checks, and other information required in the performance evaluation as described in § 63.2 and as required in this chapter.

(2) For a PM CEMS, PM CPMS, or approved alternative monitoring using a HAP metals CEMS, within 60 days after the reporting periods ending on March 31st, June 30th, September 30th, and December 31st, you must submit quarterly reports to EPA's WebFIRE database by using the Compliance and Emissions Data Reporting Interface (CEDRI) that is accessed through EPA's Central Data Exchange (CDX) (www.epa.gov/cdx). You must use the appropriate electronic reporting form in CEDRI or provide an alternate electronic file consistent with EPA's reporting form output format. For each reporting period, the quarterly reports must include all of the calculated 30-boiler operating day rolling average values derived from the CEMS and PM CPMS.

(3) Reports for an SO2 CEMS, a Hg CEMS or sorbent trap monitoring system, an HCl or HF CEMS, and any supporting monitors for such systems (such as a diluent or moisture monitor) shall be submitted using the ECMPS Client Tool, as provided for in Appendices A and B to this subpart and § 63.10021(f).

(4) Submit the compliance reports required under paragraphs (c) and (d) of this section and the notification of compliance status required under § 63.10030(e) to EPA's WebFIRE database by using the Compliance and Emissions Data Reporting Interface (CEDRI) that is accessed through EPA's Central Data Exchange (CDX) (www.epa.gov/cdx). You must use the appropriate electronic reporting form in CEDRI or provide an alternate electronic file consistent with EPA's reporting form output format.

(5) All reports required by this subpart not subject to the requirements in paragraphs (f)(1) through (4) of this section must be sent to the Administrator at the appropriate address listed in § 63.13. If acceptable to both the Administrator and the owner or operator of a source, these reports may be submitted on electronic media. The Administrator retains the

right to require submittal of reports subject to paragraphs (f)(1), (2), and (3) of this section in paper format.

(g) If you had a malfunction during the reporting period, the compliance report must include the number, duration, and a brief description for each type of malfunction which occurred during the reporting period and which caused or may have caused any applicable emission limitation to be exceeded.

Table 8 to Subpart UUUUU of Part 63—Reporting Requirements

As stated in § 63.10031, you must comply with the following requirements for reports:

You must submit a . . .	***The report must contain . . .***	***You must submit the report . . .***
1. Compliance report	*a. Information required in § 63.10031(c)(1) through (4); and b. If there are no deviations from any emission limitation (emission limit and operating limit) that applies to you and there are no deviations from the requirements for work practice standards in Table 3 to this subpart that apply to you, a statement that there were no deviations from the emission limitations and work practice standards during the reporting period. If there were no periods during which the CMSs, including continuous emissions monitoring system, and operating parameter monitoring systems, were out-of-control as specified in § 63.8(c)(7), a statement that there were no periods during which the CMSs were out-of-control during the reporting period; and*	*Semiannually according to the requirements in § 63.10031(b).*
	c. If you have a deviation from any emission limitation (emission limit and operating limit) or work practice standard during the reporting period, the report must contain the information in § 63.10031(d). If there were periods during which the CMSs, including continuous emissions monitoring systems and continuous parameter monitoring systems, were out-of-control, as specified in § 63.8(c)(7), the report must contain the information in § 63.10031(e)	

§ 63.10032 What records must I keep?

(a) You must keep records according to paragraphs (a)(1) and (2) of this section. If you are required to (or elect to) continuously monitor Hg and/or HCl and/or HF emissions, you must also keep the records required under appendix A and/or appendix B to this subpart.

(1) A copy of each notification and report that you submitted to comply with this subpart, including all documentation supporting any Initial Notification or Notification of Compliance Status or semiannual compliance report that you submitted, according to the requirements in § 63.10(b)(2)(xiv).

(2) Records of performance stack tests, fuel analyses, or other compliance demonstrations and performance evaluations, as required in § 63.10(b)(2)(viii).

(b) For each CEMS and CPMS, you must keep records according to paragraphs (b)(1) through (4) of this section.

(1) Records described in § 63.10(b)(2)(vi) through (xi).

(2) Previous (i.e. , superseded) versions of the performance evaluation plan as required in § 63.8(d)(3).

(3) Request for alternatives to relative accuracy test for CEMS as required in § 63.8(f)(6)(i).

(4) Records of the date and time that each deviation started and stopped, and whether the deviation occurred during a period of startup, shutdown, or malfunction or during another period.

(c) You must keep the records required in Table 7 to this subpart including records of all monitoring data and calculated averages for applicable PM CPMS operating limits to show continuous compliance with each emission limit and operating limit that applies to you.
(d) For each EGU subject to an emission limit, you must also keep the records in paragraphs (d)(1) through (3) of this section.

(1) You must keep records of monthly fuel use by each EGU, including the type(s) of fuel and amount(s) used.

(2) If you combust non-hazardous secondary materials that have been determined not to be solid waste pursuant to 40 CFR 241.3(b)(1), you must keep a record which documents how the secondary material meets each of the legitimacy criteria. If you combust a fuel that has been processed from a discarded non-hazardous secondary material pursuant to 40 CFR 241.3(b)(2), you must keep records as to how the operations that produced the fuel satisfies the definition of processing in 40 CFR 241.2. If the fuel received a non-waste determination pursuant to the petition process submitted under 40 CFR 241.3(c), you must keep a record which documents how the fuel satisfies the requirements of the petition process.

(3) For an EGU that qualifies as an LEE under § 63.10005(h), you must keep annual records that document that your emissions in the previous stack test(s) continue to qualify the unit for LEE status for an applicable pollutant, and document that there was no change in source operations including fuel composition and operation of air pollution control equipment that would cause emissions of the pollutant to increase within the past year.

(e) If you elect to average emissions consistent with § 63.10009, you must additionally keep a copy of the emissions averaging implementation plan required in § 63.10009(g), all calculations required under § 63.10009, including daily records of heat input or steam generation, as applicable, and monitoring records consistent with § 63.10022.

(f) You must keep records of the occurrence and duration of each startup and/or shutdown.

(g) You must keep records of the occurrence and duration of each malfunction of an operation (i.e. , process equipment) or the air pollution control and monitoring equipment.

(h) You must keep records of actions taken during periods of malfunction to minimize emissions in accordance with § 63.10000(b), including corrective actions to restore malfunctioning process and air pollution control and monitoring equipment to its normal or usual manner of operation.

(i) You must keep records of the type(s) and amount(s) of fuel used during each startup or shutdown.

(j) If you elect to establish that an EGU qualifies as a limited-use liquid oil-fired EGU, you must keep records of the type(s) and amount(s) of fuel use in each calendar quarter to document that the capacity factor limitation for that subcategory is met.

Table 7 to Subpart UUUUU of Part 63—Demonstrating Continuous Compliance

As stated in § 63.10021, you must show continuous compliance with the emission limitations for affected sources according to the following:

If you use one of the following to meet applicable emissions limits, operating limits, or work practice standards . . .	***You demonstrate continuous compliance by . . .***
1. CEMS to measure filterable PM, SO_2, HCl, HF, or Hg emissions, or using a sorbent trap monitoring system to measure Hg	*Calculating the 30- (or 90-) boiler operating day rolling arithmetic average emissions rate in units of the applicable emissions standard basis at the end of each boiler operating day using all of the quality assured hourly average CEMS or sorbent trap data for the previous 30- (or 90-) boiler operating days, excluding data recorded during periods of startup or shutdown.*
2. PM CPMS to measure compliance with a parametric operating limit	*Calculating the 30- (or 90-) boiler operating day rolling arithmetic average of all of the quality assured hourly average PM CPMS output data (e.g., milliamps, PM concentration, raw data signal) collected for all operating hours for the previous 30- (or 90-) boiler operating days, excluding data recorded during periods of startup or shutdown.*
3. Site-specific monitoring using CMS for liquid oil-fired EGUs for HCl and HF emission limit monitoring	*If applicable, by conducting the monitoring in accordance with an approved site-specific monitoring plan.*
4. Quarterly performance testing for coal-fired, solid oil derived fired, or liquid oil-fired EGUs to measure compliance with one or more non-PM (or its alternative emission limits) applicable emissions limit in Table 1 or 2, or PM (or its alternative emission limits) applicable emissions limit in Table 2	*Calculating the results of the testing in units of the applicable emissions standard.*
5. Conducting periodic performance tune-ups of your EGU(s)	*Conducting periodic performance tune-ups of your EGU(s), as specified in § 63.10021(e).*

6. Work practice standards for coal-fired, liquid oil-fired, or solid oil-derived fuel-fired EGUs during startup	*Operating in accordance with Table 3.*
7. Work practice standards for coal-fired, liquid oil-fired, or solid oil-derived fuel-fired EGUs during shutdown	*Operating in accordance with Table 3.*

Affected sources requesting an extension from Part 63 requirements have the ability to petition the Administrator for a waiver of recordkeeping and/or reporting requirements:

40 CFR §63.10 Recordkeeping and reporting requirements.

(f) Waiver of recordkeeping or reporting requirements.

(1) Until a waiver of a recordkeeping or reporting requirement has been granted by the Administrator under this paragraph, the owner or operator of an affected source remains subject to the requirements of this section.

(2) Recordkeeping or reporting requirements may be waived upon written application to the Administrator if, in the Administrator's judgment, the affected source is achieving the relevant standard(s), or the source is operating under an extension of compliance, or the owner or operator has requested an extension of compliance and the Administrator is still considering that request.

(3) If an application for a waiver of recordkeeping or reporting is made, the application shall accompany the request for an extension of compliance under § 63.6(i), any required compliance progress report or compliance status report required under this part (such as under § 63.6(i) and § 63.9(h)) or in the source's title V permit, or an excess emissions and continuous monitoring system performance report required under paragraph (e) of this section, whichever is applicable. The application shall include whatever information the owner or operator considers useful to convince the Administrator that a waiver of recordkeeping or reporting is warranted.

(4) The Administrator will approve or deny a request for a waiver of recordkeeping or reporting requirements under this paragraph when he/she—

(i) Approves or denies an extension of compliance; or

(ii) Makes a determination of compliance following the submission of a required compliance status report or excess emissions and continuous monitoring systems performance report; or

(iii) Makes a determination of suitable progress towards compliance following the submission of a compliance progress report, whichever is applicable.

(5) A waiver of any recordkeeping or reporting requirement granted under this paragraph may be conditioned on other recordkeeping or reporting requirements deemed necessary by the Administrator.

(6) Approval of any waiver granted under this section shall not abrogate the Administrator's authority under the Act or in any way prohibit the Administrator from later canceling the waiver. The cancellation will be made only after notice is given to the owner or operator of the affected source.

GenOn Northeast Management Company ("GenOn") requests a waiver from Mercury and Air Toxics Standards ("MATS") recordkeeping and/or reporting requirements for Title V Operating Permit ID Nos. 031 (Conemaugh Unit 1) and 032 (Conemaugh Unit 2), (the "Units"). This waiver request accompanies the MATS Extension request. Records of the MATS Initial Notification of Applicability and all extension and waiver requests will be maintained as required by regulation.

GenOn requests a waiver from MATS performance test requirements and recordkeeping and/or reporting requirements to allow for testing, tuning and optimization of installed controls to achieve MATS compliance. As stated in the cover letter of the MATS Extension request, Project completion schedule will provide very little time to gain experience to achieve mercury reductions on a continuous basis to demonstrate MATS compliance.

GenOn requests DEP grant Conemaugh a waiver from MATS recordkeeping and reporting requirements during the requested six month compliance extension.

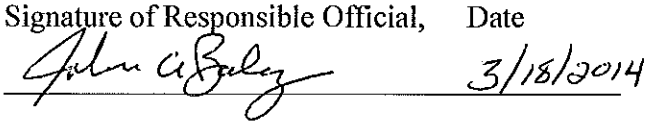
CERTIFICATION

Based upon information and belief formed after a reasonable inquiry, I, as a responsible official of the above-mentioned facility, certify that the statements contained in this request are true, accurate and complete to the best of my knowledge.

Name of Responsible Official, Title

John A. Balog, General Manager - Conemaugh

Signature of Responsible Official, Date



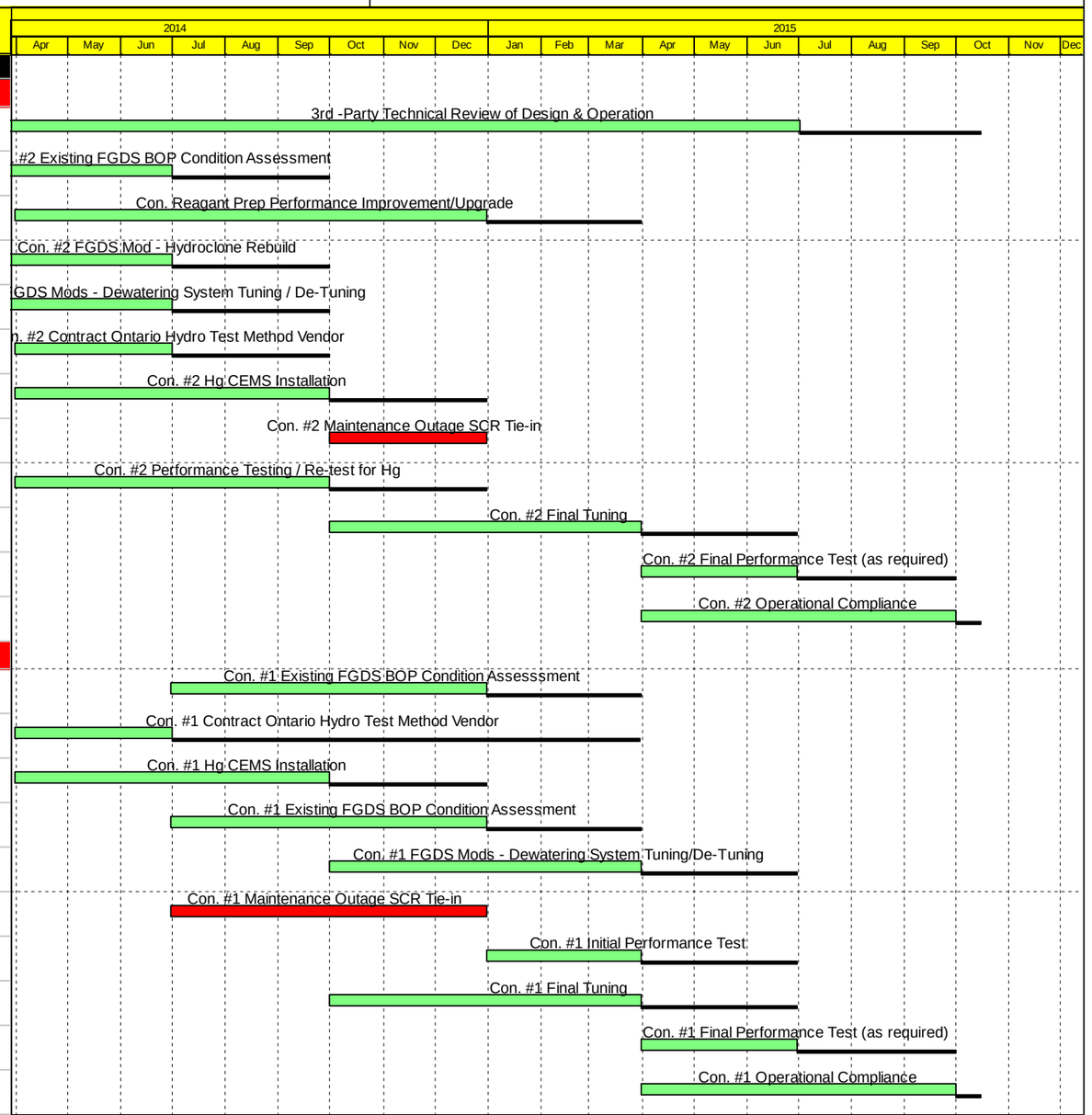
3/18/2014

ATTACHMENT D

Revised Project Schedule

Attachment D

Activity ID	Activity Name	OD	Start	Finish	Total Float	WBS
CFGDM FGD Upgrades - Level 1 Schedule (Rev.1)						
CFGDM.2 Unit 2						
A1000	3rd -Party Technical Review of Design & Operation	2688h	18-Mar-14 08*	01-Jul-15 17*	608h	CFGDM.2
A1010	Con. #2 Existing FGDS BOP Condition Assessment	600h	17-Mar-14 08*	30-Jun-14 17*	528h	CFGDM.2
A1020	Con. Reagant Prep Performance Improvement/Upgrade	1576h	31-Mar-14 08*	31-Dec-14 17*	512h	CFGDM.2
A1030	Con. #2 FGDS Mod - Hydroclone Rebuild	600h	17-Mar-14 08*	30-Jun-14 17*	528h	CFGDM.2
A1040	Con. #2 FGDS Mods - Dewatering System Tuning / De-Tuning	600h	17-Mar-14 08*	30-Jun-14 17*	528h	CFGDM.2
A1050	Con. #2 Contract Ontario Hydro Test Method Vendor	520h	31-Mar-14 08*	30-Jun-14 17*	528h	CFGDM.2
A1060	Con. #2 Hg CEMS Installation	1048h	31-Mar-14 08*	30-Sep-14 17*	528h	CFGDM.2
A1070	Con. #2 Maintenance Outage SCR Tie-in	536h	30-Sep-14 08*	31-Dec-14 17*	-240h	CFGDM.2
A1080	Con. #2 Performance Testing / Re-test for Hg	1048h	31-Mar-14 08*	30-Sep-14 17*	528h	CFGDM.2
A1090	Con. #2 Final Tuning	1048h	30-Sep-14 08*	31-Mar-15 17*	520h	CFGDM.2
A1100	Con. #2 Final Performance Test (as required)	528h	31-Mar-15 08*	30-Jun-15 17*	528h	CFGDM.2
A1110	Con. #2 Operational Compliance	1056h	31-Mar-15 08*	30-Sep-15 17*	88h	CFGDM.2
CFGDM.1 Unit 1						
A1120	Con. #1 Existing FGDS BOP Condition Assesssment	1064h	30-Jun-14 08*	31-Dec-14 17*	512h	CFGDM.1
A1130	Con. #1 Contract Ontario Hydro Test Method Vendor	520h	31-Mar-14 08*	30-Jun-14 17*	1560h	CFGDM.1
A1140	Con. #1 Hg CEMS Installation	1048h	31-Mar-14 08*	30-Sep-14 17*	528h	CFGDM.1
A1150	Con. #1 Existing FGDS BOP Condition Assessment	1064h	30-Jun-14 08*	31-Dec-14 17*	512h	CFGDM.1
A1160	Con. #1 FGDS Mods - Dewatering System Tuning/De-Tuning	1048h	30-Sep-14 08*	31-Mar-15 17*	520h	CFGDM.1
A1170	Con. #1 Maintenance Outage SCR Tie-in	1064h	30-Jun-14 08*	31-Dec-14 17*	-264h	CFGDM.1
A1180	Con. #1 Initial Performance Test	520h	31-Dec-14 08*	31-Mar-15 17*	520h	CFGDM.1
A1190	Con. #1 Final Tuning	1048h	30-Sep-14 08*	31-Mar-15 17*	520h	CFGDM.1
A1200	Con. #1 Final Performance Test (as required)	528h	31-Mar-15 08*	30-Jun-15 17*	528h	CFGDM.1
A1210	Con. #1 Operational Compliance	1056h	31-Mar-15 08*	30-Sep-15 17*	88h	CFGDM.1



Remaining Level of Effort
Actual Level of Effort
Actual ...
Remaini...

Conemaugh Station
Units 1 & 2 FGD

Data Date 17-Mar-14
Run Date 17-Mar-14 @ 13

Page 1 of 1

ATTACHMENT E

Copy of Cover Letters for FGD Upgrade RFD and SCR Plan Approval Application

GenOn

121 Champion Way
Canonsburg, PA 15317

Brian.Green@GenOn.com
Writer's Direct Dial No.
(724) 597-8219

CERTIFIED MAIL: RETURN RECEIPT REQUESTED

September 1, 2011
Mr. Mark Gorog
Southwest Region Environmental Engineer Manager
PA Department of Environmental Protection
400 Waterfront Drive
Pittsburgh, PA 15222-4745

RE: Conemaugh Power Plant (Permit Number TV-32-00059)
Request for Determination of Requirement for Plan Approval/Operating Permit (RFD)
Flue Gas Desulfurization Upgrades

Dear Mr. Gorog:

GenOn Northeast Management Company (GenOn, formerly RRI Energy), operator of Conemaugh Power Plant, is considering an to upgrade the existing flue gas desulfurization (FGD) absorber modules that service Units 1 and 2 (Source IDs 031 and 032, respectively) in the 2013 Outage for Unit 2 and the 2014 Outage for Unit 1 and is submitting the attached Request for Determination (RFD) application package to request an exemption from plan approval/operating permit requirements. Included in this submittal is Attachment A – RFD Form, Attachment B – Project Description, and Attachment C – NSR Emissions Calculations.

Currently the FGD system includes five absorber modules, two for each unit and a common spare. The FGD absorber modules, installed in 1994-95, are an open spray tower design with six spray levels, with five operating and one spare. The FGD absorber module upgrades (FGD Upgrades) are being considered to improve sulfur dioxide (SO_2) and mercury (Hg) removal efficiency anticipated as a result of the revised SO_2 National Ambient Air Quality Standard (NAAQS) and the proposed Mercury and Air Toxics Standards (MATS). Potential FGD Upgrades to improve control efficiency include the addition of a tray in each absorber, new spray header manifolds and nozzles, replacement of external recycle piping, and upgrades to existing recycle pumps, and reduce sneakage of untreated flue gas. The increased pressure drop across the absorbers due to the proposed upgrades will be addressed with the ID booster fan replacements included in the SCR Plan Approval Application submitted to the Department December 29, 2010. The FGD Upgrades will also include a fines

reinjection system that will increase mercury capture within the absorbers. Further explanation of the FGD Upgrades are included in Attachment B – Project Description.

The upgrades prescribed in this submittal are based on previous testing, analyses, and studies performed on these units to meet GenOn's targeted FGD performance specifications. If alternatives are proposed by the selected vendor GenOn will notify PaDEP.

No emissions increases of regulated pollutants are anticipated as a result of this project. On-site upgrades to the FGD absorber modules will commence in the 2013 Outage and will be complete following the 2014 Outage. PaDEP's review of the project is requested at the present time to provide for GenOn and the Owner's Groups' desire to approve and budget for the project.

In accordance with 25 Pa Code 127.14, a completed RFD form is included, in triplicate, as Attachment A. Please provide your concurrence that the subject project is exempt from plan approval requirements. If you have any questions or require any additional information concerning this matter, please contact me at (724) 597-8219.

Sincerely,

Brian W. Green
Air Quality Specialist

Attachments

Conemaugh/RFDs/FGD Upgrades

cc: Mark Wayner

GenOn

121 Champion Way
Canonsburg, PA 15317

Brian.Green@GenOn.com
Writer's Direct Dial Number
(724) 597-8219

December 29, 2010

CERTIFIED MAIL

Mr. Mark Wayner
Southwest Region Air Program Manager
PA Department of Environmental Protection
400 Waterfront Drive
Pittsburgh, PA 15222-4745

Re: Conemaugh Power Plant (Permit No. TV-32-00059)
Plan Approval Application for
Selective Catalytic Reduction (SCR) Project

Dear Mr. Wayner:

GenOn Northeast Management Company (GenOn, formerly RRI) on behalf of the Conemaugh Owners Group (Owners Group) is pleased to submit a Plan Approval Application for a potential Selective Catalytic Reduction (SCR) Project at Conemaugh Power Plant. At this date, the Owners Group has not formally approved the project but is undertaking engineering design for installation of the SCR Project described in this application and desires to begin the permitting process so that the air permitting will not present an impediment to final project approval and construction schedules. The project represents a decision to voluntary install discretionary emissions controls on Conemaugh's existing Units 1 and 2. The SCR would be installed and operated as a strategy to reduce nitrogen oxide (NOx) emissions and allowance consumption for current and anticipated future emissions trading programs. There is no existing regulatory requirement that requires installation of the SCR. We appreciate the opportunity afforded us to discuss this project with you and other PADEP staff at your office on December 3, 2010.

Major components of the SCR installation under consideration include:

- SCR Reactor and Catalyst Layers
- Economizer Bypass and Hopper Replacement
- Economizer Ash Handling System
- Aqueous Ammonia Injection System
- New Exhaust Booster Fans and Connecting Ductwork
- Limestone Addition System
- Potential SO_3 Mitigation System

- Boiler Building Steel Reinforcement
- Instrumentation and Controls, and Support Equipment.
- Economizer Gas Outlet Temperature Control System

The primary goal of the project is a significant reduction in NOx emissions from Units 1 and 2. The SCR will also provide co-benefit reduction of other pollutants including mercury. The SCR's effect on emissions from the main boilers is described in Section 6.1 of the application.

Operation of the SCR will require ancillary support operations including new material handling sources, Limestone and SO3 Sorbent storage silos, and increases in operations of existing sources (paved road deliveries of SCR feedstocks). These changes do cause a minor increase in fugitive emissions from these support activities. The SCR is projected to result in a decrease in actual emissions of NOx, particulate matter, sulfuric acid mist and mercury from the facility. The projected decrease in particulate emissions from the main units is more than adequate to offset the minor increase in support operations. These emissions changes are reflected in the New Source Review (NSR) emissions analysis that is provided in Section 9 of the application. The analysis demonstrates that NSR is not applicable to the project.

GenOn recognizes that the proposed new material handling sources at the facility necessary to support the SCR are subject to PaDEP Best Available Technology (BAT) review. Section 7 of the application provides the BAT analysis and proposed controls for the Limestone and SO3 Sorbent storage filter systems.

As of the date of the submittal of this application, GenOn is not requesting any operational or emission rate limitations for the purpose of emissions reduction credit (ERC) generation. Due to this fact and the voluntary nature of the pollution control device installation, no new limitations should be imposed on the existing permitted sources.

There will be no change to the flue gas exit stack or the exhaust plume characteristics; therefore, no dispersion modeling is necessary for approval of installation of the SCR.

Use of 29% ammonia as the SCR reagent will require revision to the plant's 40CFR68 Chemical Accident Prevention Provisions Risk Management Plan (RMP) before the ammonia is brought on site. This revision will be submitted, as required, as soon as design details are confirmed.

Notices of submission of this application (Municipal Notifications) have been sent to the West Wheatfield Township Supervisors and the Indiana County Commissioners via Certified Mail. Copies of these letters are included in Section 10 of this application.

The Certified Mail receipts will be forwarded to you as soon as they are available. An application fee of $1,000 is attached to this original letter.

Enclosed are one original and two (2) copies of the application. As a result of the project's status (Owners Group final approval has not been received) and albeit a thorough conceptual engineering design has been completed, the potential for design changes does exist. Substantive revisions in final design will be communicated to the Department as soon as they are known.

Construction of the SCR project is tentatively scheduled to begin Summer 2011 with a projected in-service date for the first unit of Fall 2014.

Please note that effective December 3, 2010, RRI Energy, Inc. and Mirant Corporation merged to form GenOn Energy, Inc. The appropriate applications and documentation are being prepared for submittal to the Department and will be completed within the 30 days allowed by regulation. Also note that the tax identification number for the station has not changed with this merger.

