

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

PACIFICORP,
INTERSTATE POWER & LIGHT COMPANY,
MIDAMERICAN ENERGY COMPANY,
WEC ENERGY GROUP, INC., AND
WISCONSIN POWER & LIGHT COMPANY
Petitioners

v.

MIDWEST ENERGY EMISSIONS CORP.
Patent Owner

Case IPR2025-00717
Patent 10,926,218

**PATENT OWNER'S
PRELIMINARY RESPONSE**

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2001	Declaration of Justin T. Nemunaitis
2002	Declaration of Richard Cochrane
2003	Original Complaint for Patent Infringement, <i>Midwest Energy Emissions Corp., et al. v. Vistra Energy Corp., et al.</i> , C.A. 1:19-cv-01334, ECF No. 1 (D. Del. July 17, 2019)
2004	Transcript of Jury Trial, <i>Midwest Energy Emissions Corp., et al. v. Arthur J. Gallagher & Co., et al.</i> , C.A. 1:19-cv-01334 (D. Del.) (Feb. 26, 2024–March 1, 2024)
2005	Non-Final Judgment Following Jury Verdict, <i>Midwest Energy Emissions Corp., et al. v. Arthur J. Gallagher & Co., et al.</i> , C.A. 1:19-cv-01334, ECF No. 697 (D. Del. March 8, 2024)
2006	Case Management Order, <i>In re: Midwest Energy Emissions Corp. Pat. Litig.</i> , No. 4:24-md-03132-SHL-WPK, ECF No. 60 (S.D. Iowa March 7, 2025)
2007	Complaint for Patent Infringement, <i>Midwest Energy Emissions Corp. v. Berkshire Hathaway Energy Company, et al.</i> , 4:24-cv-00243-SHL-WPK, ECF No. 1 (S.D. Iowa July 18, 2024)
2008	PacifiCorp’s First Amended Answer, Affirmative Defenses, and Counterclaims in Response to Plaintiff’s First Amended Complaint for Patent Infringement, <i>In re: Midwest Energy Emissions Corp. Pat. Litig.</i> , No. 4:24-md-03132-SHL-WPK, ECF No. 82 (S.D. Iowa March 21, 2025) (Redacted)
2009	Defendant MidAmerican Energy Company’s First Amended Answer, Affirmative Defenses, and Counterclaims to Plaintiff’s First Amended Complaint, <i>In re: Midwest Energy Emissions Corp. Pat. Litig.</i> , No. 4:24-md-03132-SHL-WPK, ECF No. 83 (S.D. Iowa March 21, 2025) (Redacted)
2010	Defendant Wisconsin Power and Light Company’s First Amended Answer, Affirmative Defenses, and Counterclaims to First Amended Complaint, <i>In re: Midwest Energy Emissions Corp. Pat. Litig.</i> , No.

	4:24-md-03132-SHL-WPK, ECF No. 87 (S.D. Iowa March 21, 2025) (Redacted)
2011	Opening Expert Report of Dr. Stephen Niksa, <i>Midwest Energy Emissions Corp., et al. v. Arthur J. Gallagher & Co., et al.</i> , C.A. 1:19-cv-01334 (D. Del.)
2012	Pilot- and Full-Scale Demonstration of Advanced Mercury Control Technologies for Lignite-Fired Power Plants, Quarterly Report (for the Period October 1, 2003 – December 31, 2003), dated February 2004
2013	Pilot- and Full-Scale Demonstration of Advanced Mercury Control Technologies for Lignite-Fired Power Plants, Final Report, dated February 2005
2014	Mercury Control Technologies for Electric Utilities Burning Subbituminous Coals, Final Report (For the period January 1, 2004 through June 30, 2005), dated October 2005
2015	Center for Air Toxic Metals (CATM), 2003 Research Ideas, dated August 30, 2002
2016	Document Metadata for Center for Air Toxic Metals (CATM), 2003 Research Ideas
2017	Declaration of Thomas Erickson including PTC logbook entries
2018	Declaration of Inventor John Pavlish, dated July 27, 2020
2019	Plaintiff ME2C's Brief in Support of Its Motion for Preliminary Injunction, <i>Midwest Energy Emissions Corp. v. Berkshire Hathaway Energy Company, et al.</i> , 4:24-cv-00243-SHL-WPK, ECF No. 58-1 (S.D. Iowa Oct. 11, 2024)
2020	Defendants' Brief in Support of Their Resistance to Plaintiff's Motion for Preliminary Injunction, <i>Midwest Energy Emissions Corp. v. Berkshire Hathaway Energy Company, et al.</i> , 4:24-cv-00243-SHL-WPK, ECF No. 125 (S.D. Iowa Dec. 16, 2024) (Redacted)
2021	Plaintiff ME2C's Reply Brief in Support of Its Motion for Preliminary Injunction, <i>Midwest Energy Emissions Corp. v. Berkshire Hathaway Energy Company, et al.</i> , 4:24-cv-00243-SHL-WPK, ECF No. 139 (S.D. Iowa Dec. 23, 2024) (Redacted)
2022	DTE Electric Company Affiliates Report, dated December 31, 2023

