

UNITED STATES PATENT AND TRADEMARK OFFICE

PATENT TRIAL AND APPEAL BOARD

PacifiCorp,
Interstate Power & Light Company,
MidAmerican Energy Company,
WEC Energy Group, Inc., and
Wisconsin Power & Light Company

Petitioners

v.

Birchtech Corp.

Patent Owner

IPR2025-00717
Patent No. 10,926,218

PETITION FOR *INTER PARTES* REVIEW

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<i>Koninklijke Philips N.V. v. Google LLC</i> , 948 F.3d 1330 (Fed. Cir. 2020)	<i>passim</i>
<i>NRG Energy, Inc. et al. v. Midwest Energy Emissions Corp.</i> , IPR2020-00832, Paper 17, 2020 WL 6277239 (P.T.A.B. Oct. 26, 2020)	4
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<i>NRG Energy, Inc. et al. v. Midwest Energy Emissions Corp.</i> , IPR2020-00928, Paper 17, 2020 WL 7074473 (P.T.A.B. Dec. 2, 2020)	5
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TABLE OF EXHIBITS

Exhibit	Description of Exhibits
1001	U.S. Patent No. 10,926,218 to Olson et al. (filed July 11, 2019) (“218 Patent” or “Challenged Patent”)
1002	Declaration of Dr. Stephen Niksa in Support of Petition for <i>Inter Partes</i> Review of U.S. Patent No. 10,926,218 (“218 Niksa Decl.”)
1003	Curriculum Vitae of Dr. Stephen Niksa
1004	Family Tree of ME2C Patents
1005	U.S. Patent Publication No. 2004/0013589 to Vosteen et al. (filed July 24, 2002) (“Vosteen589”)
1006	U.S. Patent Pub. No. 2008/0107579 to Downs et al. (published May 8, 2008) (“Downs-Boiler”)
1007	RESERVED
1008	Travis Starns, “Full-Scale Test of Mercury Control with Sorbent Injection and an ESP at Wisconsin Electric’s Pleasant Prairie Power Plant,” Session AE1-C, Paper No. 43249, AIR & WASTE MANAGEMENT’S ASSOCIATION’S 95 TH ANNUAL CONFERENCE (Baltimore, MD: June 23-27, 2002) (“Starns”)

Exhibit	Description of Exhibits
1009	<p>Massachusetts Dep. of Environmental Protection, Bureau of Waste Prevention, “Evaluation of the Technological and Economic Feasibility of Controlling and Eliminating Mercury Emissions from the Combustion of Solid Fossil Fuel” (Dec. 2002) (“Mass-EPA”), available at</p> <p>https://web.archive.org/web/20030411074158/http://www.state.ma.us/dep/bwp/daqc/files/mercfeas.pdf</p> <p>and at https://www.mass.gov/doc/evaluation-of-technological-economic-feasibility-of-controlling-eliminating-mercury-emissions/download</p>
1010	<p>Sharon Sjostrom, “Full Scale Evaluations of Mercury Control Technologies with PRB Coals,” Track A, Session A3 (Mercury – Control), Presentation A3b, EUEC: 8TH ELECTRIC UTILITIES ENVIRONMENTAL CONFERENCE (Tucson, Arizona: January 25, 2005) (“Sjostrom”)</p>
1011	RESERVED
1012	<p>U.S. Patent Pub. No. 2006/0048646 to Olson et al. (published Mar. 9, 2006) (“Olson-646”)</p>
1013	<p>U.S. Patent No. 6,953,494 to Nelson (filed May 6, 2003) (“Nelson”)</p>
1014	<p>U.S. Patent No. 7,514,052 to Lissianski et al. (filed Apr. 7, 2009) (“Lissianski”)</p>
1015	<p>U.S. Patent Publication No. 2011/0030592 to Baldrey (filed Feb. 10, 2011) (“Baldrey”)</p>