If you have any questions, comments or require further information, in your review of the application, please call me.

Sincerely,

Brian W. Green
Air Quality Specialist

Attachments

cc: Mark Gorog (2 complete copies)

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION
WASTE, AIR, RADIATION AND REMEDIATION

October 31, 2013

Mr. Thomas E. Hickes
PPL Brunner Island, LLC
P.O. Box 221
York Haven, PA 17370

Re: MATS Extension Request
Brunner Island Steam Electric Station
East Manchester Township, York County

Dear Mr. Hickes:

This letter is to notify you that the Pennsylvania Department of Environmental Protection (DEP) has reviewed your June 27, 2013 and October 10, 2013 one-year compliance date extension request for the Brunner Island Steam Electric Station regarding the requirements of the Mercury and Air Toxics Standard (40 CFR Part 63, Subpart UUUUU) also known as MATS.

PPL Brunner Island, LLC (PPL) has requested a one-year compliance date extension to April 16, 2016 in order to complete mercury control technology testing and subsequent installation to achieve MATS continuous compliance based on the information contained in your aforementioned letters.

PPL's request for a MATS requirements compliance date extension to April 16, 2016 for Brunner Island Units 1, 2, and 3 are approved by DEP based upon the timelines identified in your October 10, 2013 letter for all three units. If PPL is unable to meet the timelines identified in the letter, you should provide written notice to DEP as soon as possible, but no later than five business days after becoming aware of the delays. This notice must explain the delay and propose a revised compliance schedule in order to meet the April 16, 2016 MATS requirements compliance extension date.

If PPL wishes to request a compliance extension beyond April 16, 2016, that request must be sent to the Administrator of the U.S. Environmental Protection Agency.

If you need further assistance, please contact William Weaver, DEP Southcentral Region Air Quality Program Manager, by e-mail at wiweaver@pa.gov or by telephone at 717.705.4868.

Sincerely,

Vincent J. Brisini
Deputy Secretary

PPL Brunner Island, LLC
PO Box 221
York Haven, PA 17370
Tel. 717.266.7510 Fax 717.266.7519
thickes@pplweb.com

October 10, 2013

Vince Brisini | Deputy Secretary
Office of Waste, Air, Radiation and Remediation
Department of Environmental Protection
Rachel Carson State Office Building
400 Market Street
Harrisburg, PA 17101

PPL BRUNNER ISLAND LLC
MATS COMPLIANCE EXTENSION REQUEST – SUPPLEMENTAL INFORMATION

Dear Mr. Brisini,

The purpose of this letter is for PPL to submit supplemental information in support of our June 27, 2013 request for a one-year compliance extension until April 16, 2016 for PPL Brunner Island Steam Electric Station (SES) Units 1, 2 and 3 with regards to the Mercury and Air Toxics Standards (40 CFR 63 Subpart UUUUU[1], also known as the MATS). PA DEP is authorized to provide up to one additional year for the installation of controls as specified under 40 CFR 63.6(i)(4)(i)(A).

As discussed with the Department on August 12, 2013, our extension request is based on the need for additional long-term testing of the mercury control technology alternatives that have been tested on Brunner Island Unit 3 to date. The objective of this further testing will be to confirm the effectiveness of the mercury control technologies on all three units at Brunner Island SES, and to further assess any potential negative impacts on plant operations and/or equipment. Because it is only for mercury emissions that we need to install controls, we are seeking a one-year extension of the compliance deadline for only the mercury emission limit under the MATS Rule. Further explanation of the basis for our extension request is provided below.

Background

Over the past twenty–one months, PPL Corporation has been diligently working on planning for compliance with the MATS Rule for its fleet of nine affected generating plants in three states – Pennsylvania, Montana, and Kentucky. PPL's overall future investment plan to comply with the MATS Rule is presently estimated at over two billion dollars towards air pollution control improvements at several of these facilities. This plan includes the addition of new and modified equipment for mercury, particulate matter, and/or acid gas control[2].

[1] This letter, as well as PPL's June 27th letter to the PA DEP, requests a one-year extension of the MATS Rule mercury emissions limitations and associated requirements as promulgated under 40 CFR 63 Subpart UUUUU (except the initial notification requirements of 40 CFR 63.10030 which have already been fulfilled) applicable to Brunner Island Steam Electric Station Units 1, 2, and 3. Associated requirements include all dates and/or deadlines associated with complying with the MATS Rule mercury emission standards, including, initial performance demonstrations, performance tests, continuous emissions monitoring, recordkeeping and reporting, and emissions averaging.

[2] Brunner Island SES is seeking to install mercury controls only.

As noted in our June 27th extension request letter, PPL Brunner Island's evaluation of mercury control technologies began well before the MATS Rule was promulgated, in 2006 when evaluating technology options for compliance with EPA's Clean Air Mercury Rule (CAMR) and a Pennsylvania-specific mercury rule. As a result of this evaluation, in 2008, the NALCO MinPlus system was selected for mercury control on all three units at Brunner Island SES. Work was then initiated to finalize the design and procure NALCO MinPlus equipment, however, by the time the MATS Rule was finalized, NALCO had withdrawn their MinPlus product from the market[3], and we were forced to start over with our mercury control technology evaluation.

In 2012, PPL contracted with Shaw Environmental to identify current mercury control technologies and to develop a short-list of alternatives using K-T analysis for subsequent testing. PPL Brunner Island's first round of testing was completed through collaboration with the PA DEP on Unit 3 in December 2012. Due to significant mercury re-emission that was observed throughout this testing, additional testing was conducted on Brunner Island Unit 3 in June and July 2013.

Current Plant Configuration & Performance

PPL Brunner Island SES consists of three pulverized coal-fired electric generating units – Units 1, 2, and 3. Units 1 and 2 are Combustion Engineering drum type boilers used to supply steam to General Electric 350 megawatt (MW) and 400 MW turbines, respectively. Exhaust gases from Unit 1 pass through a baghouse and Unit 2 exhaust gases pass through an Electrostatic Precipitator (ESP). After passing through the baghouse and ESP, the combined Units 1 and 2 exhaust gases go through a wet limestone Flue Gas Desulfurization (FGD) system and finally exit through the Units 1/2 flue housed inside a single concrete shell.

Unit 3 is rated at 800 MW and consists of Combustion Engineering, Inc. tangentially fired, pulverized bituminous coal-fired, outdoor type boiler. Exhaust gas from the unit passes through two ESPs in series. After passing through the ESPs, the exhaust gases go through a wet limestone FGD system and finally exits through a separate, unit- specific flue, housed inside a single concrete shell. Unit 3 is also equipped with a Dry Sorbent Injection system to introduce hydrated lime or Trona into the flue gas for SO3/H2SO4 emissions control on an as-needed basis.

The performance of this existing equipment in removing mercury, particulate, and acid gases has been evaluated during recent testing. Results of these tests indicate that additional control equipment is necessary to achieve continuous compliance with the mercury standard. Baseline mercury emissions collected recently from Unit 3 ranged from 0.0046 to 0.0635 lbs/GWh, and Unit 1/2 mercury emissions were recently measured between 0.0051 to 0.0532 lbs/GWh. Both are between one-third and five times the MATS standard for mercury.

Current Brunner Island SES MATS Compliance Plans

Based upon testing completed on Unit 3 to date, PPL envisions its mercury control strategy for all three units at Brunner Island SES to consist of the following:

- Coal Pile management,
- Calcium Bromide Chemical Additive Systems, consisting of tanks/pumps/piping/and instrumentation and controls, to add calcium bromide solution to the coal prior to it being pulverized,
- Sorbent Injection Systems, consisting of silos/piping/injection equipment, to introduce mercury adsorbing sorbent into the flue gas stream either before or after the air heater, and

[3] PPL was told the product was removed from the market after certain equipment impacts (primarily in the boiler) were discovered.

- Re-Emission Inhibitor Injection Systems, consisting of tanks/pumps/piping/ and instrumentation and controls, to inject re-emission inhibitor into the FGD absorber recycle loop.

While this appears to be an adequate combination of controls based on the initial short-term testing completed on Unit 3 to date, there are several uncertainties that PPL desires to address over a period of six to nine months prior to finalizing these plans:

- Transferability of these control technologies to Brunner Island Units 1 and 2.
- Long-term impact of calcium bromide addition in terms of corrosion in the feeders, pulverizers, boiler, ductwork and other downstream components[4].
- Long-term impact of the calcium bromide solution, mercury adsorption sorbents, and re-emission inhibitor chemical addition on flyash and gypsum quality, as well as impacts to the FGD wastewater.
- Need to coordinate/optimize these controls to ensure reliable, continuous compliance with the MATS Rule mercury limit.

Implementation Approach & Potential Obstacles

We are confident these uncertainties can be resolved by implementing a long-term trial on Units 1 and 2. We plan to begin feeding calcium bromide solution and FGD re-emission inhibitor to the Unit 1/2 absorber on/around April 2014. Subsequently, over a 4 to 6 month period, we would evaluate the effectiveness of the controls, using emissions monitoring at the FGD inlets and stack, while firing coals with a variety of mercury levels. In addition, corrosion coupons would be installed to evaluate the effects of calcium bromide on the ductwork. Inspections would also be conducted before, during, and after the trial, including all outage opportunities, to evaluate corrosion.

At the appropriate time during this long-term trial, we would introduce amended silicates into the Unit 1 and 2 flue gas streams. The purpose of this sorbent injection control technology evaluation would be to:

- Evaluate the ability of amended silicates to treat higher mercury coals,
- Determine the best location for the injection ports (before or after the air heater), and
- Provide data to accurately size the feed equipment and to ensure reliable operation.

During the entire trial period, we will monitor the quality of the fly ash and gypsum to ensure the mercury controls do not have negative impacts on our ability to beneficially use our coal combustion byproducts. FGD wastewater quality will also be monitored throughout this testing.

It is our intent to move forward with the permitting and engineering process for all three units while this long-term trial is underway so that we would be in a position to submit applications near the end of the trial. As discussed briefly with PA DEP on August 12th, we anticipate submitting a Request for Determination (RFD) for the Calcium Bromide and Re-Emission Inhibitor Additive Systems. For the Sorbent Injection Systems, we anticipate utilizing the Plan Approval process. This permitting approach would be confirmed with the Department in a pre-application meeting to be scheduled at a later date.

We anticipate the Plan Approval application will be ready for submission by August 2014. As soon as the Plan Approval is obtained, PPL would move forward to complete procurement and install the Amended Silicates Sorbent Injection Systems. We expect the procurement process, following the receipt of the Plan Approval, to take 4 months. Subsequently, installation is expected to require 8

[4] This applies to all three units but would be evaluated only on Units 1 and 2.

months, followed by system commissioning which is expected to take 3 months. This totals 15 months following the receipt of the Plan Approval, which we anticipate we may receive by the end of 2014. Therefore, we are requesting a one-year extension, to April 16, 2016, of the MATS Rule mercury emissions limit to complete this work.

The current outage schedule provides adequate opportunity to meet the MATS Rule Compliance deadline; however this is subject to change based on many factors. If these outages get postponed due to PJM or other restraints, we may need to take an unscheduled shut down to make the necessary tie-ins. The timing of those outage requests would be driven by the same factors, so it is difficult to predict exactly when the units would be available for the final tie-ins.

As discussed throughout, PPL Brunner Island, LLC requests the PA DEP's written approval of a one-year extension of the MATS Rule mercury emission limit for Units 1, 2, and 3 at Brunner Island SES to complete the installation of controls necessary to achieve continuous compliance with the MATS.

We sincerely appreciate the Department's cooperation to date in addressing this matter which is of utmost importance to the longevity of the plant. Please contact me at (717) 266-7510 or thickes@pplweb.com if you should have any further questions.

Sincerely,

Thomas E. Hickes
Plant Manager – Fossil Generation

Cc:	Rob Foltz	BRUPT
	Megan Murphy	GENTW20
	Edward Werkheiser	GENPL6

Megan Murphy
PPL Services Corporation
Environmental Management
Two North Ninth Street (GENTW20)
Allentown, PA 18101-1179
mamurphy@pplweb.com

ppl™

June 27, 2013

Vince Brisini | Deputy Secretary
Office of Waste, Air, Radiation and Remediation
Department of Environmental Protection
Rachel Carson State Office Building
400 Market Street
Harrisburg, PA 17101

RECEIVED
JUL - 2 2013
DEPARTMENT OF ENV. PROTECTION
WASTE, AIR, RADIATION & REMEDIATION

Subject: PPL Brunner Island SES MATS Compliance Extension Request

Dear Mr. Brisini,

Pursuant to 42 U.S.C. 7412(i)(3)(B) and 40 CFR 63.6(i)(4)(i)(A), PPL requests the Pennsylvania Department of Environmental Protection ("PADEP") to grant a one-year extension for the Brunner Island Steam Electric Station (SES) for Units 1, 2, and 3 to meet the standards set forth in the Mercury and Air Toxics Standards (MATS). The PADEP has been delegated the authority to implement the emission standards under the MATS, including the authority to grant an extension as necessary for the installation of controls to achieve compliance with the standards.

Pursuant to 40 CFR 63.6(i)(6)(i), PPL's request for a compliance extension under 40 CFR 63.6(i)(4) is based on the following:

1. **A description of the controls to be installed to comply with the standard.**
   Since the MATS were finalized, and even prior to that, PPL has been researching and testing mercury control technologies and developing recommendations to achieve compliance with the requirements. PPL has tested, and continues to evaluate, the following technologies: concrete-friendly sorbent injection, a scrubber re-emission inhibitor, a coal mercury oxidation additive, and hydrated lime injection. PPL is currently conducting tests and evaluating the results of this, and previous tests, to determine the relative effectiveness and performance of each technology, together and separately, and their respective impacts on plant operations and compliance with other environmental requirements (e.g. EPA's Effluent Limitations Guidelines, NPDES permit requirements, etc.). PPL expects to reach conclusions regarding the solution for MATS compliance within the next five months as outlined below.

2. **Compliance Schedule**

   A. **The date by which on-site construction, installation of emission control equipment, or a process change is planned to be initiated**
   Regardless of which technology or technologies are selected, significant design, engineering and construction planning will be required, after which the control technology or technologies must be constructed and go through a start-up and test process.

PPL intends to adhere to the following timeline:

- **October 2013** – Select emissions control technology for optimum mercury control.
- **Late 2013** – Hold pre-application meeting(s) with PADEP for all necessary permit applications / permits.
- **2014** – Begin design and engineering for technology solution(s), file permit applications, and hold post-application meeting(s) with PADEP.
- **Late 2014** – Obtain necessary permits. Complete engineering and begin bid process.
- **Early 2015-Mid 2015** – Procure materials and equipment, award contracts, undertake all necessary pre-outage and non-outage work.
- **End of 2015** – Undertake and complete installation.
- **Early 2016** – Commissioning and system shakedown.

B. The date by which final compliance is to be achieved

PPL expects final compliance to be achieved by April 16, 2016.

C. The date by which on-site construction, installation of control equipment, or a process change is to be completed

PPL plans to have the necessary pollution controls installed by the end of 2015. Startup, troubleshooting, and commissioning of the equipment will happen shortly thereafter with the achievement of complete compliance by April 16, 2016.

D. The date by which final compliance is to be achieved

PPL expects final compliance to be achieved by April 16, 2016.

PPL has been diligently investigating and testing possible compliance options for the MATS. PPL cannot complete installation of the mercury control technology or technologies and assure compliance with the MATS by the deadline of April 16th, 2015. A one year extension on the compliance deadline to April 16th, 2016 will provide PPL with adequate time to design, engineer, install, and test the technology needed to comply with the standard.

Pursuant to 40 CFR 63.6(i)(12)(i), PPL requests PADEP's written approval of the request for one year extension on the MATS compliance deadline for Brunner Island from April 16, 2015 to April 16, 2016.

Thank you for your prompt attention to this request. If there are any questions or comments regarding this matter, please contact me by phone at (610) 774-5352 or by email at mamurphy@pplweb.com.

Sincerely,

Megan Murphy

Megan Murphy - PPL Environmental Management Department

Cc (PA DEP):
Bill Weaver, Air Quality Program Manager, South Central Regional Office

Cc (PPL):
Tom Hickes, Brunner Island Plant Manager
Rob Foltz, Brunner Island Environmental, Health & Safety Manager
Ed Werkheiser, Generation Technical Services Environmental Compliance Manager
Paul Hackenbrack, Director, Generation Technical Services
Linda Boyer, Senior Manager – Compliance, Environmental Management

Exhibit 3: Declaration of Ranajit Sahu

IN THE UNITED STATES COURT OF APPEALS
FOR THE DISTRICT OF COLUMBIA CIRCUIT

White Stallion Energy Center, LLC, *et al.*,	)	
Petitioners,	)	
v.	)	Case No. 12-1100, and consolidated cases
United States Enviromental Protection Agency,	)	
Respondent.	)	

DECLARATION OF RANAJIT SAHU

I, Ranajit Sahu, hereby state and declare as follows:

1. I am an engineer and an environmental consultant. I have over twenty four years of experience in the fields of environmental, mechanical, and chemical engineering including: program and project management services; design and specification of pollution control equipment; soils and groundwater remediation; combustion engineering evaluations; energy studies; multimedia environmental regulatory compliance (involving statutes and regulations such as the federal

Clean Air Act, Clean Water Act, TSCA, RCRA, CERCLA, SARA, OSHA, NEPA as well as various related state statutes); transportation air quality impact analysis; multimedia compliance audits; multimedia permitting (including air quality NSR/PSD permitting, Title V permitting, NPDES permitting for industrial and storm water discharges, RCRA permitting, etc.); multimedia/multi-pathway human health risk assessments for toxics; air dispersion modeling; and regulatory strategy development and support including negotiation of consent agreements and orders. I have consulted for various clients with regards to Clean Air Act rulemakings by the EPA for over 10 years. A copy of my resume is provided at Attachment A to this Declaration.

2. I was asked to estimate the amount of mercury, acid gas, and fine particulate matter pollution that would occur should the EPA's Mercury and Air Toxics (MATS) Rule (hereafter "Rule") be vacated as compared to it being fully implemented by April 2016.[1]

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[1] The final MATS Rule was published in the Federal Register on February 16, 2012. Although there have been additional revisions to

3. The Rule applies to several types of existing emissions sources.[2] I have only considered the implications of vacatur of the Rule for existing coal-fired power plant units that are not expected to be shut down in 2016, or are otherwise not to be converted to natural gas firing. I have excluded cogeneration units, as well as units firing waste coals and petroleum coke from my analysis. I have also excluded certain small coal-fired units that are less than approximately 50 megawatts (MW). As such, therefore, the emissions estimates that I discuss below are conservative – i.e., it is very likely that more emissions would be emitted if the Rule were vacated than what I estimate here.

4. The Rule addresses three classes of pollutants. First, it requires coal-fired units to meet mercury standards, depending on the type of coal used. For most units not firing low rank coal (i.e., lignite) they have to meet a limit of 1.2 pounds of mercury per trillion British

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the Rule as it applies to certain new units and also to address certain technical issues, the limits relevant to my Declaration are contained in the Final Rule as promulgated on February 16, 2012.

[2] See Table 2 to Subpart UUUUU of Part 63. 77 Fed. Reg. 9490 and subsequent pages.

thermal units (Btu) of heat input.[3] For units firing low rank coal, the limit is 4.0 pounds per trillion Btu. Next, the Rule addresses acid gases such as hydrochloric acid and hydrofluoric acid, as well as certain additional acid gases that can be emitted when coal is burned for power generation. The Rule allows units to meet either a limit of 0.002 lb/million Btu for hydrochloric acid (HCl) emissions (irrespective of type of coal burned) or, alternatively, a surrogate limit of 0.2 lb/million Btu for sulfur dioxide (SO_2) emissions – for those units that have air pollution control devices for SO_2 called scrubbers. Emissions control strategies for control of acid gases are expected to result in reductions of SO_2 emissions from coal-fired units; and, with lower SO_2 emissions, less fine particulate matter ($PM_{2.5}$) is expected to be created in the atmosphere (such $PM_{2.5}$ created in the atmosphere from precursor pollution is referred to as "secondary PM," as opposed to the "direct PM" emitted directly from a smokestack). Finally, the Rule requires units to meet limits for certain non-mercury metals. They can either meet

[3] While the Rule allows for sources to meet corresponding limits in so-called output units, on a per megawatt hour (MWh) basis, I use the versions of the limits in input or per heat input basis.

specified individual limits for each of the metals, or an aggregate limit for all of these metals, or a surrogate limit of 0.03 lb/million Btu for filterable particulate matter.

5. A snapshot of my analysis (for space and formatting reasons, I have only included a sample of 18 of the 632 units analyzed) and the overall results are shown in Attachment B. The Table in Attachment B shows the source of the data in the second row below each column heading. Based on the criteria noted earlier, I analyzed 632 coal units expected to be operating in 2016. Page 1 of Attachment B show various unit characteristics, as noted in the column headers. In addition to location and identification data, these include the size of the unit (in MW), the heat rate of the unit (in Btu/kWh), the type of firing and bottom ash removal at each unit, the type of coal burned at each unit, and the type of scrubber at the unit if it has one. I obtained this data from EPA's NEEDS database[4] and EPA's Acid Rain Database.[5] Column

[4] http://www.epa.gov/airmarkets/programs/ipm/psmodel.html

[5] www.epa.gov/ampd

E shows whether the unit received an extension to comply with the Rule – I obtained this data from MJ Bradley and Associates, which obtained it from the relevant State environmental agencies.

6. The estimation of annual emissions that would be reduced by the Rule – or the annual emissions that would continue to be emitted if the Rule is vacated, requires, among other inputs, an estimate of the capacity factor of units in the future; the capacity factor indicates how much a unit is being run versus being idled. For the purpose of this analysis, I used a range of future capacity factors, applied to the fleet as a whole (i.e., for each unit in my analysis). The Energy Information Administration (EIA) publishes coal fleet capacity factor information.[6] For 2014 EIA states that the coal fleet capacity factor was 61%. In reviewing data for prior years, the capacity factor was higher – in the upper 60s to lower 70 percent range. I have used a range for 61% to 75% for my analysis.[7] The annual heat input (in million Btu per year)

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[6] http://www.eia.gov/todayinenergy/detail.cfm?id=21232

[7] It is possible, with an improving economy, that the fleet capacity factor for remaining units may increase as coal units are shut down.

using one of the assumed capacity factors (0.75) is shown in Column M of Attachment B.

7. The analysis for mercury emissions is shown on page 2 of Att. B, with overall results for all 632 units analyzed shown at the bottom of page 2. Basically, the strategy for reducing mercury emissions relies on the use of additives such as activated carbon or similar additives with the coal itself – collectively noted as "ACI" (for activated carbon injection) in Column S. While most units that need to use these additives have already installed the requisite equipment, nonetheless they can simply stop using these sorbents and additives if the Rule were to be vacated – except for those units that have to meet mercury limits imposed by states, irrespective of the Rule. States (and units located within such states) with mercury limits that might apply to coal units separate from the Rule, were noted in Column R. Thus, I have assumed that units located in such states will continue to reduce mercury and meet the Rule limits irrespective of a vacatur of the Rule. I have also

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Hence, I consider the 61 to 75 percent capacity factor range to be a reasonable one – possibly conservative.

assumed that units that can already meet the Rule limits without having to do any additional controls are unaffected by a vacatur of the Rule. To identify such units, I relied on actual testing data required by EPA prior to promulgation of the Rule collected pursuant to an Information Collection Request (hereafter "ICR data"). While ICR data was not collected at each of the 632 units in the analysis, such data are available for roughly 200+ units. Column W shows the ICR data when available in black (with green highlights showing when the data already meet the Rule limit). I have filled in the corresponding data for units without ICR data (shown in red in Column W) using expert judgement – considering a variety of factors such as the type of coal burned, the type of scrubber present, the type of unit firing and similar factors. Comparing the estimated emissions rates in Column W to the Rule limits in Column V, it is clear which units will have to do more via ACI to meet the Rule limits. Using this comparison and the annual heat input (which includes the assumed capacity factor) in Column M, I have estimated the annual reductions of mercury due to the Rule in states that do not have separate (i.e., non-Rule) mercury limits. This is

shown in Column X. These reductions are all at risk – i.e., will not happen if the Rule is vacated. The sum of these emissions ranges from approximately 11.7 tons per year at an assumed capacity factor of 61% to 14.4 tons per year at a capacity factor of 75%. To put this into context, the expected benefit of the Rule for mercury reduction was 20 tons per year, as shown in Table 3-4 of the Regulatory Impact Analysis (RIA) accompanying the Rule.[8] Thus, in comparison to the 20 tons per year of mercury reductions expected as a result of the Rule, roughly 11.7-14.4 tons per year of reductions will resume or not occur if the Rule is vacated. Stated differently, if the Rule were vacated, approximately 59% to 72% of the expected emissions-reduction benefit would be lost.

8. I next did a similar analysis for acid gases – but only considering hydrochloric acid (HCl). Since other acid gases such as hydrofluoric acid (HF) and others are also similarly affected, my estimates of the mass of acid gases affected by possible vacatur of the Rule are conservative. The analysis is shown on page 3 of Attachment B. First, using ICR data (which was available for roughly 300 or so of the 632

[8] http://www3.epa.gov/ttn/ecas/regdata/RIAs/matsriafinal.pdf

units at issue), I identified which units already met the Rule limit for HCl directly – without any need for further reductions. These are shown as a "Pass" in Column AD. These units would not need to do any more reductions and are therefore unaffected by the possible vacatur of the Rule. I also identified the SO_2 rate for each of the units (based on June 2015 EPA Acid Rain data) and noted which scrubbed units already met the 0.2 lb/million Btu SO_2 surrogate limit as allowed by the Rule – shown in Column AI. These units too would be unaffected by the possible vacatur of the Rule. In Column AJ, I summarize which units can already meet the HCl Rule limit and the reason. This includes the aforementioned ICR data, or the SO_2 surrogate limit being already met. In addition, for some units I note that the limit for HCl appears to be met using a form of control using sorbent injection (DSI). DSI is a popular strategy for meeting the HCl and acid gas limit. As with mercury, although units have mostly already installed the needed equipment (or are in the process of doing so, for those units that received extensions), they can simply stop injecting the sorbent if the Rule were vacated. In Column AK, I address the units not covered by

Column AJ – i.e., the likely strategy for how these units will comply with the Rule if it is not vacated. It is my opinion that units that have scrubbers will likely be able to meet the HCl limit directly since scrubbers that are properly designed/maintained/operated are quite effective at HCl removal. In addition, it is my opinion that units that burn sub-bituminous coals, which have low chlorine contents (which is the cause of HCl formation and emissions) will also be able to meet the HCl limit without installing additional controls. Finally, I identify several units that will need DSI or similar approaches for meeting the limit. Combining the reasons/strategies discussed in Columns AJ and AK, I identify units whose ability to meet the HCl limit is in jeopardy without the Rule – i.e., the units that are relying or will rely on DSI – which can be stopped. For these units, based on my review of ICR data (collected at a variety of units of different types), I assign an emission rate absent the Rule as shown in Column AM. While I attempted to differentiate the emission rate by unit type etc., the data did not support significantly different emission rates. Hence I used a single emission rate in Column AM for this analysis. Using the estimated

heat input for each such unit, including the capacity factor assumed – per previous discussion, I then estimated the emission of HCl that would be reduced by the Rule – or continue to be emitted if the Rule were vacated. This is shown in Column AN. The sum for all 632 units – which is shown on the bottom of Att. B, page 3 – ranged from 24,294 tons per year assuming 61% capacity factor to 29,869 tons per year assuming a 75% capacity factor. For context, EPA expected a benefit of 39,800 tons per year of HCl as a result of the Rule.[9] Thus, if the Rule were vacated, approximately 61% to 75% of the expected emissions-reduction benefit would be lost.