2023	First Amended Complaint for Patent Infringement, <i>Midwest Energy Emissions Corp., et al. v. Vistra Energy Corp., et al.</i> , C.A. 1:19-cv-01334, ECF No. 130 (D. Del. July 15, 2020)
2024	EPA, “Study of Hazardous Air Pollutant Emissions from Electric Utility Steam Generating Units—Final Report to Congress”
2025	EPA Clean Air Act Overview, https://www.epa.gov/clean-air-act-overview/1990-clean-air-act-amendment-summary-title-iii
2026	EPA, Mercury Study Report to Congress Vol. I (1997)
2027	EERC internal presentation, “Description of Test Facilities Particulate Test Combustor”
2028	EERC internal presentation, “Mercury Control Technologies for Electric Utilities Burning Lignite Coals, Introduction to Project” (12/4/2001)
2029	EERC internal presentation, “Mercury Control Technologies for Electric Utilities Burning Lignite Coals Project Kickoff Meeting” part 1 (2/28/2002)
2030	EERC internal presentation, “Mercury Control Technologies for Electric Utilities Burning Lignite Coals Project Kickoff Meeting” part 2 (2/28/2002)
2031	EERC internal presentation, “Mercury Control Technologies for Electric Utilities Burning Lignite Coals, Project Review Meeting” (2/25/2003)
2032	“JV TASK 45 – MERCURY CONTROL TECHNOLOGIES FOR ELECTRIC UTILITIES BURNING LIGNITE COAL, PHASE I BENCH- AND PILOT-SCALE TESTING Final Report” (Oct. 2003) (the “Oct. 2003 Report”)
2033	Metadata for Notes on Center for Air Toxic Metals (CATM) 2003 Research Ideas
2034	DOE, Success Story for Sorbent Enhancement Additives
2035	EPA, Mercury and Air Toxics Standards, https://www.epa.gov/mats/cleaner-power-plants
2036	Order Denying Motions to Stay and Motion to Compel, <i>In re: Midwest Energy Emissions Corp. Pat. Litig.</i> , No. 4:24-md-03132-SHL-WPK, ECF No. 131 (S.D. Iowa May 22, 2025)
2037	RESERVED
2038	RESERVED

2039	RESERVED
2040	RESERVED
2041	RESERVED
2042	RESERVED
2043	J. D. Kilgroe, C. B. Sedman, R. K. Srivastava, J. V. Ryan, C. W. Lee, S. A. Thorneloe, <i>Control of Mercury Emissions from Coal-Fired Electric Utility Boilers: Interim Report</i> , U.S. Environmental Protection Agency, Office of Research and Development, EPA-600/R-01-109, April 2002.
2044	RESERVED

I. Introduction

The Board should deny institution because Petitioners fail to establish the required reasonable likelihood of success on their priority date challenge. The Petition relies on two primary references—Vosteen⁵⁸⁹ and Lissianski. Both primary references are relied on for the claimed use of iodine, but both fail to provide that teaching. Furthermore, a POSITA would not have been motivated to combine the primary references with the secondary references identified in the Petition. For at least these deficiencies, the Board should deny institution.

II. Summary of the Technology

A. Background of the Patented Technology

The story of the '218 Patent begins with the Clean Air Act Amendments of 1990. That law required the U.S. Environmental Protection Agency (EPA) to study the environmental and health effects of toxic metals, and to devise regulations for reducing those metals, including mercury. To assist in the research, in 1992, the EPA established a National Center for Excellence at the Energy & Environmental Research Center (“EERC”) referred to as the Center for Air Toxic Metals (“CATM”). The EERC’s research focused heavily on developing new methods for detecting, measuring, and ultimately, removing mercury from coal-fired power plant exhaust gas. Ex. 2018, Pavlish Decl. ¶¶ 8–10.

By 1990, the EPA already had significant experience regulating power plant emissions. Since the 1970s, coal-burning power plants had been required to install equipment for controlling acid gas and particulate matter emissions. The industry had developed a number of technologies to address those requirements such as electrostatic precipitators, fabric filters, and scrubbers. However, those systems were not designed to capture mercury. Ex. 2025, EPA, Clean Air Act Overview.

In addition, since the mid-1990s, the EPA had required waste incinerators to reduce mercury emissions by over 90%. However, as compared to coal plant emissions, incinerator emissions contain a different chemical makeup and a significantly higher amount of mercury. Thus, reducing incinerator mercury emissions to less than 90% resulted in emissions that could still have a higher concentration of mercury than coal plant emissions. Ex. 2035, EPA, Mercury and Air Toxics Standards.

In short, the removal of extremely small amounts of mercury from large volumes of coal plant flue gas presented a daunting scientific and engineering challenge. By 1998, the EPA found that no existing technologies were up to the task of significantly reducing the mercury emissions from the country's coal plant fleet. Ex. 2024, EPA, "Study of Hazardous Air Pollutant Emissions from Electric Utility Steam Generating Units—Final Report to Congress" at ES-19 ("Regarding potential methods for reducing mercury emissions, the EPA has not identified any

demonstrated add-on control technologies currently in use in the U.S. that effectively remove mercury from utility emissions.”).

In the wake of the EPA’s conclusion, various governmental and industry organizations injected millions of dollars into research and experimental studies in the search for new mercury removal technologies. Ex. 2018, Pavlish Decl. ¶ 10. Because increased regulation of mercury emissions was expected to require significant upgrades to the country’s fleet of coal-fired plants, much of the research focused on retrofit technologies that could be adopted at relatively low cost.