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1016	U.S. Patent Pub. No. 2014/0255279 to Olson et al. (published Sept. 11, 2014) (“Olson-279”)
1017	RESERVED
1018	U.S. Patent No. 8,652,235 to Olson et al. (issued February 18, 2014) (“Olson-235”)
1019	File History of U.S. Patent Application No. 15/974,343, which ultimately issued as U.S. Patent No. 10,668,430 (“430 Patent File History”).
1020	File History of U.S. Patent Prov. App. No. 60/605,640 (“Provisional”)
1021	File History of U.S. Patent Application No. 11/209,163, which ultimately issued as U.S. Patent No. 7,435,286 (“163 Application File History”)
1022	File History of U.S. Patent Application No. 12/201,595, which ultimately published as 2009/0062119 and was abandoned (“595 Application File History”)
1023	Excerpts of File History of U.S. Patent Application No. 15/951,970, which ultimately issued as U.S. Patent No. 10,933,370 (“370 Patent File History”)
1024	RESERVED

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1025	File History of U.S. Patent Application No. 12/419,219, which ultimately issued as U.S. Patent No. 8,168,147 (“147 Patent File History”)
1026	File History of U.S. Patent Application No. 15/978,760 (issued as U.S. Patent No. 10,343,114) (“114 Patent File History”)
1027	Babcock & Wilcox, STEAM: ITS GENERATION AND USE, 40th ed. (The Babcock & Wilcox Company: 1992) (“B&W: Steam”)
1028	J. Bustard, S. Sjostrom, et al., “Full Scale Evaluation of Sorbent Injection for Mercury Control on Coal-Fired Power Plants,” International Conference on Air Quality III, Paper No. A5-4 (Sept. 9-12, 2002: Arlington, VA) (“Bustard”)
1029	U.S. Patent No. 1,984,164 to Stock et al. (issued Dec. 11, 1934) (“Stock”)
1030	Electric Utilities Environment Conference 2005 Handout (“EUEC Handout”)
1031	Scan of jacket/cover of CD mailed to conference attendees from EUEC: 8th Electric Utilities Environmental Conference (Tucson, Arizona: January 23-26, 2005) (“EUEC CD Scan”)
1032	RESERVED
1033	U.S. Patent No. 8,512,655

Exhibit	Description of Exhibits
1034	U.S. Patent No. 8,821,819
1035	U.S. Patent No. 9,757,689
1036	CRC Handbook of Chemistry and Physics, 86th Ed.; Lide, D.R., ed. (“CRC Press: March 2005”)
1037	Paul Chu, “Power Plant Evaluation of the Effect of SCR Technology on Mercury,” Paper No. 106, COMBINED POWER PLANT AIR POLLUTANT CONTROL MEGA SYMPOSIUM (MEGA) (Washington, DC: May 19-22, 2003) (“Power Plant Evaluation”)
1038	Evan J. Granite et al., “Sorbents for Mercury Removal from Flue Gas,” DOE/FETC/TR–98-01, U.S. Department of Energy (Jan. 1998) (“Granite”)
1039	Thomas J. Feeley, et al., “A Review of DOE/NETL’s Mercury Control Technology R&D Program for Coal-Fired Power Plants,” <i>DOE/NETL Hg R&D Program Review</i> (April 2003) (“Feeley”)
1040	Oxtoby et al., PRINCIPLES OF MODERN CHEMISTRY, 4 th ed (Saunders College Publishing: 1999) (“Oxtoby”)
1041	N.N. Greenwood and A. Earnshaw, CHEMISTRY OF THE ELEMENTS, 2nd ed. (Butterworth-Heinemann: 1997) (“Greenwood”)
1042	B.R. Puri, <i>Surface Complexes on Carbons</i> , in CHEMISTRY AND PHYSICS OF CARBON 191 (Philip L. Walker, ed.) (Marcel Dekker: 1970) (“Puri”)