9. Finally, I addressed fine particulate matter, which is shown on page 4 of Att. B. As noted earlier, the Rule would result in expected SO_2 reductions since DSI applied to reduce HCl, for example, would also reduce SO_2 to some extent. EPA's modeling to support the Rule showed that reductions in SO_2 would result in reductions of secondary sulfate fine particulate ($PM_{2.5}$) in the atmosphere. EPA notes that "…sulfate

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[9] See RIA, Table 3-4.

reductions contributed 95% of the health co-benefits of all $PM_{2.5}$ components, with an additional 5% from direct $PM_{2.5}$ reductions."[10] The RIA showed that EPA expected a $PM_{2.5}$ benefit of 52,000 tons per year. Assuming that the 5% of this benefit due to direct emissions is not affected by the vacatur (i.e., that this would still occur even with vacatur – a conservative assumption), of the remaining 95% (i.e., 49,400 tons/year), it is likely that the same proportion of emissions reductions would not occur with vacatur of the Rule as discussed earlier for acid gases. Since SO_2 reductions are incidental to acid gas reductions, and secondary sulfate production is due to SO_2 emissions, as a first approximation, therefore, we can assume that in comparison to the 49,400 tons/year of secondary sulfate PM reductions expected due to the Rule, a range of 30,154 tons/year to 37,074 tons/year of reductions would not occur if the Rule were vacated. I approximate this range of lost reductions as 30,000 – 37,000 tons/year of fine particulate matter.

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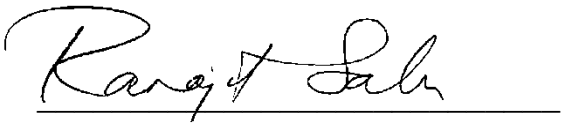
[10] RIA, p. 5-14.

Stated differently, if the Rule were vacated, approximately 61% to 75% of the expected emissions-reduction benefit would be lost.

I declare under penalty of perjury that the foregoing is true and correct.

Executed this 23rd day of September, 2015.



Ranajit Sahu

ATTACHMENT A

RANAJIT (RON) SAHU, Ph.D, QEP, CEM (Nevada)

CONSULTANT, ENVIRONMENTAL AND ENERGY ISSUES

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EXPERIENCE SUMMARY

Dr. Sahu has over twenty three years of experience in the fields of environmental, mechanical, and chemical engineering including: program and project management services; design and specification of pollution control equipment for a wide range of emissions sources; soils and groundwater remediation including landfills as remedy; combustion engineering evaluations; energy studies; multimedia environmental regulatory compliance (involving statutes and regulations such as the Federal CAA and its Amendments, Clean Water Act, TSCA, RCRA, CERCLA, SARA, OSHA, NEPA as well as various related state statutes); transportation air quality impact analysis; multimedia compliance audits; multimedia permitting (including air quality NSR/PSD permitting, Title V permitting, NPDES permitting for industrial and storm water discharges, RCRA permitting, etc.), multimedia/multi-pathway human health risk assessments for toxics; air dispersion modeling; and regulatory strategy development and support including negotiation of consent agreements and orders.

He has over twenty one years of project management experience and has successfully managed and executed numerous projects in this time period. This includes basic and applied research projects, design projects, regulatory compliance projects, permitting projects, energy studies, risk assessment projects, and projects involving the communication of environmental data and information to the public.

He has provided consulting services to numerous private sector, public sector and public interest group clients. His major clients over the past twenty three years include various steel mills, petroleum refineries, cement companies, aerospace companies, power generation facilities, lawn and garden equipment manufacturers, spa manufacturers, chemical distribution facilities, and various entities in the public sector including EPA, the US Dept. of Justice, California DTSC, various municipalities, etc.). Dr. Sahu has performed projects in over 44 states, numerous local jurisdictions and internationally.

In addition to consulting, Dr. Sahu has taught numerous courses in several Southern California universities including UCLA (air pollution), UC Riverside (air pollution, process hazard analysis), and Loyola Marymount University (air pollution, risk assessment, hazardous waste management) for the past seventeen years. In this time period he has also taught at Caltech, his alma mater (various engineering courses), at the University of Southern California (air pollution controls) and at California State University, Fullerton (transportation and air quality).

Dr. Sahu has and continues to provide expert witness services in a number of environmental areas discussed above in both state and Federal courts as well as before administrative bodies (please see Annex A).

EXPERIENCE RECORD

2000-present **Independent Consultant.** Providing a variety of private sector (industrial companies, land development companies, law firms, etc.) public sector (such as the US Department of Justice) and public interest group clients with project management, air quality consulting, waste remediation and management consulting, as well as regulatory and engineering support consulting services.

1995-2000 Parsons ES, **Associate, Senior Project Manager and Department Manager for** Air Quality/Geosciences/Hazardous Waste Groups, Pasadena. Responsible for the management of a group of approximately 24 air quality and environmental professionals, 15 geoscience, and 10 hazardous waste professionals providing full-service consulting, project management, regulatory compliance and A/E design assistance in all areas.

Parsons ES, **Manager for Air Source Testing Services**. Responsible for the management of 8 individuals in the area of air source testing and air regulatory permitting projects located in Bakersfield, California.

1992-1995 Engineering-Science, Inc. **Principal Engineer and Senior Project Manager** in the air quality department. Responsibilities included multimedia regulatory compliance and permitting (including hazardous and nuclear materials), air pollution engineering (emissions from stationary and mobile sources, control of criteria and air toxics, dispersion modeling, risk assessment, visibility analysis, odor analysis), supervisory functions and project management.

1990-1992 Engineering-Science, Inc. **Principal Engineer and Project Manager** in the air quality department. Responsibilities included permitting, tracking regulatory issues, technical analysis, and supervisory functions on numerous air, water, and hazardous waste projects. Responsibilities also include client and agency interfacing, project cost and schedule control, and reporting to internal and external upper management regarding project status.

1989-1990 Kinetics Technology International, Corp. **Development Engineer.** Involved in thermal engineering R&D and project work related to low-NOx ceramic radiant burners, fired heater NOx reduction, SCR design, and fired heater retrofitting.

1988-1989 Heat Transfer Research, Inc. **Research Engineer**. Involved in the design of fired heaters, heat exchangers, air coolers, and other non-fired equipment. Also did research in the area of heat exchanger tube vibrations.

EDUCATION

1984-1988 Ph.D., Mechanical Engineering, California Institute of Technology (Caltech), Pasadena, CA.

1984 M. S., Mechanical Engineering, Caltech, Pasadena, CA.

1978-1983 B. Tech (Honors), Mechanical Engineering, Indian Institute of Technology (IIT) Kharagpur, India

TEACHING EXPERIENCE

Caltech

"Thermodynamics," Teaching Assistant, California Institute of Technology, 1983, 1987.

"Air Pollution Control," Teaching Assistant, California Institute of Technology, 1985.

"Caltech Secondary and High School Saturday Program," - taught various mathematics (algebra through calculus) and science (physics and chemistry) courses to high school students, 1983-1989.

"Heat Transfer," - taught this course in the Fall and Winter terms of 1994-1995 in the Division of Engineering and Applied Science.

“Thermodynamics and Heat Transfer,” Fall and Winter Terms of 1996-1997.

U.C. Riverside, Extension

"Toxic and Hazardous Air Contaminants," University of California Extension Program, Riverside, California. Various years since 1992.

"Prevention and Management of Accidental Air Emissions," University of California Extension Program, Riverside, California. Various years since 1992.

"Air Pollution Control Systems and Strategies," University of California Extension Program, Riverside, California, Summer 1992-93, Summer 1993-1994.

"Air Pollution Calculations," University of California Extension Program, Riverside, California, Fall 1993-94, Winter 1993-94, Fall 1994-95.

"Process Safety Management," University of California Extension Program, Riverside, California. Various years since 1992-2010.

"Process Safety Management," University of California Extension Program, Riverside, California, at SCAQMD, Spring 1993-94.

"Advanced Hazard Analysis - A Special Course for LEPCs," University of California Extension Program, Riverside, California, taught at San Diego, California, Spring 1993-1994.

“Advanced Hazardous Waste Management” University of California Extension Program, Riverside, California. 2005.

Loyola Marymount University

"Fundamentals of Air Pollution - Regulations, Controls and Engineering," Loyola Marymount University, Dept. of Civil Engineering. Various years since 1993.

"Air Pollution Control," Loyola Marymount University, Dept. of Civil Engineering, Fall 1994.

“Environmental Risk Assessment,” Loyola Marymount University, Dept. of Civil Engineering. Various years since 1998.

“Hazardous Waste Remediation” Loyola Marymount University, Dept. of Civil Engineering. Various years since 2006.

University of Southern California

"Air Pollution Controls," University of Southern California, Dept. of Civil Engineering, Fall 1993, Fall 1994.

"Air Pollution Fundamentals," University of Southern California, Dept. of Civil Engineering, Winter 1994.

University of California, Los Angeles

"Air Pollution Fundamentals," University of California, Los Angeles, Dept. of Civil and Environmental Engineering, Spring 1994, Spring 1999, Spring 2000, Spring 2003, Spring 2006, Spring 2007, Spring 2008, Spring 2009.

International Programs

“Environmental Planning and Management,” 5 week program for visiting Chinese delegation, 1994.

“Environmental Planning and Management,” 1 day program for visiting Russian delegation, 1995.

“Air Pollution Planning and Management,” IEP, UCR, Spring 1996.

“Environmental Issues and Air Pollution,” IEP, UCR, October 1996.

PROFESSIONAL AFFILIATIONS AND HONORS

President of India Gold Medal, IIT Kharagpur, India, 1983.

Member of the Alternatives Assessment Committee of the Grand Canyon Visibility Transport Commission, established by the Clean Air Act Amendments of 1990, 1992-present.

American Society of Mechanical Engineers: Los Angeles Section Executive Committee, Heat Transfer Division, and Fuels and Combustion Technology Division, 1987-present.

Air and Waste Management Association, West Coast Section, 1989-present.

PROFESSIONAL CERTIFICATIONS

EIT, California (# XE088305), 1993.

REA I, California (#07438), 2000.

Certified Permitting Professional, South Coast AQMD (#C8320), since 1993.

QEP, Institute of Professional Environmental Practice, since 2000.

CEM, State of Nevada (#EM-1699). Expiration 10/07/2011.

PUBLICATIONS (PARTIAL LIST)

"Physical Properties and Oxidation Rates of Chars from Bituminous Coals," with Y.A. Levendis, R.C. Flagan and G.R. Gavalas, *Fuel*, **67**, 275-283 (1988).

"Char Combustion: Measurement and Analysis of Particle Temperature Histories," with R.C. Flagan, G.R. Gavalas and P.S. Northrop, *Comb. Sci. Tech.* **60**, 215-230 (1988).

"On the Combustion of Bituminous Coal Chars," PhD Thesis, California Institute of Technology (1988).

"Optical Pyrometry: A Powerful Tool for Coal Combustion Diagnostics," *J. Coal Quality*, **8**, 17-22 (1989).

"Post-Ignition Transients in the Combustion of Single Char Particles," with Y.A. Levendis, R.C.Flagan and G.R. Gavalas, *Fuel*, **68**, 849-855 (1989).

"A Model for Single Particle Combustion of Bituminous Coal Char." Proc. ASME National Heat Transfer Conference, Philadelphia, **HTD-Vol. 106**, 505-513 (1989).

"Discrete Simulation of Cenospheric Coal-Char Combustion," with R.C. Flagan and G.R.Gavalas, *Combust. Flame*, **77**, 337-346 (1989).

"Particle Measurements in Coal Combustion," with R.C. Flagan, in "**Combustion Measurements**" (ed. N. Chigier), Hemisphere Publishing Corp. (1991).

"Cross Linking in Pore Structures and Its Effect on Reactivity," with G.R. Gavalas in preparation.

"Natural Frequencies and Mode Shapes of Straight Tubes," Proprietary Report for Heat Transfer Research Institute, Alhambra, CA (1990).

"Optimal Tube Layouts for Kamui SL-Series Exchangers," with K. Ishihara, Proprietary Report for Kamui Company Limited, Tokyo, Japan (1990).

"HTRI Process Heater Conceptual Design," Proprietary Report for Heat Transfer Research Institute, Alhambra, CA (1990).

"Asymptotic Theory of Transonic Wind Tunnel Wall Interference," with N.D. Malmuth and others, Arnold Engineering Development Center, Air Force Systems Command, USAF (1990).

"Gas Radiation in a Fired Heater Convection Section," Proprietary Report for Heat Transfer Research Institute, College Station, TX (1990).

"Heat Transfer and Pressure Drop in NTIW Heat Exchangers," Proprietary Report for Heat Transfer Research Institute, College Station, TX (1991).

"NOx Control and Thermal Design," Thermal Engineering Tech Briefs, (1994).

“From Puchase of Landmark Environmental Insurance to Remediation: Case Study in Henderson, Nevada,” with Robin E. Bain and Jill Quillin, presented at the AQMA Annual Meeting, Florida, 2001.

“The Jones Act Contribution to Global Warming, Acid Rain and Toxic Air Contaminants,” with Charles W. Botsford, presented at the AQMA Annual Meeting, Florida, 2001.

PRESENTATIONS (PARTIAL LIST)

"Pore Structure and Combustion Kinetics - Interpretation of Single Particle Temperature-Time Histories," with P.S. Northrop, R.C. Flagan and G.R. Gavalas, presented at the AIChE Annual Meeting, New York (1987).

"Measurement of Temperature-Time Histories of Burning Single Coal Char Particles," with R.C. Flagan, presented at the American Flame Research Committee Fall International Symposium, Pittsburgh, (1988).

"Physical Characterization of a Cenospheric Coal Char Burned at High Temperatures," with R.C. Flagan and G.R. Gavalas, presented at the Fall Meeting of the Western States Section of the Combustion Institute, Laguna Beach, California (1988).

"Control of Nitrogen Oxide Emissions in Gas Fired Heaters - The Retrofit Experience," with G. P. Croce and R. Patel, presented at the International Conference on Environmental Control of Combustion Processes (Jointly sponsored by the American Flame Research Committee and the Japan Flame Research Committee), Honolulu, Hawaii (1991).

"Air Toxics - Past, Present and the Future," presented at the Joint AIChE/AAEE Breakfast Meeting at the AIChE 1991 Annual Meeting, Los Angeles, California, November 17-22 (1991).

"Air Toxics Emissions and Risk Impacts from Automobiles Using Reformulated Gasolines," presented at the Third Annual Current Issues in Air Toxics Conference, Sacramento, California, November 9-10 (1992).

"Air Toxics from Mobile Sources," presented at the Environmental Health Sciences (ESE) Seminar Series, UCLA, Los Angeles, California, November 12, (1992).

"Kilns, Ovens, and Dryers - Present and Future," presented at the Gas Company Air Quality Permit Assistance Seminar, Industry Hills Sheraton, California, November 20, (1992).

"The Design and Implementation of Vehicle Scrapping Programs," presented at the 86th Annual Meeting of the Air and Waste Management Association, Denver, Colorado, June 12, 1993.

"Air Quality Planning and Control in Beijing, China," presented at the 87th Annual Meeting of the Air and Waste Management Association, Cincinnati, Ohio, June 19-24, 1994.

ATTACHMENT B

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	**Plant Name**	**State Name**	**ORIS Plant Code**	**Unit ID**	**MATS Ext.**	**Capacity (MW)**	**Heat Rate (Btu/kWh)**	**On Line Year**	**Firing**	**Modeled Fuels**	**Wet/Dry Scrubber**	**Scrubber Year**	**0.75**
2	[NEEDS]	[NEEDS]	[NEEDS]	[NEEDS]	[MGB&A]	[NEEDS]	[NEEDS]	[NEEDS]	[NEEDS]	[NEEDS]	[NEEDS]	[NEEDS]	[CALC]
3	Barry	AL	3	4	Yes	362	10070	1969	tangential	BIT			23949884
4	Barry	AL	3	5		726	9940	1971	tangential	BIT	Wet	2010	47412011
5	Gorgas	AL	8	6		103	11290	1951	wall	BIT			7640056
6	Gorgas	AL	8	7		104	11530	1952	wall	BIT			7878218
7	Gorgas	AL	8	8	Yes	161	10640	1956	tangential	BIT		2008	11254673
8	Gorgas	AL	8	9	Yes	170	11080	1958	tangential	BIT	Wet	2008	12375252
9	Gorgas	AL	8	10	Yes	703	9820	1972	tangential	BIT	Wet	2008	45355732
10	E C Gaston	AL	26	5	Yes	842	9770	1974	tangential	BIT	Wet	2010	54047054
11	Widows Creek	AL	50	7	Yes	473	11014	1961	tangential	BIT/SUBBIT	Wet	1981	34227217
12	Widows Creek	AL	50	8		465	11022	1965	tangential	BIT/SUBBIT	Wet	1978	33672761
13	Dolet Hills	LA	51	1		638	11422	1986	wall	LIG/SUBBIT	Wet	1986	47877141
14	Charles R Lowman	AL	56	1	Yes	80	11300	1969	wall	BIT	Wet	2008	5939280
15	Charles R Lowman	AL	56	2	Yes	235	10300	1979	turbo	BIT	Wet	1979	15902685
16	Charles R Lowman	AL	56	3	Yes	235	10300	1980	turbo	BIT	Wet	1980	15902685
17	Platte	NE	59	1	Yes	100	11053	1982	tangential	SUBBIT	Wet	2014	7261821
18	Whelan Energy Center	NE	60	1	Yes	77	11237	1981	tangential	SUBBIT			5684686
19	Whelan Energy Center	NE	60	2		220	10896	2011	wall	SUBBIT	Dry	2011	15749078
20	Escalante	NM	87	1		247	11013	1984	tangential	SUBBIT	Wet	1984	17871786
21													
22													
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	N	O	P	Q	R	S	T	U	V	W	X	Y
1	**Plant Name**	**State Name**	**ORIS Plant Code**	**Unit ID**	**States with Hg Limits**	**ACI**	**ACI Year**	**Hg Controls**	**Hg MATS Limit (lb/MMBtu)**	**ICR Hg Data (lb/MMBtu)**	**Hg w/o MATS**	
2	[NEEDS]	[NEEDS]	[NEEDS]	[NEEDS]	[VARIOUS]	[EPA]	[EPA]	[AMPD]	[MATS]	[ICR/SAHU]	[CALC]	
3	Barry	AL	3	4		ACI	2016		1.20E-06	6.38E-06	123.95	
4	Barry	AL	3	5					1.20E-06	*3.20E-06*	94.88	
5	Gorgas	AL	8	6					1.20E-06	6.38E-06	39.54	
6	Gorgas	AL	8	7					1.20E-06	6.38E-06	40.77	
7	Gorgas	AL	8	8		ACI	2016		1.20E-06	1.15E-05	116.07	
8	Gorgas	AL	8	9		ACI	2016		1.20E-06	1.15E-05	127.62	
9	Gorgas	AL	8	10		ACI	2016		1.20E-06	1.15E-05	467.75	
10	E C Gaston	AL	26	5		ACI	2016		1.20E-06	*3.20E-06*	108.16	
11	Widows Creek	AL	50	7					1.20E-06	*2.61E-06*	48.27	
12	Widows Creek	AL	50	8					1.20E-06	*2.61E-06*	47.49	
13	Dolet Hills	LA	51	1		ACI	2015		1.20E-06	*5.64E-06*	212.68	
14	Charles R Lowman	AL	56	1					1.20E-06	*1.18E-06*	0.00	
15	Charles R Lowman	AL	56	2					1.20E-06	*3.20E-06*	31.82	
16	Charles R Lowman	AL	56	3					1.20E-06	*3.20E-06*	31.82	
17	Platte	NE	59	1		ACI	2014	Halogenated	1.20E-06	*3.32E-06*	15.39	
18	Whelan Energy Center	NE	60	1					1.20E-06	8.77E-06	43.01	
19	Whelan Energy Center	NE	60	2		ACI	2011		1.20E-06	*2.92E-06*	27.17	
20	Escalante	NM	87	1					1.20E-06	8.06E-07	0.00	
21												
22												
23												
24												
25										**CF=61%**	**23485.9**	**lb/yr**
26											**11.7**	**tpy**
27												
28										**CF=75%**	**28876.1**	**lb/yr**
29											**14.4**	**tpy**
30												
31										**Expected Benefit**	**20**	**tpy**
32										**[RIA Table 3-4]**		
33												
34										**% of Benefit Lost**	**59%**	**Low**
35										**Due To Vacatur**	**72%**	**High**

	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN
1	**Plant Name**	**State Name**	**ORIS Plant Code**	**Unit ID**	**ICR HCl lb/MMBtu**	**DSI Unit**	**June 2015 SO2 (tons)**	**June 2015 Heat Input (MMBtu)**	**SO2 Rate (lb/MMBtu)**	**Meets SO2 Surrogate Rate**	**Meets Acid Gas MATS Already**	**Reason Why Unit Will Meet MATS**	**HCl In Jeopardy w/o MATS**	**HCl Rate w/o MATS, lb/MMBtu**	**HCl Emission w/o MATS, tons/yr**
2	[NEEDS]	[NEEDS]	[NEEDS]	[NEEDS]	[ICR/SAHU]	[NEEDS]	[AMPD]	[AMPD]	[CALC]	[SAHU]	[SAHU]	[SAHU]	[SAHU]	[ICR/SAHU]	[CALC]
3	Barry	AL	3	4			612.691	1358913.75	0.90174			Likely DSI	Yes	2.77E-02	307.8
4	Barry	AL	3	5			34.498	4140176.3	0.01666	Yes	SO2 Surrogate				
5	Gorgas	AL	8	6								Likely DSI	Yes	2.77E-02	98.2
6	Gorgas	AL	8	7								Likely DSI	Yes	2.77E-02	101.2
7	Gorgas	AL	8	8			19.365	873715.4	0.04433	Yes	SO2 Surrogate				
8	Gorgas	AL	8	9			18.398	824120.3	0.04465	Yes	SO2 Surrogate				
9	Gorgas	AL	8	10			110.947	5300562.3	0.04186	Yes	SO2 Surrogate				
10	E C Gaston	AL	26	5			223.429	5696415.15	0.07845	Yes	SO2 Surrogate				
11	Widows Creek	AL	50	7			516.899	2925764.6	0.35334			Scrubbed Unit			
12	Widows Creek	AL	50	8								Scrubbed Unit			
13	Dolet Hills	LA	51	1		Yes	2153.483	4407799.752	0.97712		DSI		Yes	2.77E-02	615.2
14	Charles R Lowma	AL	56	1								Scrubbed Unit			
15	Charles R Lowma	AL	56	2			164.485	1464349.2	0.22465			Scrubbed Unit			
16	Charles R Lowma	AL	56	3			144.397	1117398.7	0.25845			Scrubbed Unit			
17	Platte	NE	59	1			53.984	604915.8	0.17848	Yes	SO2 Surrogate				
18	Whelan Energy C	NE	60	1	Pass		66.377	224241.206	0.59201		ICR Pass				
19	Whelan Energy C	NE	60	2			48.937	1274026.3	0.07682	Yes	SO2 Surrogate				
20	Escalante	NM	87	1			78.699	1239795.467	0.12695	Yes	SO2 Surrogate				
21															
22															
23															
24															
25														**CF=61%**	**24294**
26															
27															
28														**CF=75%**	**29869**
29															
30															
31														**Expected Benefit**	**39800**
32														**[RIA Table 3-4]**	
33															
34														**% of Benefit Lost**	**61%**
35														**Due To Vacatur**	**75%**

	AO	AP	AQ
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22	**PM2.5 Analysis**		
23	Expected Benefit from Rule	**52000**	**tpy**
24	[RIA Table 3-4]		
25	**Fraction of PM2.5**	**0.95**	
26	**Due to Secondary**		
27			
28	Expected SO2 Benefit	1.4	Million tpy
29	[RIA Table 3-4]		
30			
31	% of PM2.5 (Sec) Benefit Lost		
32	Assumed Same as Acid Gases/SO2		
33			
34	**Quantity of PM2.5 Not Reduced**	**30154**	**Low**
35	**Quantity of PM2.5 Not Reduced**	**37074**	**High**

Exhibit 4: Declaration of Jonathan I. Levy

UNITED STATES COURT OF APPEALS
FOR THE DISTRICT OF COLUMBIA CIRCUIT

WHITE STALLION ENERGY LLC, *et al.*, Petitioners. v. U.S. ENVIRONMENTAL PROTECTION AGENCY, Respondent.	No. 12-1100 (and consolidated cases)

Suffolk County)
)
Commonwealth of Massachusetts)

DECLARATION OF JONATHAN I. LEVY, SC.D.
BOSTON UNIVERSITY SCHOOL OF PUBLIC HEALTH

I, Jonathan I. Levy, state and declare as follows:

I. Purpose of this Declaration

1. I provide this declaration in support of the Joint Motion of the American Academy of Pediatrics, American Lung Association, American Nurses Association, American Public Health Association, Chesapeake Bay Foundation, Citizens for Pennsylvania's Future, Clean Air Council, Conservation Law Foundation, Environment America, Environmental Defense Fund, Izaak Walton

League of America, National Association for the Advancement of Colored People, Natural Resources Council of Maine, Natural Resources Defense Council, Ohio Environmental Council, Physicians for Social Responsibility, Sierra Club, and Waterkeeper Alliance; and the states of California, Connecticut, Delaware, Illinois, Iowa, New York, North Carolina, Oregon, Maine, Maryland, Minnesota, New Hampshire, New Mexico, Rhode Island and Vermont; the Commonwealth of Massachusetts; the Cities of Baltimore, Chicago, New York, the District of Columbia, and Erie County, New York. The Motion requests that the Court retain in place the effectiveness of the emissions limits contained in the Mercury and Air Toxics Standards ("Air Toxics Rule"), published at 77 Fed. Reg. 9304 (February 12, 2012), during the period when a portion of the rule is remanded to the Agency, because doing so will preserve the significant public health benefits associated with EPA's regulations.

2. I provide this declaration based on my professional experience, as outlined in Section II, which included my review of EPA's methodology for assessing and quantifying health benefits from air pollution controls as a member of U.S. EPA's Advisory Council on Clean Air Compliance Analysis. Furthermore, in preparing this declaration I reviewed the Air Toxics Rule's required emissions limitations, specifically those sections of the Rule discussing the alternative particulate matter limits imposed by the Rule, and the Agency's use of particulate

matter as a surrogate for the non-mercury metallic hazardous air pollutants, which I understand include arsenic, beryllium, cadmium, chromium, cobalt, manganese, nickel and lead among other metals. I also reviewed sections of EPA's Regulatory Impact Analysis (RIA) accompanying the final Rule's publication and discussing the Agency's methods for assessing the health benefits associated with controlling the power plant pollution regulated by the Air Toxics Rule.