B. Development of the ’218 Technology

The EERC—including the ’218 inventors John Pavlish, Edward Olson, and Michael Holmes—was at the forefront of the mercury capture research effort. In the 1990s and 2000s, the EERC developed mercury sampling and testing methodologies, and experimental test systems for simulating coal plant flue gases and characterizing and measuring the various species of mercury present in coal plant flue gas. Ex. 2018, Pavlish Decl. ¶ 8. During that time, the inventors identified various avenues of research for developing broadly applicable mercury capture solutions. Ex. 2018, Pavlish Decl. ¶ 8; *see also* Exs. 2029–30, EERC Kickoff Meeting Presentation. This included research into dozens of different additives, sorbents, and other techniques for mercury capture. Ex. 2018, Pavlish Decl. ¶¶ 16–20.

That work would eventually lead to the development of the '218 Patented technology. In particular, the inventors discovered that by providing a bromine based additive upstream of a boiler and injecting activated carbon into the flue gas downstream of the boiler, they could capture more than 90% of the emitted mercury. Ex. 2018, Pavlish Decl. ¶¶ 44–47. They further recognized that additional additives, such as iodine-based additives can also improve mercury capture. These results were described in their 2004 provisional application and in various reports to the Department of Energy (“DOE”). Ex. 2012 at 73; Ex. 2013 at 49. The results were later confirmed for a variety of coal types and plant configurations in follow-up testing performed for the DOE. The DOE and National Energy Technology Laboratory would later recognize this technology as a significant advancement in the field of mercury capture for coal-fired power plants. Ex. 2034. Because the EERC is a non-profit organization, it selected ME2C to commercialize the technology. Ex. 2017.

C. Summary of the Asserted Art

1. Vosteen

Vosteen is a patent developed in Germany that describes the use of bromine as a fuel additive for waste incinerators. In particular, Vosteen teaches that bromine may be added to fuel to completely (“100%”) oxidize the elemental mercury to ionic mercury (commonly referred to as oxidized mercury). Ex. 1005 ¶

15. This oxidized mercury can then be collected using conventional particulate matter and/or sprayer equipment already known to capture oxidized forms of mercury. Vosteen fails to teach or describe the use of activated carbon injection for this process.

Vosteen's description of bromine oxidation also fails to account for the insights and teachings of the '218 Patent. In particular, the '218 Patent teaches a chemical model whereby bromine and activated carbon are both provided into, and mixed with, a fast-moving mercury-containing gas stream. These molecules and ions dynamically interact with mercury atoms to capture the mercury in an activated carbon/mercury/bromine structure, *i.e.*, the bromine alone does not oxidize all of the mercury. Ex. 1001 at 29:10–36 (describing the carbene edge site on activated carbon and explaining “as the mercury electrons are drawn toward the positive carbon, the halide anion electrons are pushing in from the other side, which stabilizes the positive charge developing on the mercury and lowers the energy requirement for the oxidation process”). This process occurs during the few seconds when those materials are intermixed in the mercury-containing gas being transported. *See* Ex. 1026 at 348–49 (testifying that activated carbon injection provides only a few seconds of reaction time in a dynamic environment). Because Vosteen mistakenly believed that bromine alone provides complete

oxidation, he failed to appreciate or teach the critical role of activated carbon injection.

Finally, Petitioners fail to show that Vosteen's description of bromine oxidation discloses the claimed uses of iodine in the '218 Patent. Petitioners cite to a single paragraph in Vosteen as disclosing the use of iodine, but in that paragraph, Vosteen states: "from economic aspects, bromine compounds are preferably used in the inventive process." Ex. 1005 at pp 0016. Thus, even if a POSITA were motivated to modify Vosteen to arrive at the proposed combinations, Petitioners fail to show that the resulting combination would employ iodine.

2. Lissianski

Lissianski describes the use of chlorine- and bromine-based compounds to oxidize mercury when injected into flue gas. Lissianski notes that this process is more effective at the lower temperatures present *outside* of the combustion chamber, i.e., at the temperature present in the flue. *See* Ex. 1014 at 6:53–7:6, fig. 9.

Petitioners do note a passing reference in Lissianski to iodine: "Because of very low bromine and iodine contents in coal, these halogens typically contribute very little if any to mercury oxidation in flue gas. However, adding bromine or iodine *to flue gas* of low rank coals should improve mercury oxidation." *Id.* at

3:35–41 (emphasis added). However, this fails to show a disclosure of adding iodine to coal or a combustion chamber.

The earliest filing date for this reference is after the '218 inventors conceived of and reduced their invention to practice.

3. Starns and Mass-EPA

These references also fail to demonstrate unpatentability of the challenged claims. However, because Petitioners only cite these references with regard to a subset of limitations, Patent Owner need not address them for purposes of this preliminary response.

III. Claim Construction

Patent Owner does not presently propose any constructions, but it notes that the Board previously provided the following construction: “‘injecting a sorbent material comprising activated carbon into the mercury-containing gas downstream of the combustion chamber’ does not encompass blowing activated carbon into a filter, placing the filter in a structure, and then transporting mercury containing gas to the structure.” IPR2020-00834, Paper 18 at 7–8. This proposal is also consistent with the specification. For example, in describing figure 3, the specification identifies “injection point 116” and “injection point 119,” where powdered sorbent is provided into the flue gas. Ex. 1001 at 8:61–9:15. These injection points provide a location where the sorbent comes into contact with a gas

stream that is moving due to a source of transport energy such as a compressor or blower. *Id.* at 9:11–15. The patent does not describe “injecting” as placing a sorbent-coated filter in a passageway and later opening that passageway to a mercury-containing gas.