Exhibit	Description of Exhibits
1043	Frank E. Huggins et al., “XAFS Examination of Mercury Sorption on Three Activated Carbons,” <i>Energy & Fuels</i> 1999(13), p. 114-121 (1999) (“ XAFS ”)
1044	S. Niksa et al., <i>Predicting Complete Hg Speciation Along Coal-Fired Utility Exhaust Systems</i> , MEGA SYMPOSIUM, Paper # 45 (Washington, DC: Aug. 2004) (“ Hg Speciation ”)
1045	D.L. Laudal et al., <i>Evaluation of Mercury Speciation at Power Plants Using SCR and SNCR NOx Control Technologies</i> , Paper No. A5-01, INT’L CONF. ON AIR QUALITY III (Arlington, VA: Sept. 9-12, 2002) (“ Laudal ”)
1046	U.S. Patent No. 4,196,173 to DeJong (“ DeJong ”)
1047	U.S. Patent No. 5,695,726 to Lerner (“ Lerner ”)
1048	Carey, T. R., Jr., O. W. H., Richardson, C. F., Chang, R., & Meserole, F. B. (1998). Factors Affecting Mercury Control in Utility Flue Gas Using Activated Carbon. <i>Journal of the Air & Waste Management Association</i> , 48(12), 1166–1174. https://doi.org/10.1080/10473289.1998.10463753 (“ Carey ”)
1049	NETL - Mercury Emissions Control, February, 2003, available at https://web.archive.org/web/20030315093905fw_/http://www.netl.doe.gov/coalpower/environment/mercury/control-tech/inactive.html (“ U.S. DOE, Completed Mercury Projects, February, 2003 ”)
1050	Proposed National Emission Standards for Hazardous Air Pollutants; and, in the Alternative, Proposed Standards of Performance for New and Existing Stationary Sources: Electric

Exhibit	Description of Exhibits
	Utility Steam Generating Units, 69 Fed. Reg. 4652-4752 [Volume 69, No. 20] (Jan. 30, 2004) (“EPA-Proposal”)
1051	U.S. EPA, “Study of Hazardous Air Pollutant Emissions from Electric Utility Steam Generation Units -- Final Report to Congress,” (Vol. 1 1998), available at https://www3.epa.gov/ttn/utox/eurtc1.pdf (“U.S. EPA – Vol. 1 1998”)
1052	U.S. EPA, “Mercury Study Report to Congress Volume 1: Executive Summary,” EPA-452/R-97-003 (Dec. 1997), available at https://www.epa.gov/sites/production/files/2015-09/documents/volume1.pdf (“U.S. EPA – Exec. Summary Vol. 1 Dec. 1997”)
1053	U.S. EPA, AP-42: External Combustion Sources, Chapter 1: Fifth Edition, Volume I (Sep. 1998), available at https://www3.epa.gov/ttn/chief/ap42/ch01/index.html (last visited Nov. 20, 2024) (“Chapter 1 of AP-42”)
1054	U.S. DOE, Mercury Emissions Control - Regulatory Drivers (Jan. 24, 2003), available at https://web.archive.org/web/20030416142937/http://www.netl.doe.gov/coalpower/environment/mercury/regs.html (“Mercury Emissions Control”)
1055	Clean Air Mercury Rule: Basic Information, available at https://web.archive.org/web/20050920005951/http://www.epa.gov/mercuryrule/basic.htm (“Clean Air Mercury Rule”)
1056	EPA Newsroom, “EPA Announces First-Ever Rule to Reduce Mercury Emissions from Power Plants” (Mar. 15, 2005), available

Exhibit	Description of Exhibits
	<p>at https://archive.epa.gov/epapages/newsroom_archive/newsreleases/91ab7266e65751b985256fc50067d9b0.html (“3/15/2005 EPA Press Release”)</p>
1057	<p>EPA Newsroom, “Public Comment Period Begins for Proposed Power Plant Regulations” (Jan. 29, 2004), available at https://archive.epa.gov/epapages/newsroom_archive/newsreleases/4daf1d46e8dd755c85257036005511f9.html (“1/29/2004 EPA Press Release”)</p>
1058	<p>EPA Newsroom, “EPA Supplements Proposal to Reduce Power Plant Mercury Emissions,” (Feb. 24, 2004), available at https://archive.epa.gov/epapages/newsroom_archive/newsreleases/5810096dabfc9eba85256e440078905f.html (“2/24/2004 EPA Press Release”)</p>
1059	<p>Sharon Sjostrom et al., “Field Studies of Mercury Control Using Injected Sorbents,” AWMA ANNUAL MEETING, Session Ae-1b (2002) (“Field Studies of Mercury Control”)</p>
1060	<p>EPA, “Mercury Study Report to Congress Volume VIII: An Evaluation of Mercury Control Technologies and Costs,” EPA Report No. EPA-452/R-97-010 (Dec. 1997), available at https://www3.epa.gov/airtoxics/112nmerc/volume8.pdf (“EPA 1997 Mercury Study Report Vol. VIII”)</p>
1061	<p>EUEC 2005 home page, available at https://web.archive.org/web/20050303090129/http://www.euec.com/</p>