II. Experience and Qualifications

3. I am currently a Professor and Associate Chair in the Department of Environmental Health at the Boston University School of Public Health, where I have been a Professor of Environmental Health since 2010. I am also an Adjunct Professor at the Harvard T.H. Chan School of Public Health in the Department of Environmental Health, having served as an Assistant Professor from 2001-2006 and an Associate Professor from 2006-2010. I hold a Doctor of Science (Sc.D.) degree from the Harvard T.H. Chan School of Public Health, where my dissertation was on "Environmental Health Effects of Energy Use: A Damage Function Approach," and a Bachelor of Arts (B.A.) from Harvard College in Applied Mathematics, Decision and Control.

4. I have researched and published extensively on the relationship between exposure to air pollutants and human health effects, including developing models of exposures from power plants and other sources using atmospheric

dispersion models, quantifying the public health impacts associated with these exposures, and assessing the public health benefits of limiting emissions of particulate matter and other power plant air pollution. Among my publications relevant to this declaration are studies in which I quantified the health damages associated with particulate matter ($PM_{2.5}$), sulfur dioxide (SO_2), and nitrogen oxide (NOx) emissions from power plants in different parts of the country. [1,2,3,4,5,6] I have also published multiple articles evaluating the association between criteria air

[1] Levy JI, Spengler JD. Modeling the benefits of power plant emission controls in Massachusetts. J Air Waste Manage Assoc 52: 5-18 (2002).

[2] Levy JI, Spengler JD, Hlinka D, Sullivan D, Moon D. Using CALPUFF to evaluate the impacts of power plant emissions in Illinois: Model sensitivity and implications. Atmos Environ 36: 1063-1075 (2002).

[3] Levy JI, Greco SL, Spengler JD. The importance of population susceptibility for air pollution risk assessment: A case study of power plants near Washington, DC. Environ Health Perspect 110: 1253-1260 (2002).

[4] Levy JI, Wilson AM, Zwack LM. Quantifying the efficiency and equity implications of power plant air pollution control strategies in the United States. Environ Health Perspect 115: 740-750 (2007).

[5] Levy JI, Baxter LK, Schwartz J. Uncertainty and variability in environmental externalities from coal-fired power plants in the United States. Risk Anal 29: 1000-1014 (2009).

[6] Buonocore JJ, Dong X, Spengler JD, Fu JS, Levy JI. Using the Community Multiscale Air Quality (CMAQ) model to estimate public health impacts of $PM_{2.5}$ from individual power plants. Environ Int 68: 200-208 (2014).

pollutants and health outcomes, [7,8] including a study on the differential toxicity of major fine particulate matter constituents. [9] I also investigate and have published articles on the cumulative impact of various hazardous air pollutants on health endpoints. [10,11]

5. Among my professional service appointments, I was a member of U.S. EPA's Advisory Council on Clean Air Compliance Analysis from 2009-2014, a member of the National Research Council/Institute of Medicine Committee to Develop a Framework and Guidance for Health Impact Assessment from 2009-2011, and a member of the National Research Council Committee on Improving Risk Analysis Methods Used by U.S. EPA from 2006-2008. As part of my

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[7] Levy JI, Chemerynski SM, Sarnat JA. Ozone exposure and mortality: An empiric Bayes metaregression analysis. Epidemiology 16: 458-468 (2005).

[8] Levy JI, Hammitt JK, Spengler JD. Estimating the mortality impacts of particulate matter: What can be learned from between-study variability? Environ Health Perspect 108: 109-117 (2000).

[9] Levy JI, Diez D, Dou Y, Barr CD, Dominici F. A meta-analysis and multi-site time-series analysis of the differential toxicity of major fine particulate matter constituents. Am J Epidemiol 175: 1091-1099 (2012).

[10] Peters JL, Fabian MP, Levy JI. Combined impact of lead, cadmium, polychlorinated biphenyls and non-chemical risk factors on blood pressure in NHANES. Environ Res 132: 93-99 (2014).

[11] Loh MM, Levy JI, Spengler JD, Houseman EA, Bennett DH. Ranking cancer risks of organic hazardous air pollutants in the United States. Environ Health Perspect 115: 1160-1168 (2007).

membership on the Advisory Council on Clean Air Compliance Analysis, I was part of the Health Effects Subcommittee (HES), which reviewed EPA's approach for modeling the health effects associated with reductions in $PM_{2.5}$ concentrations. In general, I have served as a peer reviewer and scientific advisor of various health benefits modeling studies by U.S. EPA and other organizations since 2000.

6. A current copy of my curriculum vitae is attached to my declaration as Appendix A.

III. Primary and Secondary Particulate Matter Formation

7. When evaluating the health benefits of emissions control strategies for power plants, it is important to incorporate both primary and secondary particulate matter. Primary particulate matter consists of particles directly emitted from a source, often subdivided into filterable and condensable particles. Filterable particles are emitted in particle form and can typically be captured on a filter, whereas condensable particles are emitted in the gas phase but quickly convert to particle form when cooled. Primary particulate matter therefore consists of a number of chemicals, including but not limited to metals, organics, and acids. In contrast, secondary particulate matter is formed through chemical reactions in the atmosphere. For example, gaseous SO_2 and NOx emissions are converted to particulate matter through reactions with ambient ammonium, in a process influenced by temperature, atmospheric ozone, and other factors. Ambient fine

particulate matter concentrations are therefore a blend of primarily-emitted and secondarily-formed constituents.

8. Based on my experience and research, I understand that primary particulate matter emitted by power plants includes multiple toxic metals, such as arsenic, beryllium, cadmium, chromium, cobalt, manganese, nickel and lead. Secondary particulate matter consists primarily of sulfate, nitrate, ammonium, and secondary organic aerosols.

9. I am aware of current scientific research and analysis directed at assessing the health effects associated with individual constituents of particulate matter air pollution, including my own 2012 publication on the topic cited above in note 9. While individual studies have analyzed the health effects associated with various particle constituents, my understanding of the state of that scientific work is that it has not currently progressed to the point at which it is possible to synthesize the literature and develop concentration-response functions for the specific non-mercury toxic metal constituents of particulates, as opposed to the health effects of the mixture of constituents found in ambient fine particulate matter.

IV. U.S. EPA's Air Toxics Rule

10. I am aware that U.S. EPA's Air Toxics Rule sets emissions limits for the non-mercury toxic metals emitted by power plants. The Rule sets either non-

mercury metal toxic-specific emissions limits or filterable particulate matter emissions limits as a surrogate for total toxic non-mercury metal emissions, for each power plant unit. EPA set the emissions limits based on the performance of the best performing similar source (for new sources), or the top twelve percent of sources (for existing sources) at the time the standards were set, and providing for the variability of the input fuel constituents.

11. I understand that U.S. EPA chose to set standards for particulate matter as an alternative to non-mercury toxic metal specific standards because the non-mercury toxic metal constituents are invariably present in the particulate matter emissions from power plants, and because the Agency found that these pollutants can be controlled using particulate matter controls. 76 Fed. Reg. 24976, 25038 (May 3, 2011).

12. I understand that U.S. EPA estimates that the Air Toxics Rule will decrease emissions from coal-fired power plants (greater than 25 MW) of fine particulate matter by 52,000 tons per year, and will decrease emissions of SO_2 by 1.4 million tons per year. 77 Fed. Reg. 9304, 9424 (Feb. 12, 2012).

V. EPA's Assessment of the Health Benefits of the Particulate Matter Limits Set by the Mercury and Air Toxics Standards

13. In its RIA, U.S. EPA estimates the annual health benefits of the particulate matter concentration reductions associated with the Air Toxics Rule

following the well-understood health damage function approach. As described by U.S. EPA and throughout the peer-reviewed literature, [12,13] health benefits are calculated as a function of the baseline incidence rate for the health outcome in question, the number of exposed individuals, the change in air pollution levels to which the population is exposed, and a concentration-response function linking changes in air pollution with health outcomes. The underlying equations are widely accepted, and the fidelity of the calculations therefore depends on the fidelity of the input variables. As the number of exposed individuals is readily determined from Census data and baseline incidence rates are characterized from multiple well-regarded surveillance databases, the focus of any evaluation of health damage function modeling is generally on the air pollution modeling and concentration-response functions applied.

14. U.S. EPA evaluated the health benefits of the Air Toxics Rule by applying adjusted versions of the health damage functions (benefit-per-ton values)

[12] Chestnut LG, Mills DM, Cohan DS. Cost-benefit analysis in the selection of efficient multipollutant strategies. J Air Waste Manag Assoc 56: 530-536 (2006).

[13] Fann N, Lamson AD, Anenberg SC, Wesson K, Risley D, Hubbell BJ. Estimating the national public health burden associated with exposure to ambient $PM_{2.5}$ and ozone. Risk Anal 32: 81-95 (2012).

derived in Fann *et al*. 2009. [14] I have read this scientific publication and am familiar with the approach utilized within the study. For air pollution modeling, Fann *et al.* used a response surface model derived from the Community Multiscale Air Quality (CMAQ) model. CMAQ is a state-of-the-science model with the capacity to model both primary particulate matter and secondary particulate matter, and is the most appropriate atmospheric chemistry-transport model for this application. To estimate health damages, Fann *et al.* relied on a synthesis of the epidemiological literature linking $PM_{2.5}$ concentrations with both mortality and morbidity effects. The epidemiological studies utilized are consistent with the studies that U.S. EPA used when I was a member of the Advisory Council on Clean Air Compliance Analysis, and Fann *et al.* applied these studies appropriately. Based on my experience, this methodology for assessing the health benefits of the Air Toxics Rule is a well-established approach that is consistent with best practice in the scientific literature.

15. U.S. EPA evaluated the health benefits of the Air Toxics Rule with inclusion of both primarily emitted particulate matter and precursors for secondarily formed particulate matter (principally SO_2). Again, EPA's Rule regulates particulate matter as a surrogate for the non-mercury metal toxics emitted

[14] Fann N, Fulcher CM, Hubbell BJ, The influence of location, source, and emission type in estimates of the human health benefits of reducing a ton of air pollution, Air Qual Atmos Health 2: 169-176 (2009).

with and on the particulate matter. Inclusion of both forms of particulate matter is appropriate and represents standard practice for health benefits analysis.

16. U.S. EPA's estimates were that the Air Toxics Rule will annually result in between 4200-11,000 reduced incidences of premature mortality; 2800 fewer cases of chronic bronchitis; 4700 fewer non-fatal heart attacks; 830 fewer hospital admissions for respiratory symptoms; 1800 fewer hospital admissions for cardiovascular symptoms; 3100 fewer emergency room visits by children under age 18 for asthma symptoms; 6300 fewer cases of acute bronchitis in children between the ages of 8 and 12; 80,000 fewer cases of lower respiratory symptoms in children between the ages of 7 and 14; 60,000 fewer cases of upper respiratory symptoms in asthmatic children between the ages of 9 and 18; 130,000 fewer cases of exacerbated asthma in children between the ages of 6 and 18; 540,000 fewer lost work days; and 3,200,000 fewer minor restricted activity days in adults. U.S. EPA also reported that 95% of these health benefits would be associated with secondary sulfate formation, related to SO_2 emissions. These estimates by U.S. EPA are consistent with values in previous RIAs and within the peer-reviewed literature.

VI. The Potential Effects of Staying or Otherwise Failing to Implement the Air Toxics Rule.

17. I understand that the Air Toxics Rule was to be implemented at existing power plants in April 2015, but that some power plants have been granted one year extensions to put on controls or shut down, to April 2016.

18. I understand that certain parties may seek to stay the effectiveness of the emissions limits under the Air Toxics Rule, including the particulate matter and SO_2 emissions limits included under the Rule, or to strip those protections completely, during the period of time when EPA fixes a problem with the initial decision whether to regulate air toxics emissions from the power sector.

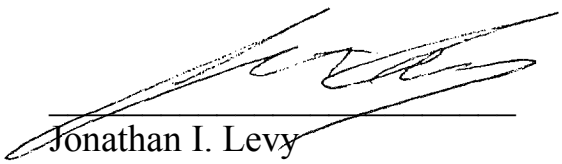
19. I understand that if the Rule is stayed, power plants that have received extensions might not be required to comply by April 2016. Additionally those plants that have put on controls to comply with the Rule's emissions limits by the initial April 2015 deadline might not be required to comply with the Rule's emissions limits during the period if the Rule were stayed or otherwise blocked.

20. Based on my understanding of power plant health impact assessment science and modelling, it is clear to me that if emissions remain uncontrolled, so that tonnage reductions are not achieved during any period in which the Air Toxics Rule is not in effect, there will be direct health impacts experienced by the population exposed to particulates that would otherwise not be emitted to the ambient air, or formed as secondary particulates after the emission of SO_2. Most of

the health outcomes quantified in U.S. EPA's RIA of the Air Toxics Rule are based on short-term exposure changes, so that health effects would be exhibited within a matter of days after air pollution levels increased (or failed to decrease). For the premature mortality estimates provided by U.S. EPA, which are based on long-term exposures, the scientific literature shows that health effects are exhibited within 1-2 years of a change in concentrations. [15] Those adverse health effects will persist for as long as particulate matter and SO_2 pollution controls are not in place and operating at the power plants, and will be reduced when the emissions of particles and SO_2 are curtailed.

I declare under the penalty of perjury under the laws of the United States, that to the best of my knowledge, the foregoing is true and correct.

Executed on September 21, 2015, at Boston, Massachusetts.



Jonathan I. Levy

[15] Schwartz J, Coull B, Laden F, Ryan L. The effect of dose and timing of dose on the association between airborne particles and survival. Environ Health Perspect 116:64–69 (2008).

Declaration of Jonathan I. Levy

Appendix A

Jonathan I. Levy, Sc.D.
Boston University School of Public Health
715 Albany St., T4W
Boston, MA 02118
PH: 617-638-4663
email: jonlevy@bu.edu

ACADEMIC APPOINTMENTS

2012-present	Associate Chair, Boston University School of Public Health (BUSPH) Department of Environmental Health
2010-present	Professor of Environmental Health, BUSPH Department of Environmental Health
2010-present	Adjunct Professor of Environmental Health, Harvard School of Public Health (HSPH) Department of Environmental Health
2006-2010	Associate Professor of Environmental Health and Risk Assessment, HSPH Departments of Environmental Health and Health Policy and Management
2001-2006	Assistant Professor of Environmental Health and Risk Assessment, HSPH Departments of Environmental Health and Health Policy and Management
1999-2001	Research Fellow, HSPH Departments of Environmental Health and Biostatistics

EDUCATION

1999	Sc.D.	Harvard School of Public Health Departments of Environmental Health, Health Policy and Management. Dissertation: *Environmental Health Effects of Energy Use: A Damage Function Approach*
1993	B.A.	Harvard College Applied Mathematics, Decision and Control (*Summa cum laude*)

PROFESSIONAL SOCIETIES

Member of Society for Risk Analysis, International Society of Exposure Science

President, Society for Risk Analysis-New England Chapter, 2008-2009

HONORS AND AWARDS

2013	Best Environmental Epidemiology Paper, Honorable Mention
2012	Chauncy Starr Distinguished Young Risk Analyst Award
2012	American Journal of Public Health Paper of the Year Award
2012	BUSPH, Excellence in Teaching Award (Urban Environmental Health)
2010	Finalist, Onassis Prize for the Protection of the Environment
2009	Knowles Scholar, Harvard College
2008	FAA Centers of Excellence Faculty of the Year Award
2005	Health Effects Institute, Walter A. Rosenblith New Investigator Award
2002-2010	HSPH, Commendation for High Student Evaluations (8 times)
1999	Howard Raiffa Student Achievement Award
1997-1998	Air and Waste Management Association Scholar, First Place
1992-1993	Phi Beta Kappa, Harvard College branch

MAJOR UNIVERSITY SERVICE

2012-2015	BU MPH Task Force and Implementation Committee, BUSPH
2011-present	Postdoctoral Advisory Board, Office of Postdoctoral Affairs, Division of Graduate Medical Sciences, Boston University School of Medicine
2011-present	Education Committee, BUSPH
2011-present	Faculty Development Committee, Department of Environmental Health, BUSPH
2010-present	Training and Curriculum Committees, Department of Environmental Health, BUSPH (Chair of Curriculum Committee, 2011-present).
2006-2008	Faculty Council (elected), HSPH
2005-2010	Committee on Concerns of Women Faculty (vice-chair 2005-2009), HSPH
2005-2010	Curriculum Committee, Department of Environmental Health, HSPH
2003-2010	Exposure, Epidemiology, and Risk Training Committee, Department of Environmental Health, HSPH

MAJOR PROFESSIONAL SERVICE

2014-present	Advisory Council for the Healthy Transportation Compact, MassDOT
2013-present	Health Effects Institute Diesel Epidemiological Project Panel
2010-present	Editorial Board, Environmental Health
2009-2014	Advisory Council on Clean Air Compliance Analysis, US EPA
2011-2012	National Research Council Committee on Science for EPA's Future
2011-2011	Black Carbon Review Panel, US EPA
2010-2011	Section Editor, Health and the Environment, BMC Public Health
2009-2011	National Research Council/Institute of Medicine Committee to Develop Framework and Guidance for Health Impact Assessment
2009	Board of Scientific Counselors, Clean Air Subcommittee, US EPA
2006-2008	National Research Council Committee on Improving Risk Analysis Methods Used by the US EPA
2004-2008	Section Editor, Chapter on Environmental/Occupational Health, Encyclopedia of Public Health
2004-2006	National Research Council Committee on the Effects of Changes in New Source Review Programs for Stationary Sources of Air Pollution
2002-present	Peer reviewer or scientific advisor for: Abt Associates, California Air Resources Board, California Energy Commission, Connecticut Fund for the Environment, Elsevier Press, Health Canada, Health Effects Institute, National Research Council, National Science Foundation, Ontario Power Generation, Rockefeller Family Fund, US Environmental Protection Agency, World Health Organization
1999-present	Peer reviewer for journals including: American Journal of Epidemiology, American Journal of Public Health, Annual Review of Energy and the Environment, Archives of Disease in Childhood, Atmospheric Environment, Environmental Health: A Global Access Science Source, Environmental Health Perspectives, Environmental Management, Environmental Research, Environmental Science and Technology, Epidemiology, Indoor Air, Industrial Ecology, Journal of Air and Waste Management Association, Journal of Environmental Quality, Journal of Exposure Analysis and Environmental Epidemiology, Journal of Immigrant and Minority Health, New Solutions, Risk Analysis, Science of the Total Environment, Social Science and Medicine

MAJOR PUBLIC SERVICE

2011-present	Contributor, Environmental Health Policy Institute, Physicians for Social Responsibility
2011-present	Spokesperson, Massachusetts Healthy Air Campaign
2008-present	Member, Massachusetts Environmental Justice Assistance Network
2008-2009	Advisory Panel for the Community Health Mapping Project, Blue Cross/Blue Shield of Massachusetts Foundation
2005-2008	Boston Air Quality Working Group, involved in planning symposia and creating links among university, government, and community representatives
2004-2006	Massachusetts Bay Transportation Authority Bus Emissions Monitoring and Control Advisory Committee

OTHER PROFESSIONAL EXPERIENCE

2002-present	Independent consultant/expert witness Clients included Synapse Energy Economics (projects for Keyspan Energy, the Natural Resources Defense Council, and the Coalition Helping Organize a Kleaner Environment; and for the State of Utah); Environmental Health and Engineering (projects for Clean Wisconsin and S.C. Johnson; and for the State of North Carolina); the Town of Alexandria, Virginia; the Environmental Law and Policy Center of the Midwest; the Maryland Nurses Association; the U.S. Department of Justice; Industrial Economics (projects for US EPA); and the Environmental Integrity Project.
1993-1996	Associate Consultant, Pizzano and Company**,** Stoneham, MA

SELECTED TEACHING EXPERIENCE

Dates	Institution	Course	Role
2013-present	BUSPH	Community-Based Methods in Environmental Health	Lead instructor
2007-present	HSPH Center for Continuing Professional Education	Analyzing Risk: Science, Assessment, and Management	Co-director (2007) and lecturer

2011-2012	BUSPH	Urban Environmental Health	Lead instructor
2002-2010	HSPH	Risk Assessment	Lead instructor
2005-2010	HSPH	Environmental Exposure, Epidemiology, and Risk Practicum	Lead instructor
2008-2010	Harvard College	Urban Environmental Health	Lead instructor and course developer
2005-2007	Harvard College	Health and Inequality	Co-instructor and course developer
2003-2004	Harvard College	Environmental Equity and Public Policy	Lead instructor and course developer
2003-2004	HSPH	Environmental Science and Risk Management Practicum (RDS 503/504)	Co-instructor and faculty supervisor

MENTORSHIP

Doctoral Students, Primary Research Advisor

Jane Clougherty HSPH	"*Environmental and Social Determinants of Childhood Asthma in Urban Communities*", 2006
Susan Greco HSPH	*"Characterizing Mobile Source Fine Particulate Matter Emissions-to-Exposure Relationships"*, 2006
Lisa Baxter HSPH	*"Predicting Indoor Exposure Patterns of Traffic-Related Air Pollutants in an Urban Area"*, 2007
Susan Wason HSPH	*"Evaluating Heterogeneity in Pesticide Exposure and Risk for Children in an Urban Low-Income Environment"*, 2010
Teresa Chahine HSPH	*"Modeling Variability in Environmental Exposures and Health Risks for Community-Based Risk Assessment"*, 2010
Leonard Zwack HSPH	*"Characterizing Spatial Patterns of Traffic-Related Air Pollutants in Complex Urban Terrain"*, 2010
Hsiao-Hsien Leon Hsu HSPH	*"Using Real-Time Monitoring Data to Explore the Relationship between Aviation Activities and Communities' Ultrafine Particle Exposures"*, 2012
Jonathan Buonocore HSPH	*"Life-Cycle Public Health Risks from Coal-Fired Power Plants"*, 2013

Stefani Penn BUSPH	*"Modeling Contributions of Major Sources to Local and Regional Air Pollutant Exposures and Health Impacts"*, 2015
Lindsay Underhill BUSPH	2012-present

Undergraduate Students, Primary Research Advisor

Kimberly Smith Harvard College	*"A Community-Based Study Evaluating Health Symptoms and the Indoor Living Environment"*, 2005
Jennifer Chung Harvard College	*"The Price of Breathing Deeply: How Socioeconomic Status and its Indirect Effects Can Influence Susceptibility to Traffic-Related Emissions of Pollutants*", 2007

Doctoral Students, Dissertation Committee Member

Ying Zhou HSPH	*"Power Plant Emissions in China: Human Exposure and Valuation"*, 2002
Edmond Toy HSPH	*"The Environmental, Health, and Safety Risks of Sport-Utility Vehicles, Vans, and Pickup Trucks"*, 2002
Yurika Nishioka HSPH	*"Estimating Public Health Costs and Benefits of Energy Demand-Side Management: A Life-Cycle Approach"*, 2003
Andrew Wilson HSPH	*"Improved Characterization of Fine Particle Intake Fractions for Air Pollution Control and Research Decision-Making"*, 2003
Anna Choi HSPH	*"Geographical Information System-Based Analysis of PCB Exposure Near a Superfund Site"*, 2005
Rhona Julien HSPH	*"Characterization and Mitigation of Pesticide Burdens in Public Housing – A Case Study of the Healthy Public Housing Initiative"*, 2006
Miranda Loh HSPH	*"Assessing Personal Exposures and Risks to Hazardous Organic Air Pollutants"*, 2006
Robin Dodson HSPH	*"Exposure to Volatile Organic Compounds in the Boston Area"*, 2007
Gretchen Stevens HSPH	"*The Public Health Implications of Transportation Policy in Mexico City"*, 2007
Ying Zhu HSPH	*"Truck Driver Exposure to Real-Time Fine Particulate Matter in Five U.S. Cities"*, 2009
Ramon Sanchez HSPH	*"Health, Environmental and Economic Assessment of Bio-Fuels for Transportation in Mexico City"*, 2011

Andrew Correia HSPH	*"Estimating the Health Effects of Environmental Exposures: Statistical Methods for the Analysis of Spatio-temporal Data"*, 2013
Allison Patton Tufts	"*Developing Time-Resolved Models for Predicting Atmospheric Concentrations of Ultrafine Particles in Near-Highway Urban Neighborhoods"*, 2014
Kevin Lane BUSPH	*"Effect of Exposure Misclassification in a Study on the Association Between UFP and Markers of Cardiovascular Health Using a Time-Activity Based Exposure Assessment Model"*, 2014
Judy Ou BUSPH	*"Neighborhoods and Health: Exploring the Effects of Physical, Social, and Cultural Stressors in an Environmental Justice Community"*, 2015

Post-Doctoral Fellows, Primary Mentor

Ying Zhou HSPH	*"Air Pollution and Health Risks from Port City Emissions"/"An Evaluation of Community Exposures and Risks Associated with Airport Emissions"*, 2005-2008
Robin Dodson HSPH	*"An Evaluation of Community Exposures and Risks Associated with Airport Emissions"*, 2007-2008
Jane Clougherty HSPH	*"Using Geographic Information Systems to Evaluate Heterogeneity in Indoor and Outdoor Concentrations of Particle Constituents"*, 2006-2009
Patricia Fabian HSPH/BUSPH	*"A Discrete Event Simulation Model of Environmental Exposures and Pediatric Asthma"/"Effects-Based Cumulative Risk Assessment in a Low-Income Community Near a Superfund Site"*, 2009-2012

INVITED PRESENTATIONS OR TESTIMONY (SELECTED)

2015	Health Co-Benefits of Carbon Standards for Existing Power Plants. Carbon Pollution, Climate Change, and Health in New Hampshire Webinar.
2014	Health Co-Benefits of Carbon Standards for Existing Power Plants. Physicians for Social Responsibility Webinar.
2014	Uncertainty and Variability in Local and National Assessments. US Environmental Protection Agency, Risk Assessment Forum Uncertainty and Variability Colloquium, Washington, DC.
2014	Modeling the Environmental and Public Health Benefits of Wind Power. Offshore Wind Power USA, Boston, MA.
2013	Meta-Analytic Approaches for Multi-Stressor Dose-Response Function Development: Strengths, Limitations, and Case Studies. Methods for Research Synthesis: A Cross-Disciplinary Approach, Boston, MA.

2013 Assessing and Communicating Exposures in a Community-Based Cumulative Risk Assessment Study. 2013 EPA Community Involvement Training Conference, Boston, MA.

2013 Air Pollution and Asthma Onset: Links with the Built Environment. Primary Prevention of Asthma: A Symposium on Current Evidence, Research Needs and Opportunities for Action, Waltham, MA.

2013 Simulating Population Characteristics and Exposures to Multiple Stressors for a Community-Based Cumulative Risk Assessment. EPA Cumulative Risk Assessment 2013 Webinar Series.

2013 Health Impact Assessment and Health Risk Assessment: Common Methods and Future Challenges. Society for Risk Analysis-New England Chapter, Boston, MA.

2013 Discussion: Causal inference methods for assessing the public health benefits of air pollution regulations in the United States. Symposium on Quantitative Methods for Implementation Science & Translational Research, Boston, MA.

2012 Integrating Chemical and Non-Chemical Stressors in Cumulative Risk Assessment. Progress Review Meeting on Cumulative Risk Grants, Washington, DC.