The Board provided this construction and then relied on this ruling to conclude that a nearly identical child patent of Vosteen⁵⁸⁹ (U.S. Patent No. 6,878,358) did not anticipate the asserted claims because it fails to disclose injecting activated carbon. IPR2020-00834, Paper 18 at 18. That construction is not strictly necessary here because Petitioners do not assert Vosteen⁵⁸⁹ as an anticipation reference.

IV. Petitioners Have Failed to Demonstrate a Reasonable Likelihood of Prevailing on the Merits.

Asserted grounds 1 and 2 are based on Vosteen as the primary reference.

Asserted grounds 3–6 are based on Lissianski as the primary reference.

A. Grounds 1 and 2: Petitioners Have Failed to Demonstrate Obviousness Based on Vosteen.

All of the challenged claims of the ’218 Patent require combustion of coal and an additive chosen from HI, an iodide salt, and combinations thereof, and adding activated carbon into a mercury-containing gas. According to Petitioners, Vosteen discloses all of the claim limitations except addition of activated carbon. Petitioners contend that it would have been obvious to modify Vosteen to arrive at

this limitation. However, Petitioners fail to provide evidence of a motivation to combine and instead just rely on the fact that various mercury control techniques were known in the art. This approach fails as a matter of law. Moreover, during prosecution of a related patent, the examiner found substantial evidence that a POSITA would not modify the prior art as petitioners propose. Petitioners have no response to that evidence and provide no basis for the Board to reach a different conclusion now.

Obviousness is a question of law based on underlying facts. *WBIP, LLC v. Kohler Co.*, 829 F.3d 1317, 1326 (Fed. Cir. 2016). Obviousness requires a showing that each of the claim elements was known in the prior art and evidence that a POSITA would have combined those elements in the specific way that they are recited in the challenged claim. *See KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 421 (2007) (“[A] patent composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art. . . . [I]t can be important to identify a reason that would have prompted a person of ordinary skill in the relevant field to combine the elements in the way the claimed new invention does.”). In other words, “obviousness concerns whether a skilled artisan not only could have made but would have been motivated to make the combinations or modifications of prior art to arrive at the claimed invention.” *See Belden Inc. v. Berk-Tek LLC*, 805 F.3d 1064, 1073 (Fed. Cir.

2015). “[The Board] must make a finding of a motivation to combine when it is disputed.” *In re Nuvasive, Inc.*, 842 F.3d 1376, 1382 (Fed. Cir. 2016).

The Federal Circuit recently addressed the level of proof required to demonstrate obviousness in an IPR. In *Virtek Vision Int’l ULC v. Assembly Guidance Sys., Inc.*, 97 F.4th 882, 886 (Fed. Cir. 2024), the Petitioner identified a reference that disclosed all of the limitations of the challenged claims except the requirement that the system employ a 3D coordinate system. The asserted primary reference instead disclosed the use of an angular direction system, and the petitioner argued that it would have been obvious to replace that system with a 3D coordinate system based on a secondary reference. The Board agreed with petitioners, but the Federal Circuit reversed. It explained:

The mere fact that these possible arrangements existed in the prior art does not provide a reason that a skilled artisan would have substituted the one-camera angular direction system in Keitler and Bridges with the two-camera 3D coordinate system disclosed in Briggs. There was no argument in the petition regarding why a skilled artisan would make this substitution—other than that the two different coordinate systems were “known to be used.”

Id. at 887; *see also Dish Network LLC v. Entropic Commc’ns, LLC*, IPR2024-00560, Paper 11 at 17–18 (PTAB Aug. 15, 2024) (denying institution where petition proposed replacing twisted pair cable in a system with coaxial cable

without providing a motivation to combine); *GCE Control Equipment Inc. v. VBOX Inc.*, IPR 2023-00326, Paper 27 at 53 (PTAB June 18, 2024) (“Under the particular facts at hand, we detect the unmistakable taint of impermissible hindsight reconstruction in Petitioner’s conclusory proposition”). As explained below, Petitioners’ asserted grounds suffer from the same flaw.

Moreover, a petitioner must provide sufficient evidence to rebut evidence of teaching away in the prior art. *See Kerry Grp. Servs. Int’l Ltd. v. Fla. Food Prods., LLC*, No. 2023-2092, 2025 WL 582881, at *5 (Fed. Cir. Feb. 24, 2025) (reversing Board finding of unpatentability for failure to address evidence of teaching away). Conclusory expert testimony cannot satisfy this burden. *Id.*

1. Response to Petitioners’ Arguments

Petitioners assert that all of the claim limitations are taught by Vosteen, except for activated carbon addition. Petition at 27–28. However, Petitioners offer no evidence to support their conclusion other than the fact that the references qualify as prior art. Petitioners argue: “*A POSITA would have used “injection” (described in Starns and Mass-EPA) to introduce activated-carbon sorbent into the mercury-containing flue gas of Vosteen589, particularly embodiments using an ESP in the dry-emission system (disclosed in Vosteen, Starns, and Mass-EPA).*” Petition at 27 (emphasis added). This is precisely the type of conclusory analysis that the Federal Circuit found insufficient to demonstrate obviousness in *Virtek*

Vision. For example, Petitioners identify no problem to be solved in Vosteen or other reason as to why a POSITA would be motivated to modify Vosteen.