Exhibit	Description of Exhibits
1062	Charlene R. Crocker et al., “Mercury Control with the Advanced Hybrid Particulate Collector Technical Progress Report,” U.S. DOE-NETL (Nov. 2003) (“Crocker”)
1063	Redline Comparison, showing changes from ’163 Application (as published at 2006/0048646) to ’970 Application (as published at 2018/0229182)
1064	Redline Comparison, showing changes from ’558 Application (as published at 2015/0246315) to ’970 Application (as published at 2018/0229182)
1065	U.S. Patent No. 8,168,147
1066	U.S. Patent No. 10,933,370
1067	U.S. Patent No. 10,589,225
1068	RESERVED
1069	U.S. Patent Pub. No. 2018/0229182 to Olson et al. (published Aug. 16, 2018) (“Published ’970 Application”)
1070	Roop Chand Bansal, et al., ACTIVE CARBON (Marcel Dekker:1988). (“Bansal”)

Exhibit	Description of Exhibits
1071	<i>Midwest Energy Emissions Corp., et al. v. Arthur J. Gallagher & Co., et al.</i> , No. 1:19-cv-01334-CJB, Dkt. No. 440 (D. Del. June 24, 2022) (“ Dkt No. 440 ”)
1072	<i>Midwest Energy Emissions Corp., et al. v. Arthur J. Gallagher & Co., et al.</i> , No. 1:19-cv-01334-CJB, Dkt. No. 447 (D. Del. July 12, 2022) (“ Dkt No. 447 ”)
1073	Welcome Page of CD mailed to conference attendees of the 2002 Air & Waste Management’s Association’s 95 th Annual Conference & Exhibition (Baltimore, Maryland: June 23-27, 2002) (“ AWMA CD Scan ”)
1074	Main Menu of CD mailed to conference attendees of the 2002 Air & Waste Management’s Association’s 95 th Annual Conference & Exhibition (Baltimore, Maryland: June 23-27, 2002) (“ AWMA CD Scan, Main Menu ”)
1075	Author Index of CD mailed to conference attendees of the 2002 Air & Waste Management’s Association’s 95 th Annual Conference & Exhibition (Baltimore, Maryland: June 23-27, 2002) (“ AWMA CD Scan, Author Index ”)
1076	Papers by Session of CD mailed to conference attendees of the 2002 Air & Waste Management’s Association’s 95 th Annual Conference & Exhibition (Baltimore, Maryland: June 23-27, 2002) (“ AWMA CD Scan, Papers by Session ”)
1077	Scan of jacket/cover of CD mailed to conference attendees of the 2002 Air & Waste Management’s Association’s 95 th Annual

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1078	AWMA Website (Internet Archive), available at https://web.archive.org/web/20020613041559/http://www.awma.org/about/overview.htm (“AWMA Overview”)
1079	AWMA Website (Internet Archive), available at https://web.archive.org/web/20020527005933/http://www.awma.org/ (“AWMA Homepage”, advertising AWMA 2002 Conference)
1080	AWMA Website (Internet Archive), available at https://web.archive.org/web/20020604012426/http://www.awma.org:80/about/ (“AWMA About Page”)
1081	AWMA Website (Internet Archive), available at https://web.archive.org/web/20020601173851/http://www.awma.org/ACE2002/tech-program/MondayPM.asp#AE-1c (“AWMA Technical Program Schedule for June 24, 2002 for Session AE-1C”)
1082	AWMA Website (Internet Archive), available at https://web.archive.org/web/20020616091740/http://www.awma.org/ACE2002/exhibition/list.asp (“AWMA 2002 Conference list of exhibitors”)
1083	AWMA Website (Internet Archive), available at https://web.archive.org/web/20020601121532/http://www.awma.org/ACE2002/top10list.asp (“AWMA 2002 Conference Top Ten Reasons”)