2011 Summary of the Cumulative Risk Assessment White Paper, Effects-Based Approaches for Cumulative Risk Assessment. Workshop on Integrating Non-Chemical and Chemical Stressors in Cumulative Risk Assessments, Research Triangle Park, NC.

2011 Spatiotemporal Patterns of Air Pollutants Near Roadways and Airports. Tufts University, Department of Civil and Environmental Engineering Seminar Series, Medford, MA.

2010 The New National Research Council Report on Improving Risk Analysis. Presentation for Massachusetts Department of Environmental Protection, Boston, MA.

2010 Evaluating Cumulative Impacts: The Value of Epidemiology. CHE Partnership Call on Evaluating the Impact of Cumulative Stressors on Health.

2010 Incorporating Disproportionate Impacts into EPA Decision-Making: The Role of Risk Assessment. Plenary Presentation, Strengthening Environmental Justice Research and Decision Making: A Symposium on the Science of Disproportionate Environmental Health Impacts. Washington, DC.

2010 Addressing Distributional Issues in Environmental Health Benefits Analysis. Invited Presentation, Strengthening Environmental Justice Research and Decision Making: A Symposium on the Science of Disproportionate Environmental Health Impacts. Washington, DC.

2010 Proposals of the National Research Council Committee on Improving Risk Analysis Methods Used by the U.S. EPA. Invited Presentation, Workshop of the Haut Conseil de la Sante Publique, Risk Assessment in a Complex Pollution Setting: Improving its Contribution to Risk Management. Paris, France.

2009 Near-Roadway Health Effects. Invited Presentation, National Association of Clean Air Agencies, Boston, MA.

2009 Evaluating Efficiency-Equality Tradeoffs in Health Benefits Analysis: Application to Air Toxics. Invited Presentation, US EPA Workshop on Estimating Benefits of Reducing Hazardous Air Pollutants, Washington, DC.

2009 Science and Decisions: Advancing Risk Assessment. Panel discussion for the Society for Risk Analysis New England Chapter, Boston, MA.

2008 Incorporating Equity Issues into Benefit-Cost Analysis. Invited Presentation, Society for Risk Analysis Annual Meeting, Boston, MA.

2008 Science and Decisions: Advancing Risk Assessment. Briefings for US Environmental Protection Agency, US Senate, US House of Representatives, Washington, DC.

2008 Asthma in Public Housing: Causes, Consequences, and Solutions. Kaiser Family Foundation Media Interns in Urban Health Reporting, Boston, MA. Annually from 2002.

2008 Small Area Health Impact Assessment. Workshop on Methodologies for Environmental Public Health Tracking of Air Pollution Effects. HEI/EPA/CDC, Baltimore, MD.

2007 Health Impacts of Aircraft Particulates. Aircraft PM National Roadmap Meeting, Washington, DC.

2007 Modeling the Health Benefits of Power Plant Emissions Controls. From Local to Global: The Rhode Island Model for Harnessing Wind Power Worldwide, Kingston, RI.

2006 The Spatial Extent of Mobile Source Air Pollution Impacts. Transportation Emissions and Air Quality: Implications for Public Policy. Metropolitan Area Planning Council, Boston, MA.

2006 Incorporating Environmental Equity into Risk Assessment: A Case Study of Power Plant Air Pollution Control Strategies. The David Bradford Seminars in Science, Technology and Environmental Policy, Princeton University, Princeton, NJ.

2005 Healthy Public Housing Initiative. Presented to the Boston Urban Asthma Coalition, Boston, MA.

2004 Incorporating Concepts of Inequality and Inequity into Environmental Risk Assessment. University of Massachusetts-Amherst, Center for Public Policy Seminar Series, Amherst, MA.

2004 Analysis of Particulate Matter Impacts for the City of Alexandria, VA.

2004 Estimating the Magnitude and Distribution of Health Benefits from Power Plant Pollution Control. Boston University, Center for Energy and Environmental Studies Seminar Series, Boston, MA.

2004 Lung Function, Respiratory Symptoms, and Quality of Life for Asthmatic Children in Public Housing in Boston. Pediatric Grand Rounds, Tufts-New England Medical Center, Boston, MA.

2003 The Relationship Between Particle Emissions and Population Exposures. Mailman School of Public Health at Columbia University, New York, NY.

2003 Power Plant Pollution and Local Community Reactions: A Case Study in Massachusetts. Community-Based Research Seminar Series, Harvard School of Public Health, Boston, MA.

2002 Estimating the Public Health Impacts of Power Plant Pollution: Case Studies in Four Cities in the United States. MIT-Harvard Seminar Series on Environmental Management, Cambridge, MA.

2002 Oral testimony on health impacts of $PM_{2.5}$, US Senate Committee on Environment and Public Works, Washington, DC.

2002 Estimating the Public Health Impacts of Power Plant Pollution: Case Studies in Massachusetts, Illinois, and Washington DC. Presentation for US Senate Environment and Public Works Committee, Washington, DC.

2001 Particle-Related Health Effects: Current Evidence and Implications. Briefing for US Environmental Protection Agency (with Doug Dockery), Washington, DC.

2001 Briefing on particulate matter health effects for US Office of Management and Budget (with Doug Dockery and John Evans), Washington, DC.

2001 Particulate Air Pollution: Who is at Risk and Why? Massachusetts Medical Society, Earth Day 2001: Environmental Issues in Clinical Practice, Waltham, MA.

2001 Estimated Public Health Impacts of Criteria Pollutant Air Emissions from Nine Fossil-Fueled Power Plants in Illinois. Presentation for Illinois Environmental Protection Agency, Springfield, IL.

2001 Invited testimony at public hearing for House Bill 284-FN (AN ACT relative to additional emissions reductions from grandfathered fossil fuel burning steam electric power plants), New Hampshire House of Representatives, Science, Technology, and Energy Committee, Concord, NH.

2001 Discussion: Impact of Particulate Air Pollution on Quality Adjusted Life Expectancy. Health and Air Quality 2001, Ottawa, Canada.

2001 Estimating the Magnitude and Distribution of Benefits from Power Plant Emission Reductions in Massachusetts: Results and Implications. Presentation for the New Hampshire State Senate, Concord, NH.

2000 Testimony at public hearing for R.C.S.A. Sections 22a-174-19a and 22a-174-22, Connecticut Department of Environmental Protection, Hartford, CT.

2000 Comments presented at public hearing on proposed amendments to 310 CMR 7.00 et seq., Massachusetts Department of Environmental Protection, Boston, MA.

2000 Estimating the Public Health Impacts of Criteria Air Pollutant Emissions from the Salem Harbor and Brayton Point Power Plants. Presentations for Massachusetts Department of Environmental Protection and Northeast States for Coordinated Air Use Management Boston, MA.

RESEARCH SUPPORT (AS PI/CO-PI)

Current Funding:

Dates	Funding Source	Role	Title
2015-2020	NIMHD/EPA 1P50MD010428-01	Co-PI	Disparities in Exposure and Health Effects of Multiple Environmental Stressors Across the Life Course
2014-2018	FAA ASCENT 13-C-AJFE-BU	PI	Health Impacts Quantification for Aviation Air Quality Tools
2012-2015	HUD MAHHU0008-12	PI	Modeling the Impact of Building-Wide Energy Retrofits on Environmental Exposures and Occupant Health
2012-2015	FAA PARTNER-10-C-NE-BU	PI	Development of Aviation Air Quality Assessment Tools
2014-2015	NAIMA	PI	Modeling the Air Quality and Public Health Benefits of Increased Residential Insulation in the United States

Past Funding:

Dates	Funding Source	Role	Title
2010-2015	US EPA EPA-G2009-STAR-E1	PI	Effects-Based Cumulative Risk Assessment in a Low-Income Urban Community near a Superfund Site
2011-2014	FAA PARTNER-09-C-NE-HU/ PARTNER-10-C-NE-BU	Co-PI	Health Effects of Aviation-Related Noise on the Elderly
2010-2014	FAA PARTNER-09-C-NE-HU/ PARTNER-10-C-NE-BU	PI	Health Impacts of Aviation-Related Air Pollutants (Phase III)
2012-2013	Heinz Foundation C2988	PI	An Open-Source Model of the Environmental and Health Benefits of Interventions on the PJM Interconnection
2010-2011	Energy Foundation	Co-PI	Risk-Based Prioritization Among Air Pollution Control Strategies in Yangtze River Delta, China

2009-2011	NIH/NIEHS R21 ES017522-01	PI	A Discrete Event Simulation Model of Environmental Exposures and Pediatric Asthma
2005-2011	Gilbert and Ildiko Butler Foundation	PI	Air Pollution and Health Risks from Port City Emissions
2007-2010	FAA PARTNER/07-C-NE-HU	PI	Health Impacts of Aviation-Related Air Pollutants (Phase II)
2009-2009	Energy Foundation	Co-PI	The Magnitude and Distribution of Air Pollution Health Impacts in Yangtze River Delta, China
2007-2008	City of Boston TAQ 22860	PI	The Influence of Traffic on Air Quality in Brigham Circle: A Community-University Partnership
2006-2008	FAA DTFAWA-05-D-012	PI	An Evaluation of Community and Individual Exposures and Risks Associated with Airport Emissions
2005-2008	Health Effects Institute HEI 4727-RFA04-5/05-1	PI	Using Geographic Information Systems to Evaluate Heterogeneity in Indoor and Outdoor Concentrations of Particle Constituents
2005-2007	NIH/NIEHS R03 ES013988-01	PI	Predictors of Spatial Patterns of Urban Air Pollution
2003-2007	NSF SES-0324746	PI	Integrating Equity into Benefit-Cost Analysis: Theory and Practice
2006-2006	NAIMA	PI (subcontract)	Health Costs and Benefits of Enhanced Residential Insulation in the US
2005-2005	NAIMA	PI (subcontract)	Assessing Global Warming Emission Reduction Impacts of Increased Insulation in New and Existing Homes
2002-2005	NIH/NHLBI U01 HL072494-01	PI (subcontract)	Asthma Coalition on Community, Environment, and Social Stress
2003-2004	US EPA 3D-6865-NTEX	PI	Meta-Analysis of Ozone Mortality Studies
2002-2003	NAIMA	PI	Comprehensive Evaluation of the Public Health Benefits of Increased Residential Insulation
1999-2003	Pew Charitable Trusts	PI	Health Impact Analysis in Air Pollution Control Strategies

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Peer-reviewed publications

1. Buonocore JJ, Luckow P, Norris G, Spengler JD, Biewald B, Fisher J, **Levy JI**. Health and climate benefits of different energy efficiency and renewable energy choices. Nature Climate Change, in press.

2. Lane KJ, **Levy JI**, Scammell MK, Patton AP, Durant JL, Zamore W, Mwamburi M, Brugge D. Effect of time-activity adjustment on exposure assessment for traffic-related ultrafine particles. J Exp Sci Environ Epidemiol, in press.

3. **Levy JI**, Fabian MP, Peters JL. Meta-analytic approaches for multi-stressor dose-response function development: strengths, limitations, and case studies. Risk Anal 36: 1040-1049 (2015).

4. Patton AP, Zamore W, Naumova EN, **Levy JI**, Brugge D, Durant JL. Transferability and generalizability of regression models of ultrafine particles in urban neighborhoods in the Boston area. Environ Sci Technol 49: 6051-6060 (2015).

5. Driscoll CT, Buonocore J, **Levy JI**, Lambert KF, Burtraw D, Reid SB, Fakhraei H, Schwartz J. U.S. power plant carbon standards and clean air and health co-benefits. Nature Climate Change 5: 535-540 (2015).

6. Penn SL, Arunachalam S, Tripodis Y, Heiger-Bernays W, **Levy JI**. A comparison between monitoring and dispersion modeling approaches to assess the impact of aviation on concentrations of black carbon and nitrogen oxides at Los Angeles International Airport. Sci Total Environ 527-528: 47-55 (2015).

7. Fantke P, Jolliet O, Apte JS, Cohen AJ, Evans JS, Hänninen OO, Hurley F, Jantunen MJ, Jerrett M, **Levy JI**, Loh MM, Marshall JD, Miller BG, Preiss P, Spadaro JV, Tainio M, Tuomisto JT, Weschler CJ, McKone TE, Health effects of fine particulate matter in life cycle impact assessment: Conclusions from the Basel guidance workshop. Int J Life Cycle Assess 20(2); 276-288 (2015).

8. Patton AP, Perkins J, Zamore W, **Levy JI**, Brugge D, Durant JL. Spatial and temporal differences in traffic-related air pollution in three urban neighborhoods near an interstate highway. Atmos Environ 99: 309-321 (2014).

9. Brunelle-Yeung E, Masek T, Rojo JJ, **Levy JI**, Arunachalam S, Miller SM, Barrett SRH, Kuhn SR, Waitz IA. Assessing the impact of aviation environmental policies on public health. Transport Policy 34: 21-28 (2014).

10. James P, Ito K, Buonocore JJ, **Levy JI**, Arcaya MC. A health impact assessment of proposed public transit service cuts and fare increases in Boston, Massachusetts (U.S.A.). Int J Environ Res Public Health 11: 8010-8024 (2014).

11. Buonocore JJ, Dong X, Spengler JD, Fu JS, **Levy JI**. Using the Community Multiscale Air Quality (CMAQ) model to estimate public health impacts of $PM_{2.5}$ from individual power plants. Environ Int 68: 200-208 (2014).

12. Peters JL, Fabian MP, **Levy JI**. Combined impact of lead, cadmium, polychlorinated biphenyls and non-chemical risk factors on blood pressure in NHANES. Environ Res 132: 93-99 (2014).

13. Hsu HH, Adamkiewicz G, Houseman EA, Spengler JD. **Levy JI**. Using mobile monitoring to characterize roadway and aircraft contributions to ultrafine particle concentrations near a mid-sized airport. Atmos Environ 89: 688-695 (2014).

14. Zhou Y, Hammitt J, Fu JS, Gao Y, Liu Y, **Levy JI.** Major factors influencing the health impacts from controlling air pollutants with nonlinear chemistry: An application to China. Risk Anal 34: 683-697 (2014).

15. **Levy JI**, Fabian MP, Peters JL. Community-wide health risk assessment using geographically resolved demographic data: a synthetic population approach. PLoS ONE 9(1): e87144 (2014).

16. Fabian MP, Adamkiewicz G, Stout NK, Sandel M, **Levy JI**. A simulation model of building intervention impacts on indoor environmental quality, pediatric asthma, and costs. J Allergy Clin Immunol 133: 77-84 (2014).

17. Brugge D, Lane K, Padro-Martinez LT, Stewart A, Hoesterey K, Weiss D, Wang DD, **Levy JI**, Patton AP, Zamore W, Mwamburi M. Highway proximity associated with cardiovascular disesase risk: the influence of individual-level confounders and exposure misclassification. Environ Health 12:84 (2013).

18. Correia AW, Peters JL, **Levy JI**, Melly S, Dominici F. Residential exposure to aircraft noise and hospital admissions for cardiovascular diseases: multi-airport retrospective study. BMJ 347:f5561 (2013).

19. Lane KJ, Scammell MK, **Levy JI**, Fuller CH, Parambi R, Zamore W, Mwambri M, Brugge D. Positional error and time-activity patterns in near-highway proximity studies: An exposure misclassification analysis. Environ Health 12:75 (2013).

20. Harper S, Ruder E, Roman HA, Geggel A, Nweke O, Payne-Sturges D, **Levy JI**. Using inequality measures to incorporate environmental justice into regulatory analyses. Int J Environ Res Public Health 10: 4039-4059 (2013).

21. Wason SC, Julien R, Perry MJ, Smith TJ, **Levy JI**. Modeling exposures to organophosphates and pyrethroids for children living in an urban low-income environment. Environ Res 124: 13-22 (2013).

22. Rodricks JV, **Levy JI**. Science and Decisions: Advancing toxicology to advance risk assessment. Tox Sci 131(1): 1-8 (2013).

23. Hsu HH, Adamkiewicz G, Houseman EA, Zarubiak D, Spengler JD, **Levy JI.** Contributions of aircraft arrivals and departures to ultrafine particle counts near Los Angeles International Airport. Sci Tot Environ 444: 347-355 (2013).

24. Fabian P, Stout NK, Adamkiewicz G, Geggel A, Ren C, Sandel M, **Levy JI**. The effects of indoor environmental exposures on pediatric asthma: A discrete event simulation model. Environ Health 11:66 (2012).

25. Diez DM, Dominici F, Zarubiak D, **Levy JI**. Statistical approaches for identifying air pollutant mixtures associated with aircraft departures at Los Angeles International Airport. Environ Sci Technol 46: 8229−8235 (2012).

26. **Levy JI**, Diez D, Dou Y, Barr CD, Dominici F. A meta-analysis and multi-site time-series analysis of the differential toxicity of major fine particulate matter constituents. Am J Epidemiol 175: 1091-1099 (2012).

27. Barrett SRH, Yim SHL, Gilmore CK, Murray LT, Kuhn SR, Tai APK, Yantosca RM, Byun DW, Fong N, Li X, **Levy JI**, Ashok A, Koo J, Wong HM, Dessen O, Balasubramanian S, Fleming GG, Pearlson MN, Wollersheim C, Malina R, Arunachalam S, Binkowski FS, Leibensperger EM, Jacob DJ, Hileman JI, Waitz IA. Public health, climate, and economic impacts of desulfurizing jet fuel. Environ Sci Technol 46: 4275-4282 (2012).

28. Wason SC, Smith TJ, Perry MJ, **Levy JI**. Using physiologically-based pharmacokinetic models to incorporate chemical and non-chemical stressors into cumulative risk assessment: A case study of pesticide exposures. Int J Environ Res Public Health 9: 1971-1983 (2012).

29. Hsu HH, Adamkiewicz G, Houseman EA, Vallarino J, Melly SJ, Wayson RL, Spengler JD, **Levy JI**. The relationship between aviation activities and ultrafine particulate matter concentrations near a mid-sized airport. Atmos Environ 50: 328-337 (2012).

30. Fabian P, Adamkiewicz G, **Levy JI**. Simulating indoor concentrations of NO_2 and $PM_{2.5}$ in multifamily housing for use in health-based intervention modeling. Indoor Air 22: 12-23 (2012).

31. **Levy JI**, Woody M, Baek BH, Shankar U, Arunachalam S. Current and future particulate matter-related mortality risks in the United States from aviation emissions during landing and takeoff. Risk Anal 32: 237-249 (2012).

32. Adamkiewicz G, Zota AR, Fabian MP, Chahine T, Julien R, Spengler JD, **Levy JI**. Moving environmental justice indoors: understanding structural influences on residential exposure patterns in low-income communities. Am J Public Health 101: S238-S245 (2011).

33. Zhu Y, Smith TJ, Davis ME, **Levy JI**, Herrick R, Jiang H. Comparing gravimetric and real-time sampling of $PM_{2.5}$ concentrations inside truck cabins. J Occup Environ Hygiene 8: 662-672 (2011).

34. Chahine T, Schultz B, Zartarian V, Subramanian SV, Spengler J, Hammitt J, **Levy JI**. Modeling geographic and demographic variability in residential concentrations of environmental tobacco smoke using national data sets. J Exp Sci Environ Epidemiol 21: 646-655 (2011).

35. Robinson LA, **Levy JI.** The [r]evolving relationship between risk assessment and risk management. Risk Anal 31: 1334-1344 (2011).

36. Chahine T, Schultz BD, Zartarian VG, Xue J, Subramanian S, **Levy JI**. Modeling joint exposures and health outcomes for cumulative risk assessment: the case of radon and smoking. Int J Environ Res Public Health 8(9): 3688-3711 (2011).

37. Chahine T, Subramanian SV, **Levy JI**. Sociodemographic and geographic variability in smoking in the U.S.: A multilevel analysis of the 2006- 2007 Current Population Survey, Tobacco Use Supplement. Soc Sci Med 73: 752-758 (2011).

38. Zwack LM, Hanna SR, Spengler JD. **Levy JI**. Using advanced dispersion models and mobile monitoring to characterize spatial patterns of ultrafine particles in an urban area. Atmos Environ 45: 4822-4829 (2011).

39. Fann N, Roman HA, Fulcher CM, Gentile MA, Hubbell BJ, Wesson K, **Levy JI**. Maximizing health benefits and minimizing inequality: Incorporating local scale data in the design and evaluation of air quality policies. Risk Anal 31: 908-922 (2011).

40. **Levy JI**, Hanna SR. Spatial and temporal variability in urban fine particulate matter concentrations. Environ Pollution 159: 2009-2015 (2011).

41. Zwack LM, Paciorek CJ, Spengler JD, **Levy JI**. Modeling spatial patterns of traffic-related air pollutants in complex urban terrain. Environ Health Perspect 119: 852-859 (2011).

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43. Zwack LM, Paciorek CJ, Spengler JD, **Levy JI**. Characterizing local traffic contributions to particulate air pollution in street canyons using mobile monitoring techniques. Atmos Environ 45: 2507-2514 (2011).

44. Clougherty JE, Houseman EA, **Levy JI**. Source apportionment of indoor residential fine particulate matter using land use regression and constrained factor analysis. Indoor Air 21: 53-66 (2011).

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57. **Levy JI**, Baxter LK, Schwartz J. Uncertainty and variability in environmental externalities from coal-fired power plants in the United States. Risk Anal 29: 1000-1014 (2009).

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matter emissions-to-exposure relationships in the Boston urban area. Environ Sci Technol 41: 7675-7682 (2007).

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Exhibit 5: Declaration of Douglas W. Dockery

UNITED STATES COURT OF APPEALS
FOR THE DISTRICT OF COLUMBIA CIRCUIT

WHITE STALLION ENERGY LLC, *et al.*,	)	No. 12-1100 (and consolidated cases)
Petitioners.	)	
v.	)	
U.S. ENVIRONMENTAL PROTECTION AGENCY,	)	
Respondent.	)	

Suffolk County)
)
Commonwealth of Massachusetts)

DECLARATION OF DOUGLAS W. DOCKERY, M.S. Sc.D.
HARVARD UNIVERSITY SCHOOL OF PUBLIC HEALTH

I, Douglas W. Dockery, state and declare as follows:

I. Purpose of this Declaration

1. I provide this declaration in support of the Joint Motion of the American Academy of Pediatrics, American Lung Association, American Nurses Association, American Public Health Association, Chesapeake Bay Foundation, Citizens for Pennsylvania's Future, Clean Air Council, Conservation Law

Foundation, Environment America, Environmental Defense Fund, Izaak Walton League of America, National Association for the Advancement of Colored People, Natural Resources Council of Maine, Natural Resources Defense Council, Ohio Environmental Council, Physicians for Social Responsibility, Sierra Club, and Waterkeeper Alliance; and the states of California, Connecticut, Delaware, Illinois, Iowa, New York, North Carolina, Oregon, Maine, Maryland, Minnesota, New Hampshire, New Mexico, Rhode Island and Vermont, the Commonwealth of Massachusetts; the Cities of Baltimore, Chicago, New York, the District of Columbia, and Erie County, New York. The Motion requests that the Court retain in place the effectiveness of the emissions limits contained in the Mercury and Air Toxics Standards ("Air Toxics Rule"), published at 77 Fed. Reg. 9304 (February 12, 2012), during the period when a portion of the rule is remanded to the Agency, because doing so will preserve the significant public health benefits associated with EPA's regulations.

2. I provide this declaration based on my professional experience, as outlined herein and in my curriculum vitae, attached as Appendix A to this declaration. In preparing this declaration I reviewed the Air Toxics Rule's required emissions limitations, specifically those sections of the Rule discussing the alternative particulate matter limits imposed by the Rule, and the Agency's use of particulate matter as a surrogate for the non-mercury metallic hazardous air

pollutants. I also reviewed sections of EPA's Regulatory Impacts Analysis accompanying the final Rule's publication and discussing the Agency's methods for assessing the health benefits associated with controlling the power plant pollution regulated by the Air Toxics Rule.

II. Experience and Qualifications

3. I am currently the John L. Loeb and Frances Lehman Loeb Professor of Environmental Epidemiology, and the Chair of the Department of Environmental Health at Harvard University's T.H. Chan School of Public Health. I also serve as the Director of the Harvard-National Institute of Environmental Health Studies Center for Environmental Health, and as an Associate Professor of Medicine in Epidemiology at the Harvard Medical School's Channing Laboratory. I have held appointments at the Harvard School of Public Health since 1987. I hold a Master of Science (M.S.) and a Doctorate in Science (Sc.D.) in environmental health from the Harvard School of Public Health, an M.S. in meteorology from the Massachusetts Institute of Technology, and a Bachelor of Science (B.S.) in physics from the University of Maryland.

4. I have for 40 years studied and published extensively on the human health effects of exposure to fine particulate air pollution. I was the Principal Investigator of "Respiratory Health Effects of Respirable Particles and Sulfur

Oxides," commonly known as the Harvard Six Cities Study,[1] which examined the health effects of air pollution exposures in populations who have been followed for over 35 years. The results of both that study and the subsequent work affirming those results are relied on by U.S. EPA in modelling the health benefits of the particulate matter reductions resulting from the Air Toxics Rule.

5. My work also examines the respiratory effects associated with particulate and acid aerosol air pollution,[2] the growth of lung function in children,[3] and decline in adults, the environmental risk factors affecting these trajectories, and the relationship between particulate air pollution and adverse cardiovascular

[1] Dockery DW, Pope CA, Xu X, Spengler JD, Ware JH, Fay ME, Ferris BG, Speizer FE, An association between air pollution and mortality in six United States cities, 329 New Eng. J. Med. 1753 (1993); Laden F, Schwartz J, Speizer FE, Dockery DW, Reduction in Fine Particulate and Mortality: Extended follow-up of the Harvard Six Cities Study, 173 Am. J. Respiratory & Critical Care Med. 667 (2006); Lepeule J, Laden F, Dockery D, Schwartz J. Chronic Exposure to Fine Particles and Mortality: An Extended Follow-up of the Harvard Six Cities Study from 1974 to 2009, 120(7) Envtl. Health Persp. 965 (2012).

[2] Dockery DW, Speizer FE, *et al*., Effects of inhalable particles on respiratory health of children, 139 Am. Rev. Respiratory Disease 587 (1989); Dockery DW, Cunningham J, Damokosh AI, Neas LM, Spengler JD, Koutrakis P, Ware JH, Raizenne M, and Speizer FE, Health Effects of Acid Aerosols on North American Children-Respiratory Symptoms. 104 Envtl. Health Persp. 500 (1996).

[3] Wang X, Dockery DW, Wypij D, Gold DR, Speizer FE, Ware JH, Ferris BJ, Jr., Pulmonary function growth velocity in children 6 to 18 years, 148 Am. Rev. Respiratory Disease 1460 (1993).

effects.[4] My research team in 1993 demonstrated that life expectancy is strongly associated with community particulate air pollution levels.[5] I also research the effectiveness of environmental controls in improving health, including studies of improved life expectancy in the Harvard Six Cities Study subjects following lower fine particle concentrations,[6] the health effects of coal bans on mortality in

[4] Dockery DW, Epidemiologic evidence of cardiovascular effects of particulate air pollution, 109 Envtl. Health Persp. (Supp 4), 483 (2001); Rich DQ, Schwartz J, Mittleman MA, Link M, Luttmann-Gibson H, Catalano PJ, Speizer FE, Dockery DW, Association of short-term ambient air pollution concentrations and ventricular arrhythmias, 161 Am J. Epidemiology 1123 (2005); Rich DQ, Mittleman MA, Link MS, Schwartz J, Luttman-Gibson H, Catalano PJ, Speizer FE, Gold DR, Dockery DW, Increased risk of paroxsysmal atrial fibrillation episodes associated with acute increases in ambient air pollution, 114 Envtl. Health Persp. 120 (2006).