Petitioners' expert declaration does not fill this gap as he merely copies and pastes the same argument. Ex. 1002 at 248.

Petitioners and Dr. Niksa also state, "Though Vosteen589 discloses activated-carbon sorbent and particle-control devices (*e.g.*, ESPs), Vosteen589 does not fully disclose certain implementational details, such as how sorbent is introduced." Petition at 27. That is incorrect; as the Board previously found with respect to a nearly identical child patent of Vosteen (U.S. Patent No. 6,878,358) ("Vosteen358"), Vosteen teaches the use of activated carbon in a fixed form, *i.e.*, coated on a fabric filter rather than being injected into a gas stream. *See* IPR2020-00834, Institution Decision, Paper 18 at 17–18. Thus, Petitioners propose that a POSITA would modify Vosteen to replace one known use of activated carbon, with a different use of activated carbon. But they provide no evidence or analysis to support this conclusion. Again, the Federal Circuit has held that, as a matter of law, this approach is insufficient to demonstrate obviousness. *See Virtek*, 97 F.4th at 886.

Regardless, Dr. Niksa's testimony is entitled to little weight. He previously testified that Vosteen358 discloses activated carbon injection, but the Board found that his testimony lacked support for that conclusion. IPR2020-00834, Institution

Decision, Paper 18 at 17–18. Dr. Niksa has now changed his testimony to state that the virtually identical Vosteen589 is actually ambiguous on how activated carbon is used and that a POSITA would be motivated to add activated carbon injection to Vosteen’s approach. It may be that the Board persuaded him that his prior testimony was incorrect, but he does not actually explain why he changed his testimony. Expert testimony that merely parrots attorney argument (particularly where that attorney argument is a do-over of a previously considered invalidity theory) is entitled to little weight.

2. Additional Evidence Demonstrates that a POSITA Would Not Combine the Asserted References in a Manner that Arrives at the Claimed Invention.

As explained above, Petitioners have not met their burden with respect to this obviousness theory. In addition, there is strong objective evidence that the proposed combinations do not invalidate the challenged claims.

As an initial matter, this precise obviousness issue was extensively considered during prosecution of the related U.S. Patent No. 10,343,114 (the “’114 Patent”) and rejected by the examiner. The inventors explained that activated carbon injection was known in the art (’114 Patent at 1:55–2:9), and the use of halogen additives were also known in the art (’114 Patent at 2:60–3:5 (citing Vosteen358)). The examiner initially rejected the claims on that basis. *See, e.g.*, Ex. 1026 at 413, December 26, 2018 Final Rejection at 15 (responding to argument

that “the applicant contends that there is no way a person of ordinary skill in the art could predict from the cited references that in-flight promotion of a sorbent with bromide promoters is more effective for mercury removal”).

Patent Owner provided substantial evidence and multiple declarations rebutting this assertion, and the examiner ultimately found this evidence persuasive:

For claims 2-19 and 22-28, as shown within the declarations, in flight promotion with HBR or Br promoters is more effective for mercury removal than treating the sorbent with HBr, Br or Br₂ outside the mercury-containing gas. Further the Nelson reference seems to teach away from inflight promotion as it states that the bromide is extremely corrosive. Lastly one having ordinary skill in the art would not have looked to in-flight promotion because for the prior art the contact time between the bromine promoter and the activated carbon is about 15 min, while when the promoter is contacted with the activated carbon in-flight, the contact time is generally less than 10 s.

Ex. 1026 at 203–04, April 19, 2019 Office Action at 8–9. Petitioners provide no basis for the Board to reach a different result here.

To understand the problems with Petitioners’ obviousness theories, it is helpful to understand the context of the claimed invention.

In 1990, Congress amended the Clean Air Act and law required the U.S. Environmental Protection Agency (EPA) to study the impact of various air

pollutants, including mercury.¹ To assist in the research, in 1992, the EPA established a National Center for Excellence at the Energy & Environmental Research Center (EERC) referred to as the Center for Air Toxic Metals (CATM).

In 1997 and 1998, the EPA issued two reports to Congress: *Mercury Study Report to Congress* (issued December 1997)² and *Study of Hazardous Air Pollutant Emissions from Electric Utility Steam* (issued February 1998).³ As an outcome of these studies, the EPA found a pressing need for regulation of mercury pollution from power plants.⁴ Unfortunately, it also found that no existing

¹ Ex. 2025, United States Environmental Protection Agency, *1990 Clean Air Act Amendment Summary: Title III* (last updated, Nov. 12, 2024), <https://www.epa.gov/clean-air-act-overview/1990-clean-air-act-amendment-summary-title-iii>.

² Ex. 2026, United States Environmental Protection Agency, *Mercury Study Report to Congress, Volume I: Executive Summary*, EPA-452/R-97-003, December 1997, <https://www.epa.gov/mercury/mercury-study-report-congress>.

³ Ex. 2024, United States Environmental Protection Agency, *Study of Hazardous Air Pollutant Emissions from Electric Utility Steam Generating Units—Final Report to Congress, United States Office of Air Quality*, EPA-453/R-98-004a, Environmental Protection Planning and Standards, February 1998, <https://www.epa.gov/mats/study-hazardous-air-pollutant-emissions-electric-utility-steam-generating-units-final-report>.

⁴ On March 15, 2005, the EPA issued the Clean Air Mercury Rule to significantly reduce mercury emissions from coal-fired power plants, with a goal of reducing utility emissions of mercury from 48 tons/year to 15 tons/year, a reduction of nearly 70 percent. *See Mercury regulation in the United States*, WIKIPEDIA, https://en.wikipedia.org/wiki/Mercury_regulation_in_the_United_States.

technologies were up to the task of significantly reducing the mercury pollution from those plants.⁵

With that said, the EPA did provide some indications as to promising areas for future research. For example, the EPA noted a connection between the chlorine content in coal and potential ways to remove mercury.⁶ It also identified activated carbon injection as a potential control technology for mercury removal.⁷

Nonetheless, it acknowledged that much more research was needed:

Research continues on the chemistry and interactions of flue gas, fly ash, and mercury species. This fundamental research is needed at various flue gas conditions encountered across the utility industry in order to develop low cost mercury strategies for full-scale utility operation. Thus, while AC injection shows promise as a mercury control technology, more data and research are needed to understand the factors that affect mercury removal.⁸

In the wake of these reports, various governmental and industry organizations injected millions of dollars into basic scientific research and experimental studies

⁵ Ex. 2024 at 51 (“Regarding potential methods for reducing mercury emissions, the EPA has not identified any demonstrated add-on control technologies currently in use in the U.S. that effectively remove mercury from utility emissions.”).

⁶ Ex. 2024 at 467–68.

⁷ Ex. 2024 at 470–71.

⁸ Ex. 2024 at 473.

in the search for new mercury removal technologies.⁹ Because increased regulation of mercury emissions was expected to require significant upgrades to the country's fleet of coal-fired plants, much of the research focused on retrofit technologies that could be adopted at relatively low cost, including sorbent injection systems.¹⁰

In 2002, the EPA surveyed the state of research in this field and produced a follow-up report.¹¹ It noted that the complex chemistry of the coal combustion process was still not fully understood but that progress had been made. It described how coals with higher halogen content (specifically, chlorine) were better able to oxidize mercury and promote its capture.¹² However, it noted that this oxidation reaction could be inhibited by other chemicals present during combustion in the boiler.¹³ The EPA also described promising experiments being performed with halogen-treated sorbents.¹⁴

⁹ See Ex. 1026 at 347.

¹⁰ See *id.*

¹¹ Ex. 2043, J. D. Kilgroe, C. B. Sedman, R. K. Srivastava, J. V. Ryan, C. W. Lee, S. A. Thorneloe, *Control of Mercury Emissions from Coal-Fired Electric Utility Boilers: Interim Report*, U.S. Environmental Protection Agency, Office of Research and Development, EPA-600/R-01-109, April 2002.

¹² *Id.* at 6-7.

¹³ *Id.* at 5-7 (“It is speculated that SO₂ and water vapor may inhibit gas-phase oxidation of Hg⁰ by scavenging the chlorinating agent.”).

¹⁴ *Id.* at ES-8 (“Impregnation of carbons with sulfur, iodine, or chlorine can increase the reactivity and capacity of sorbents.”).

Notably, the EPA did not recommend in-flight sorbent enhancement in the flue gas by spraying additives on coal or injecting halogens into the boiler. Rather, it described research into methods for *pre-treating* sorbents with various additives, including chlorine, and then injecting those pre-treated sorbents downstream from the boiler.¹⁵ This approach ensured that, *e.g.*, chlorinating agents could react with the sorbent material without being “scavenged” by other chemicals present in the boiler.¹³ This approach also ensured that the sorbent additive would have plenty of time to react with the sorbent—the EPA explained that, for many plants, injected sorbents would have only a few seconds to find and react with mercury present in the flue gas, with high and costly carbon-to-Hg ratios needed to achieve adequate mercury removal.¹⁶ This is consistent with the general understanding in the industry that sorbent additives such as halogens or halides should be mixed with sorbents *before* coming in contact with mercury-containing flue gas.

Thus, at the time of the patented invention, conventional wisdom taught that bromine additives and activated carbon sorbents were separate technologies. If

¹⁵ *See id.* at 5-33 to 5-34.

¹⁶ *Id.* at 5-33 (“Activated carbon duct injection seems to be the most promising Hg control technology for coal-fired electric utility boilers equipped with ESPs. In this technology, the injected activated carbon removes Hg only while contacting the flue gas during very limited sorbent/gas contact time (<3 seconds).”). Note that this section of the report refers to the reaction between pre-treated chlorinated sorbent and mercury as occurring “in-flight.” To be clear, it describes only the use of a pre-treated sorbent, not the claimed invention.

they were to be combined at all, this would be done by pre-treating the activated carbon with bromine before injecting the carbon downstream of the boiler. Indeed, during prosecution, the examiner found that conventional wisdom taught that activated carbon would need at least 15 minutes to react with activated carbon to be effective, and that this amount of pre-treatment time could not be achieved when bromine is added to coal or the combustion chamber before injecting activated carbon. Ex. 1026 at 203–04.