[5] Dockery DW, Pope CA III, Xu X, Spengler JD, Ware JH, Fay ME, Ferris BG Jr, Speizer FE, An association between air pollution and mortality in six US cities. 329 New Eng. J. Med. 1753-1759 (1993).

[6] Laden L, Schwartz J, Speizer F, Dockery DW, Reduction in fine particulate air pollution and mortality: Extended follow-up of the Harvard Six Cities study. 173(6) Am. J. Respiratory & Critical Care Med. 667 (2006); Lepeule J, Laden F, Dockery D, Schwartz J, Chronic Exposure to Fine Particles and Mortality: An Extended Follow-up of the Harvard Six Cities Study from 1974 to 2009, 120(7) Envtl. Health Persp. 965 (2012).

Ireland,[7] and on the effects of reduced fine particle concentrations on life expectancy in the United States.[8]

6. Among my professional service appointments, I have provided expert advice to the U.S. Environmental Protection Agency as a Review Panel member of the Clean Air Science Advisory Committee. Of particular relevance to this declaration, I reviewed U.S. EPA's assessment of the concentration-response function for fine particulate (PM 2.5)-related mortality and the mortality impact of changes in fine particulate matter concentrations in the U.S. in 2006 and 2008. I also provided comments to the Agency in 2005 on the Staff Paper related to updating the National Ambient Air Quality Standards for Particulate Matter.

III. The Health Effects of Exposure to Particulate Matter

7. Particulate matter is produced both by direct emissions of fuel combustion (these are the primary particles) and by chemical reactions in the

[7] Clancy L, Goodman P, Sinclair H, Dockery DW, Effect of air-pollution control on death rates in Dublin, Ireland: an intervention study, 360 The Lancet 1210 (2002).

[8] Pope A, Ezzati M, Dockery DW, Fine-Particulate Air Pollution and Life Expectancy in the United States, 360(4) New England Journal of Medicine 376 (2009); Correia AW, Pope CA 3rd, Dockery DW, Wang Y, Ezzati M, Dominici F, Effect of air pollution control on life expectancy in the United States: an analysis of 545 U.S. Counties for the period from 2000 to 2007, 24(1) Epidemiology 23 (2013).

atmosphere after sulfur dioxide is emitted (the secondary particles). Both primary and secondary particles cause adverse health effects in humans.

8. There is a robust scientific literature analyzing and describing the public health effects of breathing various concentrations of particulate matter in the ambient air, including effects on mortality, as well as adverse respiratory and cardiovascular effects. This work has been ongoing since the late 1970s, and at this point over a dozen prospective cohort epidemiological studies show significant associations between various measures of long-term exposure to particulate matter and elevated rates of annual mortality.[9] These prospective cohort designs control at the individual subject level for variables other than particulate matter exposure. These studies, including my own, show consistent relationships between fine particle indicators and premature mortality over multiple locations in the United States, Canada, and similar developed countries in Europe. Additional work has examined the correlation between reductions in particulate matter exposures and improvements in health endpoints in the United States.[10]

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[9] Hoek G, Krishnan RM, Beelen R, Peters A, Ostro B, Brunekreef B, Kaufman JD, Long-term air pollution exposure and cardio- respiratory mortality: a review, 12 (1) Envtl. Health 43 (2013).

[10] Pope A, Ezzati M, Dockery DW, Fine-Particulate Air Pollution and Life Expectancy in the United States, 360(4) New Eng. J. Med. 376 (2009); Correia AW, Pope CA III, Dockery DW, Wang Y, Ezzati M, Dominici F, Effect of air pollution control on life expectancy in the United States: an analysis of 545 U.S. Counties for the period from 2000 to 2007, 24(1) Epidemiology 23 (2013).

9. The richness and consistency of this published research means we have more confidence today regarding the quantitative relationship between adverse health effects and both the long term and short term populations exposures to various levels of particulate matter and sulfur dioxide air pollution than when EPA's Air Toxics Rules were set in 2011 and in 2012.

10. Reducing exposure to particulate matter reduces premature mortality in adults. Both prospective cohort and cross-sectional comparisons between communities have demonstrated that populations living in communities with higher particulate air pollution concentrations have higher mortality rates and shorter life expectancy. Examination of changes over time in these same communities has shown that as particulate air pollution improves, mortality rates and life expectancy improve. In the United States, communities with the greatest reductions in fine particulate air pollution between 1980 and 2000 had on average the largest improvement in life expectancy. Improved life expectancy was even observed in communities with fine particle concentrations already in compliance with the National Ambient Air Quality Standards.

11. In addition to reduced mortality, the direct health benefits of reducing exposure to particulate matter emissions include reduced incidence of non-fatal heart attacks, avoided respiratory hospital admissions, avoided cardiovascular hospital admissions, reduced emergency room visits for asthma in children under

18, reduced incidence of acute bronchitis and reduced incidence of chronic bronchitis in adults, reduced asthma exacerbation and upper respiratory symptoms in asthmatic children, reduced incidence of acute bronchitis and lower respiratory symptoms in children, reduced incidence of other cardiovascular and respiratory effects, fewer lost work days and fewer restricted activity days.

12. I understand that power plant particulates include non-mercury metals which are adsorbed on to both primary and secondary fine particles. I understand that these toxic metals include, among other constituents, arsenic, beryllium, cadmium, chromium, cobalt, manganese, nickel and lead. Each of these metals has demonstrated toxic effects.

13. I am aware of current scientific research and analysis directed at assessing the health effects associated with the non-mercury metal toxic constituents of particulate matter air pollution. My understanding of the state of that scientific work is that it not possible to quantify precisely the health effects attributable to the specific non-mercury toxic metal constituents of particulates, separately for the health effects of ambient exposures to fine particles.

IV. U.S. EPA's Air Toxics Rule

14. I am aware that EPA's Air Toxics Rule sets emissions limits for the non-mercury toxic metals emitted by power plants. The Rule sets either non-mercury metal toxic-specific emissions limits or filterable particulate matter emissions limits as a surrogate for total toxic non-mercury metal emissions, for each power plant unit.

15. I understand that U.S. EPA set standards for particulate matter as an alternative to non-mercury toxic metal specific standards because the non-mercury toxic metal constituents are invariably present in the particulate matter emissions from power plants. The Agency logically concluded that control of the particulate matter emissions would also limit emissions of these non-mercury toxic metal constituents. 76 Fed. Reg. 24976, 25038 (May 3, 2011).

16. I understand that when U.S. EPA modelled the health benefits of the Air Toxics Rule, the Agency assumed that all forms of the fine particulates controlled by the Rule are equally potent in causing premature mortality and adverse health effects. In part EPA makes this assumption because the state of the science does not yet support separate assessments of the health risks of individual constituents of particulate matter. For example, the recently completed National

Particle Toxicity Component (NPACT)[11] studies did not find evidence that any specific source, component, or size class of particulate matter could be excluded as a possible contributor to PM toxicity, and concluded that regulations targeting specific sources or components of fine particulate mass would not be more effective than controlling fine particulate mass as a whole.

V. EPA's Assessment of the Health Benefits of the Particulate Matter Limits Set by the Mercury and Air Toxics Standards

17. U.S. EPA evaluates the health benefits of the Air Toxics Rule in part by evaluating the health benefits of the reductions in particulate matter to be achieved by the Air Toxics Rule. EPA estimates the annualized health benefits of the particulate matter reductions based on the published, peer-reviewed work done by Fann, *et al*. in 2009,[12] on benefit-per-ton of pollution factors. These estimates use well established and commonly used risk assessment approaches.

18. EPA also estimates the health benefits of the Air Toxics Rule based on the sulfur dioxide emissions reductions expected as a result of the rule, and the health effects associated with the secondary particulate matter formed in the atmosphere after emissions, but avoided due to the sulfur dioxide emissions limits imposed by the Rule.

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[11] Health Effects Institute, HEI NPACT Review Panel, HEI's National Particle Component Toxicity (NPACT) Initiative, Executive Summary, Boston, MA (2013), *available a*t: http://www.healtheffects.org/Pubs/NPACT-ExecutiveSummary.pdf (last visited Sept. 21, 2015).

19. EPA's calculation of the value of the health benefits associated with the Air Toxics Rule follows the established, commonly used risk assessment approach. Under that methodology, EPA translated the changes in particulate matter emissions associated with the rule into estimated population exposures. Health impact are then calculated based on population, baseline disease and mortality rates, estimated changes in air pollution exposures, and exposure-response functions from the peer-reviewed literature. This health impacts assessment quantified changes in the incidence of adverse health impacts resulting from changes in human exposures to specific pollutants, such as fine particulates. EPA's health impact assessment for the Air Toxics Rule was based on the health effects directly linked to ambient particulate matter concentrations. The health effects assessment is based on the best available methods of benefits transfer -- a means of adapting primary research from similar contexts to obtain the most accurate measure of benefits for the environmental quality change under analysis.

20. Based on my experience, this methodology for assessing the health benefits of the particulate matter standards set by the Agency is a well-established approach to estimating the retrospective or prospective change in adverse health impacts expected to result from population-level changes in exposure to pollutants.

VI. The Potential Effects of Staying or Otherwise Failing to Implement the Air Toxics Rule.

21. I understand that the Air Toxics Rule was to be implemented at existing coal- and oil-fired power plants by April 2015, but that some power plants have been granted one year extensions to put on controls or shut down, to April 2016.

22. I understand that certain parties seek to stay the effectiveness of the emissions limits under the Air Toxics Rule, including the particulate matter and sulfur dioxide emissions limits included under the Rule, or to strip those protections completely, during the period of time when EPA fixes a problem with the initial decision whether to regulate air toxics emissions from the power sector.

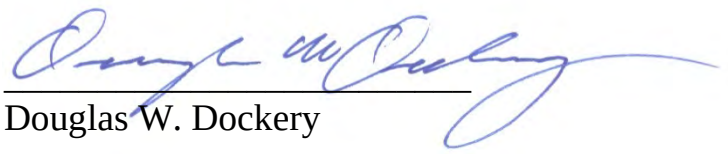
23. I understand that if the Rule is stayed, power plants that have received extensions will not be required to comply by April 2016. Additionally those plants that have put on controls to comply with the Rule's emissions limits by the initial April 2015 deadline will not be required to run those controls in order to comply with the Rule's emissions limits during the period when the Rule is stayed or otherwise not in place.

24. It is clear to me that if particulate matter and sulfur dioxide emissions remain uncontrolled, so that tonnage reductions are not achieved during any period in which the Air Toxics Rule is not in effect, there will be direct health impacts that would otherwise not be experienced, had the sulfur dioxide and particulates been controlled during the same time period. Those adverse health effects will

persist for as long as particulate matter and sulfur dioxide pollution controls are not in place and operating at the power plants, and will be reduced when the emissions of particles and sulfur dioxide are curtailed.

I declare under the penalty of perjury under the laws of the United States, that to the best of my knowledge, the foregoing is true and correct.

Executed on September 22, 2015, at Boston, Massachusetts.



Douglas W. Dockery

Declaration of Douglas W. Dockery

Appendix A

CURRICULUM VITAE

Name: **Douglas William Dockery**

Office Address: 665 Huntington Avenue
Boston, MA 02115

Work Phone: 617.432.0729

Work E-mail: ddockery@hsph.harvard.edu

Work Fax: 617.432.6913

Education:

1969	BS	Physics	University of Maryland
1972	MS	Meteorology	Massachusetts Institute of Technology
1974	MS	Environmental Health Sciences	Harvard School of Public Health
1979	ScD	Environmental Health Sciences	Harvard School of Public Health

Postdoctoral Training:

1976-1980	Teaching Fellow	Environmental Health Sciences	Harvard School of Public Health

Faculty Appointments:

1987-1990	Assistant Professor	Environmental Science and Physiology	Harvard School of Public Health
1987-1990	Assistant Professor of Medicine (Epidemiology)	Channing Laboratory	Harvard Medical School and Brigham & Women's Hospital
1990-present	Associate Professor of Medicine (Epidemiology)	Channing Laboratory	Harvard Medical School and Brigham & Women's Hospital
1990-1998	Associate Professor of Environmental Epidemiology	Environmental Health	Harvard School of Public Health
1998-2014	Professor of Environmental Epidemiology	Environmental Health	Harvard School of Public Health
2014-present	John L. Loeb and Frances Lehman Loeb Professor of Environmental Epidemiology	Environmental Health	Harvard School of Public Health

Other Professional Positions:

1972-73	General Physical Scientist	Environmental Protection Agency, Boston, MA
1973-74	Staff Meteorologist	Environmental Research and Technology, Concord, MA
1974-79	Research Assistant	Harvard Six-Cities Study, Harvard School of Public Health
1979-1987	Research Associate	Environmental Science & Physiology, Harvard School of Public Health

Major Administrative Leadership Positions:

2005-present	Chair, Department of Environmental Health	Harvard School of Public Health
2008-present	Director, Harvard-NIEHS Center for Environmental Health	Harvard School of Public Health

Committee Service / Standing Professional Committees

Non-Harvard

Liberty Mutual Research Institute for Safety, Advisory Committee	2008-present
Air Pollution Subcommittee, Environmental and Occupational Health Assembly American Thoracic Society	1988-present
Acid Aerosols Subcommittee, Clean Air Science Advisory Committee U.S. Environmental Protection Agency	1988
Bio-Medical Committee (TE-1) Air Pollution Control Association	1981-1985
Indoor Air Quality Committee (TT-7) Air Pollution Control Association	1977-1985

Harvard School of Public Health

Lown Scholars Program Committee	2010-present
Academic Council	2008-present
Human Study Committee (Institutional Review Board) Harvard School of Public Health	1988-1995, 1998-2004
Committee on Educational Policy	1993-1996; Chair, 1995-1996
Faculty Council	1991-1993

Workshops and Working Groups

Health Burden of Indoor Air Pollution on Women and Children in Developing Countries USDHHS, USDoS, USEPA, USAID	2011
Harvard-Brazil Symposium: Environment & The Sciences, Itapuã, Brazil	2008
Sixth Princess Chulabhorn International Science Congress Chulabhorn Research Institute, Thailand	2007
National Illness Cost of Air Pollution Canadian Medical Association, ICAP Expert Panel	2007
NIEHS “Global Variability in Response to Air Pollution” Workshops, Mexico City	2007
Conference Co-Chair, Joint Annual Meeting of International Society for Environmental Epidemiology and International Society for Exposure Assessment	1998
European Respiratory Society/American Thoracic Society Workshop on Longitudinal Analysis of Lung Function	1995
American Thoracic Society Working Group on Health Effects of Air Pollution	1993-1996

WHO Workshop on Air Pollution Epidemiology, Beijing	1993
American Thoracic Society Workshop on Health Effects of Atmospheric Acids and their Precursors	1990
The Health Benefits of Smoking Cessation: A Report of the Surgeon General	1990
American Thoracic Society Workshop on Lung Function Testing: Selection of Reference Values and Interpretative Strategies	June 1988
American Thoracic Society Workshop on Environmental Control and Lung Disease	March 1988
"Indoor Pollutants," Committee on Indoor Pollutants National Research Council	1980

Professional Societies

Air Pollution Control Association
American Meteorological Society
American Public Health Association
American Thoracic Society
Society for Epidemiologic Research
International Society for Environmental Epidemiology (President Elect 1996-97, President 1998-99)

Grant Review

American Heart Association
British Columbia Health Research Foundation
Center for Indoor Air Research
US Environmental Protection Agency
Harvard CATALYST
Health Effects Institute
Health Research Board (Ireland)
Mexican Health Foundation
National Institute of Environmental Health Sciences
National Institute of Health, Epidemiology and Disease Control 2
National Institute of Child Health and Human Development
Netherlands Organisation for Scientific Research (VIDI)
Qatar National Research Fund
Wellcome Trust

Program Review

National Cancer Institute, Occupational & Environmental Epidemiology Branch	2007, 2011
US EPA, Epidemiology and Biomarkers Branch	2008
US EPA, National Exposure Research Laboratory	2008
Yale School of Public Health, Department of Environmental Health	

Regulatory Review

US EPA, Air Quality Criteria for Particulate Matter	1995
US EPA, Air Quality Criteria for Ozone	1993
US EPA, Respiratory Health Effects of Passive Smoking: Lung Cancer and Other Disorders	1992
US EPA, Air Quality Criteria for Nitrogen Dioxide	1989, 1992
US EPA, Staff Paper on Acid Aerosols	1987
US EPA, Air Quality Criteria for Particulate Matter and Sulfur Oxides	1980

US EPA, Clean Air Science Advisory Committee, Nitrogen Dioxide 2013-

Major Professional Service:

Editorial Review

American Journal of Respiratory and Critical Care Medicine
American Journal of Epidemiology
British Medical Journal
Chest
Circulation
Environmental Health
Environmental Health Perspectives (Associate Editor)
Environmental Research
Environmental Science & Technology
Epidemiology
Indoor Air
International Journal of Environmental Respiratory Public Health
Journal of the American Medical Association
Journal of the American Statistical Association
Journal of Asthma
Journal of Epidemiology and Community Health
Journal of Exposure Assessment and Environmental Epidemiology
The Lancet
New England Journal of Medicine
Occupational and Environmental Medicine
Pediatric Pulmonology (Associate Editor)
PLOS ONE Pediatrics
Tobacco Control (Associate Editor)
Thorax

Honors and Prizes:

1992	Matilde M. de Santos Prize	La Fundacion Mexicana para la Salud (Mexican Health Foundation)	Ambient Ozone/School Children, Mexico City
1999	John Goldsmith Award	International Society for Environmental Epidemiology	Sustained and outstanding contributions to the knowledge and practice of Environmental Epidemiology
2003	JMS Doctor Award	Irish Journal of Medical Sciences	Best clinical research paper (Respiratory and Overall) for “Effect of air-pollution control on death rates in Dublin, Ireland: an Intervention study.”
2009	Best Environmental Epidemiology Paper Award	International Society for Environmental Epidemiology	Best environmental epidemiology paper in a peer-reviewed journal for “Fine-Particulate Air Pollution and Life Expectancy in the United States.”

Funded Research

Proposed

2014-2019	PI	NIEHS Kresge Center Grant, 5 P30 ES000002-53	$9,274,851

Past

2009-2014	PI	NIEHS Kresge Center Grant, 5 P30 ES000002-48 "HSPH NIEHS Center for Environmental Health" Research focused on interdisciplinary investigations of environmental health problems using epidemiological methods. Initial funding provided to support new faculty while they are establishing their research and training.	$8,403,258
2003-2009	PI	HEI 4694-RFA02-1-03-7/R-82811201 "Effect of Air Pollution Control on Mortality and Hospital Admissions in Ireland" Provide results for a direct assessment of the effects of long-term reductions in particulate air pollution on mortality and hospital admissions, and information on the timing of such benefits after controls are put in place.	$590,023
1996-2005	PI	NIH/FIC D43 TW000828-05 "International Training in Environmental Health"	$708,461
1992-1993	PI	NIEHS R01 ES-06239 "Effects of Acid Aerosols and Ozone on Urban Populations"	$961,575
1991-1992	PI	NIEHS ES-000002 "Respiratory Health Effects of Kuwaiti Oil Fires" Supplement to Kresge Center for Environmental Health; John B. Little, PI	$56,000
1989-1992	PI	EPA CR816071 "Epidemiology Studies of Criteria Pollutants, Particles, and Acids"	$238,404
1988-1993	PI	NIEHS ES-01108 "Effects of SO_2 and Respirable Particulates on Health"	$4,213,708
1977-1993	PI	EPRI RP1001 "Health Effects of Sulfur Oxides and Particulates"	$3,994,924

Teaching and Training

2014–present	ESPP 90t *Environmental Health: Your World and Your Life At Risk* Harvard College; undergraduate students	Instructor
2008–present	EH521 *Environmental Cardiology* Harvard School of Public Health; MPH, MS, ScD graduate students (1) 2-hour session/week for 7 weeks	Primary Instructor
1990–present	ID269 *Respiratory Epidemiology* Harvard School of Public Health; MPH, MS, ScD graduate students (1) 2-hour session/week for 6 weeks	Primary Instructor
2005–present	EH202 *Principles of Environmental Health* Harvard School of Public Health; MPH, MS, ScD graduate students (2) 2-hour session/week for 18 weeks	Course Director
1993–2005	ID215 *Environmental and Occupational Epidemiology* Harvard School of Public Health; MS, ScD graduate students (1) 2-hour session/week for 16 weeks	Course Director
2007–2008	EHE511 *Environmental Epidemiology* Cyprus International Institute; MS, ScD graduate students	Course Director
2000–2012	*Environmental Epidemiology* University of Basel; 2-week post-graduate summer course	Instructor
2012, 2014	*Analytic Methods for Assessing Environmental Exposures and Hazards* Harvard Special Session winter course, Teikyo University	Instructor

DOCTORAL STUDENTS

Thesis Advisor
Mohammad AlSeaidan

Jennifer Nguyen	"Weather as a Trigger of Cardiac Arrhythmias." Thesis Advisor, May 2012
Melanie Pickett	"Smoke-free Air Laws, Secondhand Smoke Exposure and Health in Children and Adults." Thesis Advisor, May 2010
Mey Akasha	"Fish Consumption, Mercury Intake, and the Associated Risks to the Kuwaiti Population." Thesis Advisor, March 2011
Anna Choi	"PCB Exposure and Neurodevelopment of Children residing near a Superfund Site." Thesis Advisor, June 2005
Jane Burns	"Effects of Air Pollution, Nutrition, and Weight, on Adolescent Respiratory Health." Thesis Advisor, January 2005
David Q. Rich	"Ambient Air Pollution and the Risk of Cardiac Arrhythmias Detected by Implantable Cardioverter Defibrillators." Thesis Advisor, June 2004
Joseph Abraham	"Household Endotoxin and Maternal Allergy: Associations with Early Childhood Immune Responses , Asthma and Allergic Disease." Thesis Advisor, June 2003

Adrienne Ettinger	"Dietary and Environmental Determinants of Endogenous Exposure to Lead over the Course of Lactation." Academic Advisor, June 2003
John Mike Wright Environmental Health	"Disinfection Byproducts in Massachusetts Drinking Water and Their Role in Fetal Development." Thesis Advisor, June 2001
Mark Raizenne Environmental Health/ Epidemiology	"Effects of Long-Term Particulate Air Pollution Exposure on Lung Function of Children and Adolescents." Thesis Advisor, June 2001
Kathleen Mortimer Epidemiology	"Effects of Air Pollution on Children in National Inner City Asthma Study." Thesis Advisor, June 1999
Joan Cunningham Epidemiology	"Perinatal Environmental Tobacco Smoke Exposure as a Risk Factor for Respiratory Morbidity in Children." Thesis Advisor, May 1994
Lucas M. Neas Epidemiology	"Indoor Air Pollutants and Childhood Respiratory Symptoms and Pulmonary Function." Thesis Advisor, May 1991

Thesis Committee

Mathilda Chiu Environmental Health, HSPH	"Inflammatory Markers and Secondhand Smoke Exposure among the Non-Smokers in the U.S. Trucking Industry." Thesis Committee, May 2011
Andrey Egorov Environmental Health, HSPH	"Health Effects of Drinking Water Pollution in Cherepovets, Russia." Thesis Committee, November 2001
Tina Bahadori Environmental Health, HSPH	"Human Particulate Exposure Assessment: Relationship between Outdoor, Indoor, and Personal Measurements." Thesis Committee, January 1998
Ginger Chew Environmental Health, HSPH	"Exposure Assessment of Allergens and Culturable Fungi found in Domestic Indoor Environmental." Thesis Committee, May 1997
Christl Ann Donnelly Biostatistics, HSPH	"The Analysis of Correlation in Longitudinal and Spatial Data." Thesis Committee, August 1992
Victor G. DeGruttola Biostatistics, HSPH	"Multivariant Models for Longitudinal Data: Diagnostics and Resistant Methods." Thesis Committee, June, 1988

Thesis Examiner/Reader

Sarah Henderson University of British Columbia	"Spatial assessment of forest fire smoke exposure and its health impacts in Southeastern British Columbia during the summer of 2003" September 2009
Geoffrey Morgan University of Sydney, Australia	"The Acute Health Effects of Short-Term Air Pollution Exposures in Sydney, Australia: A Time Series Analysis of Daily Mortality and Hospital Admissions." Thesis Examiner, May 2001
Willem Roemer Agricultural University	"Acute Effects of Ambient Air Pollution Episodes on Respiratory Pollution Episodes on Respiratory Health of Children." Dissertation Opponent

Wageningen, The Netherlands	
Sarah H. Downs University of Sydney Sydney, Australia	"Asthma in Rural Australia and the Clinical Importance of Alternaria." Reader, December 2000
Patrick Goodman University of Dublin Dublin, Ireland	"Particulate Air Pollution and Mortality in Dublin: 1990-1996." Thesis Examiner January 1999
Gerard Hoek Agricultural University Wageningen, The Netherlands	"Acute Effects of Ambient Air Pollution Episodes on Respiratory Pollution Episodes on Respiratory Health of Children." September 1992

POST-DOCTORAL FELLOWS

Bert Brunekreef, Ph.D. Agricultural University Wageningen, the Netherlands 1986-1987	"Effects of dampness in home with respiratory illness of children"
Toshio Nakadate, MD Natl. Inst. of Industrial Health Kawasaki, Japan 1986-1987	"Effects of early childhood illness on prevalence of wheeze and asthma"
Joel Schwartz, PhD US Environmental Protection Agency Washington, DC 1987-1988	"Effects of acute air pollution exposures on daily symptom reports"
Cary Young, MD Electric Power Research Institute Palo Alto, CA 1988-1989	"Effects of chronic air pollution exposure on respiratory health of children"
Ursula Ackerman-Liebrich, MD, PhD University of Basel Basel, Switzerland 1988-1989	"Assessment of research and training programs in environmental epidemiology"
Xiping Xu, MD, PhD Harvard School of Public Health Boston, MA 1989-1991	"Effects of smoking and air pollution exposures on rate of decline of lung function in adults"
Claudia Spix, PhD University of Dortmund Dortmund, Germany 1991-1992	"Air pollution effects on mortality in East Germany"
William Beckett, MD Yale University School of Medicine New Haven, CT	"Effects of occupational exposures on acute changes in lung function"

1992-1993	
C. Arden Pope III, PhD Brigham Young University Provo, UT 1992-1993	“Effects of chronic air pollution exposures on mortality”
John Condon, MD Dept. of Health and Community Services Northern Territory, Australia November 1993	“Effects of indoor exposures on respiratory health of aborigine populations”
Xiaobin Wang, MD, PhD Research Fellow 1993-1994	“Growth of lung function in children and effects of smoking (active and passive), respiratory illness, and air pollution”
Baloau Li Peking Union Medical Hospital Beijing, China 1993	“Association of air pollution episodes with hospital admissions”
Dong Jin Wu Peking Union Medical Hospital Beijing, China 1993	“Association of air pollution episodes with hospital admissions”
Gao Jun Ministry of Public Health Beijing, China 1993	“Association of air pollution episodes with daily mortality in Beijing”
Paulo Saldiva Faculdade de Medicina Universidade de Sao Paulo Sao Paulo, Brazil 1993	“Time series analysis of mortality in the elderly in Sao Paulo, Brazil”
Annette Peters GSF - Forschungscentrum für Umwelt und Gesundheit Munich, Germany 1993-1994	“Short-term effects of particulate air pollution on respiratory morbidity in asthmatic children”
Gerard Hoek, PhD Wageningen Agricultural University Wageningen, the Netherlands 1995-1996	“Effects of particulate air pollution on acute mortality and the development of chronic obstructive lung disease”
Stephanie von Klot-Heydenfeldt GSF - National Research Center for Environment and Health Neuherberg, Germany 1999, 2001	“Exacerbation of asthma in association with ambient fine and ultrafine particles”
Alfesio Braga, MD Universidade de Sao Paulo	“Effects of particulate air pollution on acute mortality and morbidity”

Sao Paulo, Brazil
1999-2000

Matthias Stoelzel GSF - National Research Center for Environment and Health Neuherberg, Germany 2001	“Mortality time series of source-apportioned particulates in Erfurt, Germany”
David Rich, PhD Harvard School of Public Health Boston, MA 2004-2005	“Ambient Air Pollution and the Risk of Cardiac Arrhythmias Detected by Implantable Cardioverter Defibrillators”
Jennifer Nguyen, ScD Harvard School of Public Health Boston, MA 2012-	“Weather as a Trigger of Cardiac Arrhythmias”

Bibliography:

ORIGINAL REPORTS

1. Ferris BG Jr, Speizer FE, Spengler JD, **Dockery DW**, Bishop YMM, Wolfson M, Humble C. Effects of sulfur oxides and respirable particulates on human health: 1. Methodology and demography of population in study. American Review of Respiratory Disease 1979; 120(4):767-779.