Thus, the objective evidence demonstrates a long-felt need for the claimed invention, failure of others, and conventional teaching away from the claimed invention. It further demonstrates that Petitioners’ conclusory assertions of a motivation to combine and expectations of success are erroneous. Accordingly, Patent Owner requests that the Board deny institution with respect to grounds 1 and 2.

3. Even if Petitioners Had Presented Evidence Supporting their Proposed Combinations, They Fail to Show that the Resulting Combination Would Employ the Claimed Use of Iodine.

The only evidence that Petitioners identify as a teaching of iodine use is the following paragraph from Vosteen:

[0016] Mercury can *in principle* also be oxidized by chlorine compounds or iodine compounds. However, it has been found that bromine compounds oxidize mercury more effectively under the given

conditions of high-temperature processes, such as temperature and in particular also at a high sulphur dioxide content (see above) than chlorine compounds. Iodine compounds oxidize mercury more effectively compared with bromine compounds. ***However, from economic aspects, bromine compounds are preferably used in the inventive process. Chlorine compounds or iodine compounds possibly present in the wastes, for example in special waste, therefore contribute to mercury oxidation.*** In a preferred embodiment, the inventive process proceeds, in addition to the bromine compounds, in the presence of chlorine and/or iodine and/or a chlorine compound and/or an iodine compound and/or a mixture of such compounds. ***The chlorine compound and/or iodine compound can be fed, for example, in the form of high-chlorine or high-iodine wastes as a supplement to, or partial replacement of, the added bromine compound.***

Ex. 1005 (emphasis added). But this description indicates that a POSITA should ***not*** employ iodine additives. At most, Vosteen teaches that a waste incinerator may be able to reduce the amount of bromine additive employed when combusting high iodine waste. But this is simply not a teaching that a POSITA should add high iodine waste to a coal combustion chamber. Indeed, such a result would likely cause a catastrophic failure as waste incinerators are not interchangeable with coal combustors.

B. Grounds 3 and 4: Petitioners Have Failed to Demonstrate Obviousness Based on Lissianski.

Petitioners' grounds 3 and 4 are similar to grounds 1 and 2 but merely replace Vosteen with Lissianski. For the same reasons that Petitioners failed to support the proposed combinations with Vosteen, Petitioners fail to show that a POSITA would combine the secondary references with Lissianski.

In addition, all of the challenged claims of the '218 Patent require combustion of coal and an additive chosen from HI, an iodide salt, and combinations thereof, and adding activated carbon into a mercury-containing gas. However, Lissianski consistently touts the benefits of adding additives to *flue gas*, not the combustion chamber.¹⁷ Lissianski explains that this is important because—in contrast to the teachings of the '218 patent—Lissianski asserts that the only benefit of halogen additives is mercury oxidation, which cannot occur in the combustion chamber. *See* Ex. 1014 at 6:57–59 (“Equilibrium modeling predicted that without additives all mercury is present in the elemental form at temperature higher than 700° F.”).

¹⁷ As Petitioner's expert Dr. Niksa explained, the term “flue gas” refers to gas that is outside the combustion chamber. Ex. 1002 at pp 74 (“It was known that the point within the furnace after the last bank of the superheater section, and before the entrance to the economizer, was commonly referred to as the “furnace exit” and was understood as the transition point after which the combustion gases were referred to as flue gases from there forward.”).

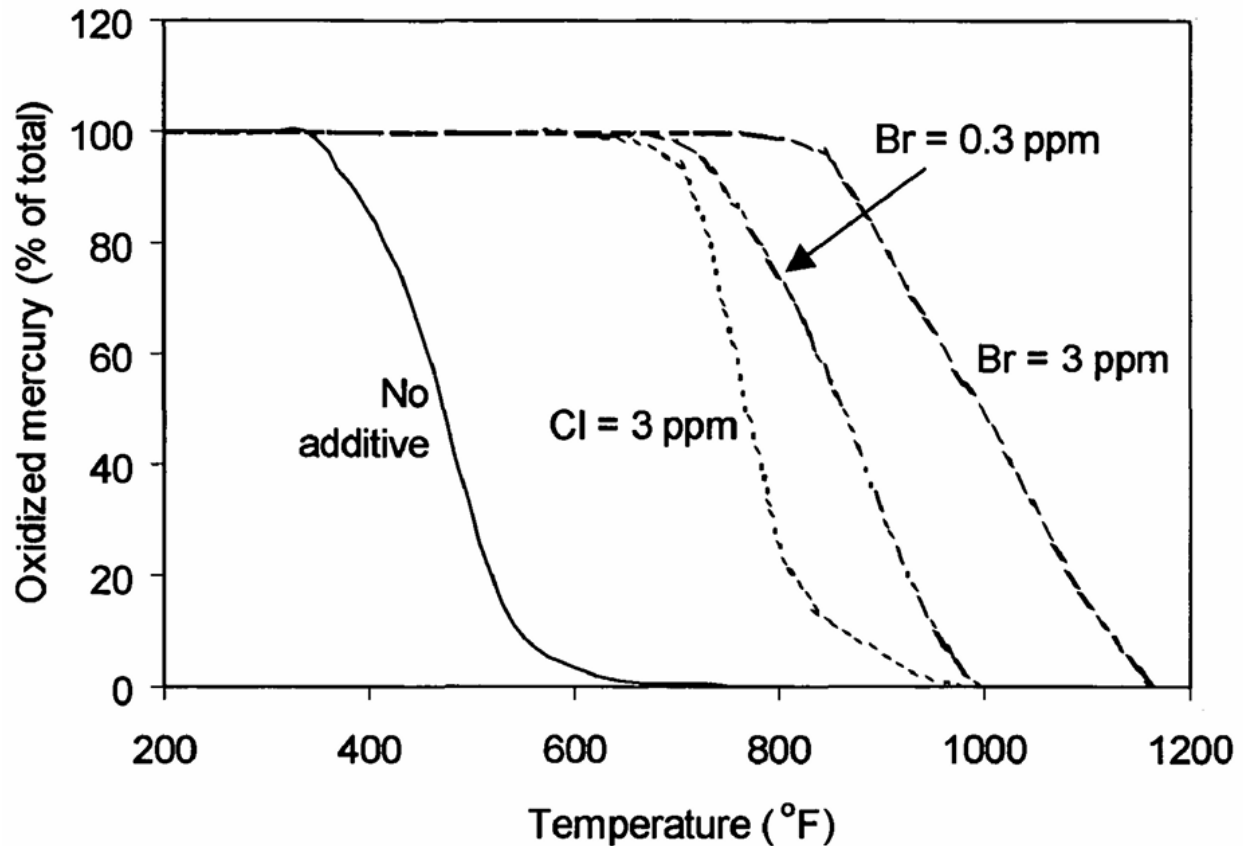
To overcome this problem, Petitioners rely on a single example described in Lissianski in figure 2. Petitioners specifically rely on the following paragraph to support their theories:

FIG. 2 schematically shows a second coal fired power plant 44. Common reference numbers are used to identify components of the second plant that are common to the first plant 10. In the second plant 44, a halogen containing additive agent, an NH_4Cl aqueous solution 36 is injected through nozzles 46 into the boiler along with the OFA 20 into the burnout zone 29. As with the first plant, the boiler 12 of the second plant 44 can be retrofitted with OFA 20 and/or a reburn system 18. The additive can be injected separately downstream of the primary combustion zone, such as with or downstream of the 40 OFA unit. The halogen additive can also be added with ammonia, urea or other N-agent solution 42 (SNCR process) to increase efficiency of NO_x reduction.

Ex. 1014 at 4:30-42. According to Petitioners, this paragraph contains a teaching of adding iodine additives to coal or a combustion chamber, but it simply does not say that. Rather, it refers to NH_4Cl , which is neither HI nor an iodide salt.

Moreover, Petitioners' argument fails to consider the actual conclusion of Lissianski. Lissianski discloses three different embodiments in figures 1, 2, and 3. These embodiments describe injection of a halogen agent into flue gas (figure 1), into overfire air (figure 2), and further downstream of the combustion chamber

near the SCR (figure 3). Lissianski then describes various tests and mathematical models culminating in the model shown in figure 9:



As shown above, when no additive is used, mercury oxidation does not begin until the flue gas cools to around 600–800 degrees Fahrenheit. When various concentrations of chlorine and bromine are employed, the beginning temperature for oxidation may be increased to 1,200 degrees Fahrenheit. However, even at the most effective amounts, that temperature is well below the temperature of a coal combustion chamber including both the primary combustion chamber and the overfire burnout zone. *See Ex. 1014 at 4:19* (explaining that coal combustion

chamber temperatures are above 2,300 degrees Fahrenheit). Thus, even if Lissianski disclosed adding iodine additives to the combustion chamber—which it does not—Petitioners fail to identify any teaching that would lead a POSITA to add an iodine-based additive to coal or a combustion chamber as opposed to the flue. Indeed, all of the claims of Lissianski require the addition of additives to flue gas, and the specification contains numerous descriptions of flue gas additives. Petitioners fail to identify any teaching in Lissianski that use of upstream additives would be similarly effective.

C. Grounds 5 and 6: Petitioners Have Failed to Demonstrate Obviousness Based on Lissianski and Vosteen.

Petitioners propose combining all of their asserted references to demonstrate unpatentability of various dependent claims. Because these theories rely in grounds 1–4 to support their challenges as to the independent claims, these grounds fail for the same reasons described above with respect to grounds 1–4.

V. Conclusion

Petitioners asserted grounds rely on a number of additional errors. For example, they wrongly equate test results related to bromine experiments and measured ratios with results that would be applicable to iodine uses. Nonetheless, the issues identified above are broadly applicable to all of the challenged claims

and thus, for the reasons stated above, Patent Owner respectfully requests that the Board deny the Petition.

Dated: August 11, 2025

Respectfully submitted,

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CERTIFICATE OF COMPLIANCE

Pursuant to 37 C.F.R. § 42.24(d), the undersigned certifies that the foregoing Patent Owner's Preliminary Response, exclusive of the exempted portions as provided in 37 C.F.R. § 42.24, contains 5,318 words and therefore complies with the type-volume limitations of 37 C.F.R. § 42.24. The word count was calculated by starting with Microsoft Word's total document word count and subtracting the words for the Cover Page, Table of Contents, Table of Authorities, Table of Exhibits, Table of Challenged Claims, Mandatory Notices, Certificate of Compliance, and Certificate of Service.

CERTIFICATE OF SERVICE UNDER 37 C.F.R. § 42.6(e)(4)

It is hereby certified that on this 11th day of August, 2025, a copy of the foregoing document was served via electronic mail, as consented to by Petitioner upon the following counsel of record:

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