2. Ferris BG Jr, Speizer FE, Spengler JD, **Dockery DW**, Bishop YMM, Wolfson JM, Colome SD. Relationship between outdoor and indoor air pollution and the implications on health. In:Indoor Climate Effects on Human Comfort, Performance and Health in Residential, Commercial and Light-Industry Buildings. (Fanger PO and Valbjorn, O, Eds) 1979; Danish Building Research Institute, Copenhagen, pp25-37.

3. Spengler JD, Ferris BG Jr, **Dockery DW**, Speizer FE. Sulfur dioxide and nitrogen dioxide levels inside and outside homes and the implications on health effects research. Environmental Science and Technology 1979; 13 (10):1276-1280.

4. Turner WA, Spengler JD, **Dockery DW**, Colome SD. Design and performance of a reliable personal monitoring system for respirable particulates. Journal of the Air Pollution Control Association 1979; 29(7):747-748.

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8. **Dockery DW**, Spengler JD, Reed MP, Ware JH. Relationships among personal, indoor, and outdoor NO2 measurements. Environment International 1981; 5:101-107.

9. **Dockery DW**, Ware JH, Ferris BG Jr, Speizer FE, Cook NR, Herman SM. Change in pulmonary function in children associated with air pollution episodes. Journal of the Air Pollution Control Association 1982; 32(9):937-942.

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12. Ware JH, **Dockery DW**, Spiro A, III, Speizer FE, Ferris BG Jr. Passive smoking, gas cooking, and respiratory health of children living in six cities. American Review of Respiratory Disease 1984; 129: 366-374.

13. **Dockery DW**, Ware JH, Ferris BG Jr., Glicksberg DS, Fay ME, Spiro A, III, Speizer FE. Distribution of forced expiratory volume in one second and forced vital capacity in healthy, white, adult never smokers in six U.S. cities. American Review of Respiratory Disease 1985; 131(4):511-520.

14. Ferris BG Jr., Ware JH, Berkey CS, **Dockery DW**, Spiro A III, Speizer FE. Effects of passive smoking on health of children. Environmental Health Perspectives 1985; 62:289-295.

15. Berkey CS, Ware JH, **Dockery DW**, Ferris BG Jr., Speizer FE. Indoor air pollution and pulmonary function growth in preadolescent children. American Journal of Epidemiology 1986; 123(2):250-260.

16. Ferris BG Jr, Ware JH, Spengler JD, **Dockery DW**, Speizer FE. The Harvard six cities study. In Lee SD, Schneider T, Grant LD, Verkerk PJ (Eds) Aerosols: Research, Risk Assessment and Control Strategies, Lewis Publishers, 1986; pp721-730.

17. Louis TA, Robins J, **Dockery DW**, Spiro A III, Ware JH. Explaining discrepancies between longitudinal and cross sectional models. Journal of Chronic Disease 1986; 39(10): 831-839.

18. Ware JH, Ferris BG Jr., **Dockery DW**, Spengler JD, Stram DO, Speizer FE. Effects of ambient sulfur oxides and suspended particles on respiratory health of preadolescent children. American Review of Respiratory Disease 1986; 133(5):834-892.

19. Eisen EA, **Dockery DW**, Speizer FE, Fay MA, Ferris BG Jr. The inability to perform acceptable spirometry tests and respiratory symptoms in a population-based study in six U.S. cities. American Review of Respiratory Disease 1987; 136:1371-1376.

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22. **Dockery DW**, Speizer FE, Ferris BG Jr, Ware JH, Louis TA, Spiro A III. Cumulative and reversible effects of lifetime smoking on simple tests of lung function in adults. American Review of Respiratory Disease, 1988; 137:286-292.

23. Brunekreef B, **Dockery DW**, Speizer FE, Ware JH, Spengler JD, Ferris BG Jr. Home dampness and respiratory morbidity in children. American Review of Respiratory Disease, 1989: 140:1363-1367.

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45. Schwartz J, **Dockery DW**. Particulate air pollution and daily mortality in Steubenville, Ohio. American Journal of Epidemiology 1992; 135(1):12-19.

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NAMED and INTERNATIONAL INVITED TALKS

June 18-20, 1992	"Air Pollution And Lung Disease In Children: The Facts," Swiss Pediatric Society Meeting, Davos, Switzerland
October 1993	WHO Workshop on Air Pollution Epidemiology, Beijing
February 22, 1994	"Priorities in Environmental Epidemiology," The Netherlands Institute for Health Sciences. Seminar on Exposure Experience in Epidemiology, Wageningen, the Netherlands
February 25, 1994	"Epidemiology of Environment-Associated Bronchopulmonary Disease." 1st International Congress on Environmental Medicine, Duisburg, Germany
September 23, 1994	"Acute Respiratory Effects of Particulate Air Pollution," Conference on Urban Air Pollution and Public Health, University College London
September 21, 1995	"Longitudinal studies of air pollution effects on lung function" (with Bert Brunekreef), ERS/ATS Workshop on Longitudinal Analysis of Lung Function, Barcelona, Spain
March 28, 1996	"Health Effects of Particulate Air Pollution," New South Wales Health Department, Sydney, Australia
August 18, 1997	"Air Pollution Health Effects," International Society of Environmental Epidemiology Ninth Annual Conference, Taipei, Taiwan
September 18, 1997	"Occupational and Environmental Reproductive Epidemiology," Fogarty International Training Workshop, Anqing, People's Republic of China
September 24, 1997	"Health Effects of Fine Particulate Air Pollution," 38th Annual Meeting of Japan Society of Atmospheric Environment, Tsukuba, Japan
November 8-11, 1999	"Health Effects of Fine Particulate Air Pollution," Institute of Physics Science Week, Cork, Galway, and Dublin, Ireland
November 12, 1999	"Health Effects of Fine Particulate Air Pollution in Dublin," Irish Thoracic Society, Belfast, Ireland
June 1, 2000	"Epidemiologic Evidence for Health Effects of Particles," Seminario Internacional, Effectos en Salud de los Contaminantes Atmosfericos, Santiago, Chile
November 27, 2000	"Fine Particulate Air Pollution: Smoke and Mirrors of the 90's or Hazard of the New Millenium?" 15th International Clean Air and Environment Conference, Sydney, Australia.
April 26, 2001	"General Mortality and Associations with Airborne Particulate," 2001 Symposium in Environmental Health and Occupational Risk Assessment, Beijing, China
June 8, 2001	"Epidemiologic Studies: Cardiac Effects," 8th International Inhalation Symposium (INIS) Hannover, Germany
April 29, 2004	"Outdoor Air Pollution," 7th Annual Congress of Turkish Thoracic Society Conference, Antalya, Turkey
December 1, 2004	"Acute Effects of Air Pollution on Respiratory and Cardiac Health," Symposium on Respiratory Diseases and the Environment, Cyprus International Institute for the Environment and Public Health, Nicosia, Cyprus

April 14, 2005	"The Role of Air Pollution in Human Disease," Environment and Disease Conference, American Lung Association of PA and the College of Medicine at Penn State, Hershey, PA
April 22, 2005	"Effects of Short Term Air Pollution on Cardiovascular Events," Wadsworth Seminar, Albany, NY
June 14, 2005	"Can Timing of Exposure Predispose Older Adults to Disease?" Effects of Air Pollution on Health of Older Adults, The Mickey Leland National Urban Air Toxics Research Center Symposium, Arlington, VA
June 14, 2005	"Chronic Disease: Lessons from Air Pollution, Opportunities for Environmental Health," Roundtable on Environmental Health Sciences, Research, and Medicine, Institute of Medicine, Falmouth, MA
January 21, 2006	"Concentration and Acidity of Airborne Particulate Matter in Communities on the Big Island of Hawaii," Cities on Volcanoes 4, Quito, Ecuador
September 2, 2006	International Conference on Environmental Epidemiology and Exposure, Paris, France
December 8, 2006	"Academic Risks of Environmental Health Research: Freedom of Information versus Academic Freedom," Pediatric Environmental Health Retreat, Arlington, VA
January 18, 2007	"Boston Air Pollution: Where does it come from? What is it doing to you?" HSPH Community Forum
November 26, 2007	"Measuring the Efficacy of Air Pollution Controls: Cork, Ireland," The Use of 'Omics' in Human Health Assessment Workshop, Chulabhorn Research Institute, Bangkok, Thailand
November 8, 2008	"Measuring the Efficacy of Air Pollution Controls," EnviroCities 2008 International Air Pollution Conference, Dubai
March 17, 2009	"Air Quality and Health Effects," Environmental Health Conference 2009, Abu Dhabi
March 25, 2009	"Measuring Efficacy of Air Pollution Controls," Winona B. Vernberg Lecture, University of South Carolina
March 26, 2009	"Measuring Efficacy of Air Pollution Controls," David V. Bates Memorial Lecture, Vancouver, Canada
June 1, 2009	"Health Effects of PM: What We Have Learned from Epidemiological Studies," 11th International Congress on Combustion By-Products and Their Health Effects Combustion Engineering and Global health in the 21st Century: Issues and Challenges, North Carolina
August 26, 2009	"Control of Particulate Air Pollution: An Epidemiologic Success Story," Keynote Plenary ISEE, International Conference, Dublin, Ireland
October 1, 2009	"Health Impacts of $PM_{10}/PM_{2.5}$," 2nd International Congress, Klagenfurt, Austria
April 28, 2010	"Health Implications of Energy Policy," Sixth Annual Public Health Leadership Forum; Clearing the Air: Energy Practices & Human Health, Massachusetts Medical Society, Waltham, MA
June 18, 2010	"Future of Risk Assessment Sciences" University of Utrecht, The Netherlands

July 13, 2010	"Understanding Particle Health Effects and Future Challenges," Atmospheric Chemistry: Challenging the Future. ICACGP-IGAC 2010 Conference, Halifax, Canada
October 23, 2010	"Health Effects of Particulate Air Pollution from Urban Traffic, Forest Fires, and Dust Storms," Hellenic Thoracic Society, 19th Pan-Hellenic Congress, Rhodos, Greece
August 25, 2011	"Air Pollution and Environmental Epidemiology," TV Globo RespirAR Seminar, University of Sao Paulo Faculty of Medicine, Sao Paulo, Brazil
June 27, 2012	"Health Benefits of Improving Air Quality," Clean Air–the Continuing Public Health Challenge, Dublin Institute of Technology, Dublin, Ireland
July 27, 2012	"Potential Effects of Shifts in Power Generation on Air Quality and Public Health," 19th Kyoto University International Symposium, Health Concerns in the Wake of the Tohoku Triple Disaster, Kyoto, Japan
August 29, 2012	"Lessons for and from Epidemiology," Symposium: Improving the Linkages between Air Pollution Epidemiology, Qualitative Science Assessment, and Quantitative Risk Assessment, International Society of Environmental Epidemiology Annual Meeting 2012, Columbia, South Carolina
October 18, 2012	"Lessons from Birth Cohort Studies," Dasman Diabetes Institute, Kuwait
November 5, 2012	"Epidemiological Advances Using Spatial Data," Frontiers in Spatial Epidemiology Symposium, Imperial College London, London, England
March 1, 2013	"Measuring the Health Benefits of Improved Air Quality," Environmental Science and Engineering Seminar series, School of Engineering and Applied Science, Harvard University, Cambridge, MA
June 11, 2013	"Health Effects of Desert Dust Storms," Dasman Diabetes Institute, Kuwait City, Kuwait
June 26, 2013	"Lessons from Epidemiologic Studies of Ambient Fine and Ultrafine Particles," ETH Conference on Combustion Generated Nanoparticles, Swiss Federal office for the Environment, Zurich, Switzerland
October 16, 2013	"Indoor and outdoor air pollution," Impact of Cardiovascular Risk Factors on Healthy Lifespan and Mortality in Brazil and Mexico conference, Swiss Re Center for Global Dialogue, Cambridge, MA
November 11, 2013	"Environmental and Behavioral Risk Factors for Cardiovascular Disease in China," Swiss Re Centre for Global Dialogue, Ruschlikon, Switzerland
December 6, 2013	"The Six Cities Mortality Study: Impact 20 Years Later," The Centennial Whittenberger Symposium, Boston, MA
January 19, 2014	"Estimating the effect of air pollution on life expectancy in China," Teikyo University, Tokyo, Japan
February 7, 2014	"Evaluation of the benefits of controlling particulate air pollution," Harvard University Center for the Environment, Cambridge, MA
July 24, 2014	"Celebrating a Decade of Promoting Public Health in the Eastern Mediterranean" Cyrpus University of Technology, Limassol, Cyprus

July 26, 2014 "Understanding the Effect of Air Pollutants on Cardiovascular Disease" American University of Beirut, Beirut, Lebanon

October 15, 2014 "Health Risk – Air Pollution" Health Risk Factors in Rapidly Changing Economies. *Swiss RE Center for Global Dialogue, Zurich, Switzerland*

April 24, 2015 "Measuring the Health Benefits of Air Pollution Controls" Ezra's Round Table / Systems Seminar, Cornell University, Ithaca, NY

Exhibit 6: Declaration of Amy B. Rosenstein

UNITED STATES COURT OF APPEALS
FOR THE DISTRICT OF COLUMBIA CIRCUIT

WHITE STALLION ENERGY LLC, *et al.*, Petitioners. v. U.S. ENVIRONMENTAL PROTECTION AGENCY, Respondent.	)	No. 12-1100 (and consolidated cases)

Middlesex County)
)
Commonwealth of Massachusetts)

DECLARATION OF AMY B. ROSENSTEIN, MPH

I, Amy B. Rosenstein, state and declare as follows:

I. Purpose of this Declaration

1. I provide this declaration in support of the Joint Motion of the American Academy of Pediatrics, American Lung Association, American Nurses Association, American Public Health Association, Chesapeake Bay Foundation, Citizens for Pennsylvania's Future, Clean Air Council, Conservation Law Foundation, Environment America, Environmental Defense Fund, Izaak Walton League of

America, National Association for the Advancement of Colored People, Natural Resources Council of Maine, Natural Resources Defense Council, Ohio Environmental Council, Physicians for Social Responsibility, Sierra Club, and Waterkeeper Alliance; and the states of California, Connecticut, Delaware, Illinois, Iowa, New York, North Carolina, Oregon, Maine, Maryland, Minnesota, New Hampshire, New Mexico, Rhode Island and Vermont, the Commonwealth of Massachusetts; the Cities of Baltimore, Chicago, New York, the District of Columbia, and Erie County, New York. The Motion requests that the Court retain in place the effectiveness of the emissions limits contained in the Mercury and Air Toxics Standards ("Air Toxics Rule"), published at 77 Fed. Reg. 9304 (February 12, 2012), during the period when a portion of the rule is remanded to the Agency, because doing so will preserve the significant public health benefits associated with EPA's regulations.

II. Qualifications.

2. I provide this declaration based on my 25 years of professional experience in human health risk assessment, exposure assessment, toxicity evaluation, and risk communication. I hold a Masters in Public Health ("MPH") degree in Environmental Health from Yale University, and a Bachelor of Arts ("B.A.") degree in Biology and Environmental Studies from Brandeis University. A current copy of my resume is attached to my declaration as Appendix A.

3. I have specific experience in air quality health impact and benefit analysis, as a co-author of the Sub-Saharan Africa Refinery Study (July 2009), for which I evaluated current health impacts of the fuels used in Sub-Saharan African countries and predicted the beneficial impacts of implementing the refining of reduced sulfur gasoline and other petroleum products. For this World Bank study, I estimated the reduction in refinery emissions and air concentrations to which populations near the refineries would be exposed, and estimated the potential for associated human health and monetary benefits in three regions of Sub-Saharan Africa.

4. I was a key contributor to the U.S. EPA's Air Toxics Risk Assessment Reference Library, the risk assessment guidance for EPA's Air Toxics Program, explaining the goals and methods of air quality risk assessments, toxicity evaluations, and risk communication.

5. I have also provided critical reviews of toxicity and epidemiologic data, along with the inhalation risks for ecological receptors following oil spills, for federal and state agencies, including for setting regulatory standards for EPA's Office of Water, and for private clients. Among my private clients were a number of the environmental organizations for whom I am providing this declaration, and for whom I completed an assessment of the literature on the toxicity of acid gases and available regulatory levels to support the development of comments on EPA's regulatory limits

on acid gas emissions from coal- and oil-fired industrial boilers. My work for other clients focuses on human health and ecological risk assessments for contaminated sites and for facility siting, related to air, water, soil, sediment, fish, and product exposures.

6. In preparing to make this declaration I reviewed the Air Toxics Rule's required emissions limitations to address the acid gas emissions from coal- and oil-fired power plants, specifically those sections of the Rule setting and discussing EPA's reasoning for setting, in the alternative, sulfur dioxide (SO_2) or hydrochloric acid gas (HCl) limits as a surrogates for the acid gases emitted by such power plants, including HCl, hydrofluoric acid (HFl), chlorine gas (Cl_2), and hydrogen cyanide (HCN). I also reviewed the sections of EPA's Regulatory Impact Analysis (RIA) accompanying the final Rule's publication and discussing the Agency's methods for assessing the health benefits associated with controlling the power plant pollution regulated by the Air Toxics Rule.

III. Human Health Effects of the Acid Gases Emitted by Coal- and Oil-fired Power Plants

7. I understand that acid gases which may include hydrogen chloride (HCl), chlorine (Cl_2), hydrogen fluoride (HF), and hydrogen cyanide (HCN) are emitted by coal- and oil-fired power plants. It is important to understand that they are emitted in a mixture with the other stack emissions from a power plant, for example, HCl, HCN, and Cl_2 are emitted together with sulfur dioxide as part of the flue gases

emitted by power plants, not as separate pollutants. These gaseous pollutants are emitted as mixtures, and exposures are therefore exposures to the mixture of pollutants in the flue gas, which includes the individual components listed above.

8. There are documented health effects associated with inhalation exposures to the acid gases emitted by coal- and oil-fired power plants, which were taken into consideration by the U.S. Environmental Protection Agency (EPA) in the Air Toxics Rule. EPA summarized available information on both the acute and chronic health impacts of acid gases. I have reviewed EPA's analysis of the acute and chronic health impacts of acid gases, and I note that their conclusions are based on an analysis of the published research that was available at the time of the Final Rule.

9. My work requires me to remain up to date on the details of the literature and research findings about the human health effects of acid gases. Since the publication of EPA's Final Air Toxics Rule, additional publications have documented the health effects of exposures to acid gases. These more recent publications do not contradict EPA's analysis in the Air Toxics Rule, and in fact further support the need for controls on acid gas emissions.

10. Acid gas exposures can cause acute or chronic human health effects, or both. Acute effects occur in the short-term, immediately following an exposure. Acute toxicity assessments are based on short-term animal tests and/or human studies

such as case reports from accidental poisonings or industrial accidents. Chronic effects occur only after some time has gone by, and are evaluated based on longer-term animal studies that usually range from 90 days to 2 years in duration. Human studies investigating chronic health effects may include studies of a population exposed to ambient air pollutants or workers exposed over time to a particular chemical, and may range from exposures of a few years to a lifetime. Evidence has shown that an acute exposure or a series of acute exposures can also result in chronic health effects.

11. EPA's Regulatory Impact Analysis (RIA)[1] for the Air Toxics Rule summarizes the acute and chronic health effects of the acid gases emitted by coal- and oil-fired power plants. These adverse health effects include severe respiratory problems, particularly in the most sensitive populations (for example, children or those suffering from asthma). I have reviewed the EPA's Air Toxics Rule and RIA summary of the adverse health effects of exposure to the acid gases, as well as more recent publications, and conclude that the following paragraphs describe important health effects of concern that are associated with inhalation of these gases.

[1] EPA, Regulatory Impact Analysis for the Final Mercury and Air Toxics Standards (Dec. 2011), EPA-HQ-OAR-2009-0234-20131 ("RIA").

a. Chlorine Gas.

12. Exposure to chlorine gas (Cl_2) causes acute effects that, even at relatively low levels, include tissue damage to the eyes, skin, throat, and respiratory tract, respiratory irritation,[2] and, at higher levels, include respiratory distress with airway constriction and pulmonary edema. Delayed pulmonary edema may also develop up to 24 hours following acute exposure.[3] These data are supported by acute exposure experiments in laboratory animals.[4] In Jonasson, *et al.* (2013), mice were exposed once to Cl_2, and, although there was a marked acute response that subsided after 48 hours, a sustained airway hyperresponsiveness was observed for at least 28 days. Other observed effects of Cl_2 inhalation in laboratory animals include cardiac

[2] *Id.*; California Office of Environmental Health Hazard Assessment (CA OEHHA), Appendix D.2: *Acute RELs and toxicity summaries using the previous version of the Hot Spots Risk Assessment guidelines* (available at http://www.oehha.ca.gov/air/hot_spots/2008/AppendixD2_final.pdf); Appendix D.3: *Chronic RELs and toxicity summaries using the previous version of the Hot Spots Risk Assessment guidelines* (available at http://www.oehha.ca.gov/air/hot_spots/2008/AppendixD3_final.pdf) (CA OEHHA).

[3] CA OEHHA, Appendices D.2 and D.3 *supra* n.2.

[4] *Id*; Martin JG, Campbell HR, Iijima H, Gautrin D, Malo JL, Eidelman DH, Hamid Q, Maghni K, Chlorine-induced injury to the airways in mice, 168(5) Am. J. Respiratory & Critical Care Med. 568 (2003) (available at http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.312.1091&rep=rep1&type=pdf). Jonasson S, Koch B, Bucht A, Inhalation of chlorine causes long-standing lung inflammation and airway hyperresponsiveness in a murine model of chemical-induced lung injury, 303 Toxicology 34 (2013).

pathology.[5] Reactive airways dysfunction syndrome, a chemically induced asthma, has been reported following acute exposure to Cl_2,[6] and reactive airways dysfunction syndrome has been reported to persist in exposed individuals.[7]

13. Chronic inhalation exposure to low concentrations of Cl_2 can cause eye and nasal irritation, sore throat, and cough, as well as corrosion of the teeth,[8] and, at higher levels, can cause respiratory distress with airway constriction, pulmonary edema, and lung collapse.[9] Breathing capacity impacts were more severe among individuals with pre-existing airway hyperresponsiveness (a characteristic feature of asthma) and reactive airways dysfunction syndrome developed among workers exposed to Cl_2.[10] These effects are supported by chronic laboratory animal studies,

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[5] Zaky A, Bradley WE, Lazrak A, Zafar I, Doran S, Ahmad A, White CW, Louis J Dell'Italia, Matalon S, Ahmad S, Chlorine inhalation-induced myocardial depression and failure, 3 Physiology Rep. e12439 (2015) (available at http://physreports.physiology.org/content/3/6/e12439.full-text.pdf+html).

[6] RIA at 4-75 to 4-76.

[7] Brooks SM, Weiss MA, Bernstein IL, Reactive airways dysfunction syndrome (RADS). Persistent asthma syndrome after high level irritant exposures. 88(3) CHEST J. 376 (1985). (available at http://journal.publications.chestnet.org/data/Journals/CHEST/21486/376.pdf).

[8] CA OEHHA, Appendices D.2 and D.3 *supra* n.2.

[9] RIA at 4-75 to 4-76.

[10] CA OEHHA, Appendices D.2 and D.3 *supra* n.2.

one of which resulted in upper respiratory epithelial lesions.[11] White and Martin (2010)[12] state that while the respiratory and lung effects of acute severe Cl_2 inhalation have been shown in some cases to be reversible, certain vulnerable populations such as smokers and atopic individuals (those with a predisposition toward developing certain allergic hypersensitivity reactions) have longer-term chronic respiratory disorders resulting from longer-term low-level exposures.

b. Hydrogen Chloride.

14. Acute inhalation exposure to hydrogen chloride gas (HCl) causes irritation of the nose, throat, and respiratory tract, with the greatest impact on the upper respiratory tract. In addition, exposure to HCl can lead to reactive airways dysfunction syndrome, with children being more vulnerable to these effects.[13] These

[11] Wolf DC, Morgan KT, Gross EA, Barrow C, Moss OR, James RA, Popp JA, Two-year inhalation exposure of female and male B6C3F1 mice and F344 rats to chlorine gas induces lesions confined to the nose, 24 Fundamentals of Appl. Toxicology 111 (1995) (as cited in CA OEHHA).

[12] White CW, Martin JG, Chlorine gas inhalation: human clinical evidence of toxicity and experience in animal models. *In:* 7 Proc. Am. Thoracic Soc. 257 (2010) (available at http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3136961/pdf/PROCATS74257.pdf).

[13] RIA at 4-77.

effects have also been observed in laboratory animal experiments, with the addition of ocular effects.[14]

15. Chronic exposure to HCl can cause changes in pulmonary function, chronic bronchitis, skin inflammation, dental enamel erosion, and effects on the mucous membranes of the nose, mouth, and eyes. For some effects, symptoms may be delayed 1-2 days.[15] Animal studies show impacts on the upper respiratory tract due to chronic HCl exposures.[16]

c. Hydrogen Flouride.

16. Acute inhalation exposure to hydrogen fluoride (HF) causes severe respiratory symptoms and damage, including severe irritation and pulmonary edema.[17] Animal data support the acute toxicity of HF.[18] While injury due to

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[14] CA OEHHA, Appendix D.2, *supra* n.2, *Individual Acute Toxicity Summaries: Hydrogen Chloride.*

[15] CA OEHHA, Appendix D.3, *supra* n.2, *Individual Chronic Toxicity Summaries: Hydrogen Chloride.*

[16] EPA, Integrated Risk Information System On-Line (IRIS) (available at http://www.epa.gov/iris/) (last accessed 9/18/15).

[17] RIA at 4-77 to 4-78.

[18] CA OEHHA, Appendix D.3, *supra* n.2, *Individual Chronic Toxicity Summaries: Hydrogen Fluoride*.

inhalation of HF is thought to be unlikely at concentrations less than 60%, there are a few reported cases[19] of pulmonary injury occurring at much lower concentrations.[20]

17. Chronic inhalation exposures to fluorides have been studied in the workplace. A statistically significant increase in the incidence of acute respiratory disease was reported, as well as statistically significant relationships between air fluoride and bone density increases. Several studies of the inhalation of HF in animals show chronic effects.[21]

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[19] Bennion JR, Franzblau A, Chemical pneumonitis following household exposure to hydrofluoric acid, 31 Am. J. Indus. Med. 474 (2003) (available at http://deepblue.lib.umich.edu/bitstream/handle/2027.42/34814/15_ftp.pdf); Franzblau A, Sahakian N, Asthma following household exposure to hydrofluoric acid, 44 Am. J. Indus. Med. 321 (2003) (available at http://deepblue.lib.umich.edu/bitstream/handle/2027.42/34824/10274_ftp.pdf?sequence=1).

[20] Miller SN, Acute Toxicity of Respiratory Irritant Exposures. *In*: The Toxicant Induction of Irritant Asthma, Rhinitis, and Related Conditions, 83 (WJ Meggs ed., 2014) (available at https://books.google.com/books?id=MOK5BAAAQBAJ&pg=PA244&dq=meggs+rhinitis&hl=en&sa=X&ved=0CDAQ6AEwAGoVChMIl9XItJyIyAIVQc-ACh2J0AO-#v=onepage&q=meggs%20rhinitis&f=false).

[21] CA OEHHA, Appendix D.3, *supra* n.2, *Individual Chronic Toxicity Summaries: Fluorides Including Hydrogen Fluoride*.

d. Hydrogen Cyanide.

18. Acute inhalation exposure to hydrogen cyanide (HCN) results primarily in central nervous system effects, ranging from headache to unconsciousness.[22] Additionally, acute exposures result in respiratory and cardiovascular health effects. These reported acute health effects are similar among animals and humans,[23] and have been reported in one recent animal study.[24]

19. The chronic effects of HCN include central nervous system, thyroid, and hematological (blood) impacts. Although occupational studies are complicated by mixed chemical exposures, several reports indicate that chronic low exposure to HCN can cause neurological, respiratory, cardiovascular, and thyroid effects.[25]

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[22] CA OEHHA, Appendix D.2, *supra* n.2, *Individual Acute Toxicity Summaries: Hydrogen Cyanide*.

[23] *Id.*

[24] Sweeney LM, Sharits B, Gargas NM, Doyle T, Wong BA, James RA, Acute Lethality of Inhaled Hydrogen Cyanide in the Laboratory Rat: Impact of Concentration x Time Profile and Evaluation of the Predictivity of Toxic Load Models (No. NAMRU-D-13-35), Naval Medical Research Unit Dayton Wright-Patterson AFB OH (2014) (available at http://www.dtic.mil/cgi-bin/GetTRDoc?AD=ADA579551).

[25] CA OEHHA, Appendix D.3, *supra* n.2, *Individual Chronic Toxicity Summaries: Hydrogen Cyanide*; EPA IRIS, *supra* n.16 (last accessed Sept. 18, 2015).

IV. The Derivation and Use of Inhalation Threshold Levels for the Acid Gases

20. After evaluation of the toxicity literature, inhalation "threshold" levels (concentrations of chemicals in air) for the general population (including sensitive sub-populations) can be established. Safety factors are often applied to animal or human study results to account for species differences and sensitive populations, resulting in a lower (that is, a more protective) threshold level. Depending on the exposure durations, safety factors, and interpretations of the data, threshold levels established by various entities (for example, government agencies) may be different. Threshold levels may be set for short-term exposures, such as 1-hour peak concentrations, or may be set in terms of exposure to average air concentrations over time. These threshold levels describe the concentrations in the air that are generally considered to be safe for the general population or for the general population of workers in specific industries. They do not indicate the absence of risk of health effects for air concentrations at or below the threshold.

21. Chronic acid gas exposure threshold levels have been established for the general public by both the California Office of Environmental Health Hazard Assessment as chronic recommended exposure limits (RELs) for all four acid gases[26]

[26] CA OEHHA, Appendix D.3, *supra* n.2, *Individual Chronic Toxicity Summaries: Chlorine; Hydrogen Cyanide; Fluorides Including Hydrogen Fluoride; Hydrogen Chloride*.

and by the EPA as chronic reference concentrations (RfC) for HCl and HCN.[27] These chronic threshold levels for inhalation of acid gases are designed to assess exposures and health risks, and to protect the general population against adverse health effects over time, but they do not take into account repeated short-term peaks in air concentrations. In addition, although sensitive populations are taken into account in some air quality standards, threshold levels are not always set at levels which will protect the most sensitive individuals in the population, such as children, elderly, or those with respiratory diseases. Each agency has based the derived threshold level on comprehensive reviews of the literature and has selected appropriate toxicity studies to support their setting of these chronic threshold levels. I note that all four of the acid gases under consideration have established threshold levels for both acute and chronic effects, and, thus, it is clear that there is solid evidence of adverse health effects associated with the inhalation of these gases.

22. Whether or not acid gas emissions from a particular power plant result in exposures above established threshold levels, adverse health effects might still occur, in particular, in sensitive individuals (for example, the elderly, children, and persons with respiratory conditions such as asthma) living near the source of the emissions, especially if these lower exposure levels occur repeatedly over time. For example, for HCl, researchers have noted that recurring exposures at low-to-moderate

[27] EPA IRIS, *supra* n.16 (last accessed Sept. 18, 2015).

levels may result in increased bronchial responsiveness and asthma-like symptoms.[28] Importantly, certain hazardous air pollutants may interact with criteria pollutants in ambient air to exacerbate asthma, and these "adverse responses after ambient exposures to complex mixtures often occur at concentrations below those producing effects in controlled human exposures to a single compound."[29]

V. Localized Acid Gas Emissions and EPA's Air Toxics Rule

23. As part of the reviews accompanying the final Air Toxics Standards, I understand that EPA assessed the demographics of the areas surrounding the existing regulated power plants, and found that individuals living within three miles of a coal-fired power plant were 48 percent more likely to be members of a racial minority, and 31 percent more likely to be living below the poverty line, than the national average. 77 Fed. Reg. 9304, 9445 (Feb. 12, 2015).

24. As acknowledged by EPA in the Air Toxics Rule, evidence points to the increased susceptibility of minority and lower-income communities to environmental

[28] Leroyer C, Malo J-L, Girard D, Dufour J-G, Gautrin D, Chronic rhinitis in workers at risk of reactive airways dysfunction syndrome due to exposure to chlorine, 56 Occupational Envtl. Med. 334 (1999) (available at http://oem.bmj.com/content/56/5/334.full.pdf).

[29] Leikauf GD, Hazardous air pollutants and asthma, 110(4) Envtl. Health Persps. 505 (2002) (available at http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1241200/pdf/ehp110s-000505.pdf).

exposures, including ambient air pollution and industrial emissions,[30] including complex mixtures of environmental air pollutants.[31] Minority and low-income communities incur disproportionate exposures to environmental contaminants, as well as being more susceptible than the general population to the effects of such exposures "because of limited understanding of environmental hazards, disenfranchisement from the political process, and socioeconomic factors such as poor nutrition, stress, and lack of adequate health care…, and … substandard housing and resource-poor communities…."[32] Although the specific components of these

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[30] Bell ML, Zanobetti A, Dominici F, Evidence on vulnerability and susceptibility to Health Risks associated with short-term exposure to particulate matter: A systematic review and meta-analysis, 178 Am. J. Epidemiology 865 (2013) (available at http://aje.oxfordjournals.org/content/early/2013/07/24/aje.kwt090.full.pdf+html); Jerrett M, Burnett R, Brook J, Kanaroglou P, Giovis C, Finkelstein N, *et al*., Do socioeconomic characteristics modify the short term association between air pollution and mortality? Evidence from a zonal time series in Hamilton. Canada. 58 J. Epidemiol. Community Health 31 (2004) (available at http://jech.bmj.com/content/58/1/31.full.pdf+html); Krewski D, Jerrett M, Burnett RT, Ma R, Hughes E, Shi Y *et al*., Extended Follow-Up and Spatial Analysis of the American Cancer Society Study Linking Particulate Air Pollution and Mortality, 140 Respiratory Rep. Health Effects Inst. 114 (2009) (available through: http://pubs.healtheffects.org/).

[31] Carter-Pokras O, Zambrana RE, Poppell CF, Logie LA, Guerrero-Preston R, The environmental health of Latino children, 21 J. Pediatric Health Care 307 (2007) (available at http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2967224/pdf/nihms-244430.pdf).

[32] *Id.* (citing Institute of Medicine, *Toward environmental justice: Research, education, and health policy needs*, Washington, D.C. (1999) (available at http://www.nap.edu/read/6034/chapter/1).

mixed air pollution exposures that cause disease are not completely characterized,[33] it is well known that some components of air pollution, including particulate matter and acid gases, can cause disease in experimental animals and in occupationally exposed humans.

VI. Power Plants and U.S. EPA's Air Toxics Rule

25. I am aware that coal-and oil-fired power plants greater than 25 MW in size are regulated by the Air Toxics Rule. I am also aware that these are the largest industrial sources of HCl and HF, emitting the majority of these acid gases nationally.

26. I am aware that U.S. EPA's Air Toxics Rule sets emissions limits for the acid gases emitted by coal- and oil-fired power plants. The Rule sets either sulfur dioxide emissions limits or HCl emissions limits as a surrogate for total toxic acid gas emissions, for each coal-fired power plant unit, and for oil-fired units, HCl and HF limits are set as surrogates for all the acid gases those power plants emit. EPA set the emissions limits based on the performance of the best performing similar source (for new sources), or the top twelve percent of sources (for existing sources) at the time the standards were set, and providing for variability of the input fuel constituents. EPA did not set health threshold-based emissions standards. EPA's emissions

[33] Delfino RJ, Epidemiologic evidence for asthma and exposure to air toxics: linkages between occupational, indoor, and community air pollution research, 110(4) Envtl. Health Persps. 573 (2002) (available at http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1241209/pdf/ehp110s-000573.pdf).

standards for coal-fired power plants regulate surrogates because the specific acid gases are invariably present in the sulfur dioxide plumes emitted by coal-fired power plants, and can be controlled by sulfur dioxide controls. The Agency found that the acid gases emitted by oil-fired power plant units are invariably present in the plume emissions from oil-fired power plants and that both HF and HCl can be measured and monitored. 76 Fed. Reg. 24976, 25023 (May 3, 2011).

27. I understand that U.S. EPA estimates that the Air Toxics Rule will decrease emissions of sulfur dioxide from coal-fired power plants (greater than 25 MW) by 1.4 million tons per year, and will reduce emissions of HCl by about 40,000 tons per year. 77 Fed. Reg. 9304, 9424, Table 7 (Feb. 12, 2012). EPA assesses the reductions in sulfur dioxide emissions because sulfur dioxide is regulated as a surrogate for the acid gas emissions from power plants. It is readily monitored and measured, and the health benefits of reducing sulfur dioxide levels are well understood.

VII. The Potential Effects of Staying or Otherwise Failing to Implement the Air Toxics Rule.

28. I understand that the Air Toxics Rule was to be implemented at existing power plants in April 2015, but that some power plants have been granted one year extensions to put on controls or shut down, to April 2016.

29. I understand that certain parties may seek to stay the effectiveness of the emissions limits under the Air Toxics Rule, including the HCl, HF and sulfur dioxide

emissions limits included under the Rule, or to strip those protections completely, during the period of time when EPA fixes a problem with the initial decision whether to regulate air toxics emissions from the power sector.

30. I understand that if the Rule is stayed, power plants that have received extensions may not be required to comply by April 2016. Additionally those plants that have put on controls to comply with the Rule's emissions limits by the initial April 2015 deadline may not be required to comply with the Rule's emissions limits during the period when the Rule is stayed or otherwise not in place.

31. Based on my understanding of acid gas health impacts, both chronic and acute, it is clear to me that if emissions remain uncontrolled, so that tonnage reductions are not achieved during any period in which the Air Toxics Rule is not in effect, there could be direct health impacts experienced by the population most exposed to the uncontrolled emissions (that is, those living near the power plants) that would otherwise not occur.

32. Those adverse health effects, which include acute effects such as severe respiratory symptoms, respiratory damage, severe irritation, nervous system effects, and pulmonary edema, and chronic effects such as chronic respiratory disorders, exacerbation of allergic diseases, changes in pulmonary function, chronic bronchitis, and effects on the mucous membranes of the nose, mouth, and eyes, will persist for as long as acid gas emissions (whether measured in terms of the total tons of the four

major acid gases HCl, HF, Cl_2 and HCN, or as sulfur dioxide levels) remain uncontrolled. That is, they will continue to occur so long as the pollution controls are not in place and operating at the power plants to meet the Air Toxics Standards, and will be reduced when the emissions of acid gases and sulfur dioxide are curtailed.

I declare under the penalty of perjury under the laws of the United States, that to the best of my knowledge, the foregoing is true and correct.

Executed on September 22, 2015, at Boston, Massachusetts.

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Amy B. Rosenstein

Declaration of Amy B. Rosenstein

Appendix A

AMY B. ROSENSTEIN
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EXPERIENCE OVERVIEW

Amy Rosenstein has over 25 years of environmental experience, including air toxics, human health and ecological risk assessment, exposure assessment, toxicity evaluation, and risk communication. Ms. Rosenstein conducts risk assessments to support USEPA rule-making, site remediation, and environmental impact assessments. She is also involved with policy-level risk and dose-response analyses, focusing on advancing risk assessment practice. Ms. Rosenstein manages projects, assesses chemical, safety, and occupational risks, determines safe exposure levels, and provides in-depth toxicity reviews for specific chemicals in air, water, sediment, soil, and food. She is experienced in communicating complex toxicity and risk results to the public and to regulators. She was a key contributor to the U.S. EPA's Air Toxics Risk Assessment Reference Library, provides critical reviews of toxicity and epidemiologic data, and has assessed the inhalation risks for ecological receptors following oil spills. For the World Bank, Ms. Rosenstein led an air quality and health study providing health and economic impact estimates related to the quality of transportation fuels produced in Sub-Saharan Africa, integrating data from several different African countries. She has completed projects for the U.S. Environmental Protection Agency (EPA), U.S. Department of Energy, National Oceanic and Atmospheric Administration (NOAA), U.S. Army, state governments, and private clients, both domestic and international.

Risk Assessments and Toxicity Evaluations

Ms. Rosenstein has provided risk assessments, both human health and ecological, in support of site assessments and remedial actions, and for EPA rule-making. She assesses chemical and safety risks for workers and residents, determines safe exposure levels for both human and ecological receptors, and provides in-depth toxicity reviews for specific chemicals of concern. She has also completed comprehensive reviews and summaries of toxicity data for the EPA, NOAA, Food and Drug Administration, Department of Defense, and private clients.

Scientific Panels and Policy Initiatives

Ms. Rosenstein supported two risk assessment improvement initiatives to address the recommendations from the National Academy of Sciences (NAS) National Research Council (NRC). She supported the EPA's Risk Assessment Forum, which focused on how to move forward with the overarching changes suggested by the NRC, by compiling a summary of the EPA workshops, and by pulling together the viewpoints of EPA headquarters, regions, and scientific experts to forge a path forward. Ms. Rosenstein also supported the Alliance for Risk Assessment workshops which focused on methods for improving dose-response assessments. Ms. Rosenstein, for the American Institute of Chemical Engineers, worked with a diverse panel of industry experts to develop a Total Cost Assessment tool.

Environmental Impact Assessments

As a participant in environmental impact assessments for petroleum and natural gas companies conducting drilling explorations and oil well development off the coasts of Brazil, Trinidad/Tobago, and West Africa, and for the development of natural gas pipelines in West Africa, Ms. Rosenstein compiled ecological data to assess potential habitat and wildlife impacts in the proposed development areas, for example, for migrating marine mammals and sea turtles. Ms. Rosenstein assisted with the design of household surveys to establish baseline health and economic conditions at proposed sites. Finally, she provided comprehensive impact assessments and mitigation approaches for potential human, ecological, and socioeconomic benefits and impacts. Ms. Rosenstein recently evaluated the potential inhalation health impacts for marine mammals following the Gulf of Mexico BP oil spill. Previously, Ms. Rosenstein co-authored a study evaluating the potential health impacts of exposures for marine mammals after the Exxon Valdez oil spill.

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CURRENT PROJECTS

Analysis of Marine Mammal Inhalation Impacts from Oil Spills, 2011 to present. Ms. Rosenstein is leading a marine mammal impact assessment study to assess the health impacts of the Gulf of Mexico BP oil spill. The study will be used by the National Oceanic and Atmospheric Administration (NOAA) in the natural resources damages litigation. She developed innovative approaches to evaluating the toxicity and adverse health effects of the inhaled oil components for Gulf of Mexico marine mammals. Ms. Rosenstein compiled air quality data and gathered supporting evidence from the literature and from scientific experts on physiological and toxicological inputs for the assessment.

Risk Assessments for the Department of Defense at Spring Valley Formerly Used Defense Site, Washington, DC; Fort Stewart, Georgia; Lake Erie, Ohio; Frankford Arsenal, Philadelphia, PA; and Aberdeen Proving Ground, Maryland. U.S. Army Corps of Engineers, 2010 to present. Ms. Rosenstein is conducting human health and ecological risk assessments for a variety of Department of Defense sites, where chemical agents, munitions, and metals are of concern. She is responsible for writing Work Plans, meeting with Partnering Committees and regulators to present and negotiate approaches, and conducting the risk assessments.

SELECTED PROJECT EXPERIENCE

Air Emissions Health Benefits Study, Sub-Saharan Africa Refinery Project, World Bank, 2008-2009. For the World Bank, Ms. Rosenstein conducted a health study to estimate the impacts of improving the quality of transportation fuels produced in Sub-Saharan Africa. Different fuels result in distinct types of emissions from refineries, mobile, and stationary sources. The study estimated the emissions and air concentrations to which populations would be exposed, based on the properties of several different fuel types, and estimated the potential for associated human health and monetary benefits in three regions. Ms. Rosenstein worked with environmental regulators from many of the Sub-Saharan African nations, both educating and helping the group to produce a scientific document that served as the basis for future transportation fuel developments in the region (http://siteresources.worldbank.org/EXTOGMC/Resources/336929-1266963339030/ssa_refinery_study1.pdf).

Consideration of the National Academy of Sciences Recommendations for Advancing Risk Assessment, U.S. EPA Risk Assessment Forum and the Alliance for Risk Assessment, 2010 to 2013. Ms. Rosenstein participated in two initiatives to address the recommendations from the National Academy of Sciences (NAS) National Research Council (NRC) to improve risk assessment practice. One was for the EPA's Risk Assessment Forum, to internally determine how to move forward with the overarching changes suggested by the NRC. The second project was for the Alliance for Risk Assessment, a non-profit group funded by states, industries, consultants, and trade groups. Ms. Rosenstein served as a rapporteur at several Workshops, compiling and summarizing the views of the scientific panel in a workshop summary document, and prepared the initial draft of an article for publication in a peer-reviewed journal (http://www.allianceforrisk.org/ARA_Dose-Response.htm).

U.S. EPA, Air Toxics Risk Assessment Reference Library, 2003-2004. Ms. Rosenstein authored several chapters and edited the risk assessment guidance for EPA's Air Toxics Program, explaining the goals and methods of air quality risk assessment and focusing on the key steps for success (http://www2.epa.gov/fera/risk-assessment-and-modeling-air-toxics-risk-assessment-reference-library).

Clean Air Task Force (CATF), 2010. Ms. Rosenstein reviewed and summarized the scientific literature on the toxicity of acid gases, as well as available regulatory levels, to support the development of comments on EPA's regulatory limits on acid gas emissions from coal- and oil-fired industrial boilers. Co-authored a memo to CATF supporting individual standards for each of the acid gases.

Sierra Club, 2011. Ms. Rosenstein composed two Fact Sheets outlining the potential health effects of acid gases, one geared to laypersons who may be concerned about air pollution and general health issues, and the second providing more detailed information summarizing the available scientific knowledge of the potential health impacts of acid gases, and the assumptions that have been made in setting regulatory levels. The audience for the second fact sheet was Congressional offices.

Site Investigation, Human Health Risk Assessment, and Risk Communication, Nyanza Superfund Site, Ashland, MA, U.S. Army Corps of Engineers and U.S. Environmental Protection Agency, 2000-2007. Ms. Rosenstein managed the indoor air risk assessment at the site, where trichloroethene, chlorobenzenes, and mercury were of concern, using site ground water and air data and conducting vapor intrusion modeling for residential and commercial locations. The vapor intrusion and risk assessment results were used to decide the final remedial action for the homes and businesses near the site. Ms. Rosenstein prepared materials for EPA for presentation at public meetings.

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Design of a Creel Angler Survey and Risk Assessment Planning at an Urban River in New Jersey, PRP Group, 2010-2012. Ms. Rosenstein designed a creel angler survey and wrote the human health risk assessment work plan for an urban river in New Jersey. The fish and crab ingestion rates from the creel angler survey will be used in a human health risk assessment to decide on possible remedial actions. Key challenges included determining the best survey method for a low-use urban river, developing statistical approaches, and addressing the concerns of the stakeholders, including the US EPA, NJ DEP, and local city officials.

Human Health and Ecological Risk Assessments, Angler Survey, and Risk Communication at U.S. Army Research Laboratory Superfund Site, Natick, Massachusetts, 1995-2010. Ms. Rosenstein conducted the risk assessments for groundwater, soil, and a recreational lake. She wrote and coordinated several Feasibility Studies and Proposed Plans and the first Five-Year Review, interacting with both EPA and Mass DEP on a regular basis, developed the site cleanup goals for groundwater and sediment, and negotiated the goals with the regulators. She also completed ecological risk assessments at the facility, a detailed uncertainty evaluation for a Tier III ecological risk assessment for contaminated sediments, and human health risk assessments for swimming, fish ingestion, and soil and air exposures, as well as an angler survey. Ms. Rosenstein also presented the risk assessment approaches and results to the community on numerous occasions.

Environmental Impact Assessments for Oil Well Development off the Coast of Trinidad and Tobago, 2004-2005. Ms. Rosenstein evaluated the noise impacts of drilling exploratory wells, including the increased marine traffic, on fish, marine mammals, and sea turtles. She summarized potential direct and toxic impacts of drilling muds and chemicals.

Environmental Impact Assessment (EIA) of the Escravos Gas Project – Phase 3 Chevron Nigeria Limited, 2003. Ms. Rosenstein compiled and assessed the impact information for human and ecological receptors for a gas pipeline development in Nigeria. She wrote and responded to comments on the Ecological Risk Assessment, Environmental Impact Assessment, and Human Health Risk Assessment portions of the EIA. The project consisted of both onshore and offshore components, thus impacts to marine receptors and ecological receptors associated with a variety of onshore habitats, including mangrove swamps, old and recent dredged spoil heaps, strand vegetation, freshwater swamp forests, secondary forests, cultivated land, and built-up areas, were examined. Fishing along rivers, creeks, and open seas is the most important occupation in the area; Ms. Rosenstein examined the economic impacts to the local fisheries.

American Institute of Chemical Engineers' (AIChE) Center for Waste Reduction Technologies, 1997-1999. Ms. Rosenstein coordinated and provided technical support for a collaborative Task Force consisting of ten major corporations to develop a Total Cost Assessment Methodology. She was the primary author of the manual, incorporating the diverse viewpoints of the industries involved, which included chemical, pulp and paper, pharmaceutical, and other consumer products industries. The Methodology provides a framework for project decision-making, taking into consideration all potential environmental and health costs, both short-term and long-term (http://www.aiche.org/ifs/resources/total-cost-assessment/manual).

SELECTED PUBLICATIONS AND PRESENTATIONS

Meek ME, Bolger M, Bus JS, Christopher J, Conolly RB, R. Lewis J, Paoli G, Schoeny G, Haber LT, Rosenstein AB, and Dourson M. *A Framework for Fit-for-Purpose Dose Response Assessment*. Regulatory Toxicology and Pharmacology Volume 66, Issue 2, July 2013, Pages 234–240 (http://www.sciencedirect.com/science/article/pii/S0273230013000500).

Rosenstein A. 2012. *Munitions and Ecorisks: What's New?* Annual Meeting of the North Atlantic Chapter of the Society for Environmental Toxicology and Chemistry, June, 2012, West Greenwich, Rhode Island.

Rosenstein A. 2011. *Analysis of the Fish Ingestion Rates in EPA's Final Exposure Factors Handbook (2011)*. Society for Environmental Toxicology and Chemistry Annual Meeting, November, 2011, Boston, Massachusetts.

Ruffle B, L Bradley, A Rosenstein, and R Law. 2011. *Use of Site-Specific Angler Survey Data in Human Health Risk Assessments.* Society for Environmental Toxicology and Chemistry Annual Meeting, November, 2011, Boston, Massachusetts.

EnSys Energy & Systems, ICF International, J Hammitt, and L Robinson. July 2009. *Sub-Saharan Africa Refinery Study. Report Summary.* Extractive Industries for Development Series #12. (http://siteresources.worldbank.org/EXTOGMC/Resources/336929-1266963339030/ssa_refinery_study1.pdf)

Rosenstein A and L Biton. 2009. *Estimation of Exposures to Particulate Matter in Urban Areas of Sub-Saharan Africa*. Society for Risk Analysis Annual Meeting, Baltimore, Maryland.

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Rosenstein A. 2008. *Risk from Fish Ingestion: Is Site-Specific Angler Information Necessary?* Joint Services Environmental Management Training Conference & Exposition "Environment and Energy Management in a Transforming DoD," Denver, Colorado.

Rosenstein A, M McVey, K Palaia, J Connolly. 2007. *Angler Survey at an Eastern Massachusetts Lake*. Society for Risk Analysis Annual Meeting, San Antonio, Texas.

Rosenstein A. 2003. *Consumer Product Risk Assessment to Limit Business Liabilities*. Society for Risk Analysis Annual Meeting, December, Baltimore, Maryland.

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Rosenstein, A. 1991. *Estimating Inhalation Effects of the Valdez Oil Spill on Alaska's Wildlife*. Society of Environmental Toxicology and Chemistry Annual Meeting, Seattle, Washington.

EDUCATION

Masters in Public Health (MPH), Environmental Health, Yale University School of Medicine, New Haven, CT, 1989
BA, Biology and Environmental Studies, Brandeis University, Waltham, MA, 1981

MEMBERSHIPS

Society of Toxicology
Society for Risk Analysis-New England Chapter (President 2009-2010)
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Independent Risk Assessment Consultant, 2009-present
ICF International, Senior Associate, 2002-2009
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