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1084	AWMA Website (Internet Archive), available at https://web.archive.org/web/20020610093515/http://www.awma.org/ACE2002/welcome.asp (“AWMA 95th Annual Conference and Exhibition Welcome Page”)
1085	AWMA Website (Internet Archive), available at https://web.archive.org/web/20020806044928/http://www.awma.org:80/pubs/bookstore/ItemInfo.asp?OrderCode_s=VIP-110-CD (“AWMA Bookstore Page for 2002 AWMA Conference CD”)
1086	AWMA Website (Internet Archive), available at https://web.archive.org/web/20020806041256/http://www.awma.org:80/pubs/bookstore/ (“AWMA Bookstore Homepage”)
1087	State of Massachusetts Mass-EPA (Internet Archive) (dated Jan. 6, 2003), available at https://web.archive.org/web/20030106044457/http://www.state.ma.us/dep/bwp/about.htm (describing mission of Mass Department of Environmental Protection, Bureau of Waste Prevention)
1088	State of Massachusetts Mass-EPA (Internet Archive) (dated Dec. 21, 2002), available at https://web.archive.org/web/20021221040816/http://www.state.ma.us/dep/bwp/bwpprogs.htm (describing the divisions and programs of the Mass Bureau of Waste Prevention)
1089	State of Massachusetts Mass-EPA (Internet Archive) (dated Jan. 6, 2003), available at https://web.archive.org/web/20030106024342/http://www.state.ma.us/dep/bwp/bwppubs.htm (describing the publications by program of the Mass Bureau of Waste Prevention)

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1090	State of Massachusetts Mass-EPA (Internet Archive) (dated Dec. 20, 2002), available at https://web.archive.org/web/20021220143210/http://www.state.ma.us/dep/bwp/daqc/daqcpubs.htm#ecp (describing the Air Program Planning Unit Publications of the Mass Bureau of Waste Prevention)
1091	Internet Archive Standard Affidavit, explaining how to interpret hyperlinks, available at https://archive.org/legal/affidavit.php
1092	Expert Report of Philip J. O’Keefe, PE Regarding Infringement (Oct. 25, 2022) (excerpted), submitted by Patent Owner in <i>Midwest Energy Emissions Corp., et al. v. Arthur J. Gallagher & Co., et al.</i> , No. 1:19-cv-01334-CJB
1093	Deposition Transcript of Phillip O’Keefe Vol. 1 (Mar. 2, 2023), taken in <i>Midwest Energy Emissions Corp., et al. v. Arthur J. Gallagher & Co., et al.</i> , No. 1:19-cv-01334-CJB.
1094	Deposition Transcript of Phillip O’Keefe Vol. 2 (Mar. 3, 2023), taken in <i>Midwest Energy Emissions Corp., et al. v. Arthur J. Gallagher & Co., et al.</i> , No. 1:19-cv-01334-CJB.
1095	Deposition Transcript of Edwin Olson (Aug. 26, 2022) (excerpted), taken in <i>Midwest Energy Emissions Corp., et al. v. Arthur J. Gallagher & Co., et al.</i> , No. 1:19-cv-01334-CJB.
1096	Deposition Transcript of Michael Holmes (Aug. 24, 2022) (excerpted), taken in <i>Midwest Energy Emissions Corp., et al. v. Arthur J. Gallagher & Co., et al.</i> , No. 1:19-cv-01334-CJB.

Exhibit	Description of Exhibits
1097	Deposition Transcript of John Pavlish (Aug. 25, 2022) (excerpted), taken in <i>Midwest Energy Emissions Corp., et al. v. Arthur J. Gallagher & Co., et al.</i> , No. 1:19-cv-01334-CJB.
1098	Affidavit of Tanya Zeif, Custodian of Records for Internet Archive (1/10/2025), sponsoring Exhibits 1078-1086
1099	Affidavit of Tanya Zeif, Custodian of Records for Internet Archive (1/13/2025), sponsoring Exhibits 1009, 1061, 1087-1090
1100	RESERVED
1101	RESERVED
1102	RESERVED
1103	RESERVED
1104	<i>IN RE: MIDWEST ENERGY EMISSIONS CORP. PATENT LITIGATION</i> , No. 4:24-md-03132-SHL-WPK, Dkt. No. 60 (S.D. Iowa Mar. 7, 2025) (“ Dkt No. 60 ”)
1105	<i>NRG Energy, Inc. et al. v. Midwest Energy Emissions Corp.</i> , IPR2020-00926, Paper 13 (P.T.A.B. Sep. 4, 2020)
1106	Clarion Energy Content Directors, “A Variety of Hg Capture Solutions Are Available” (June 1, 2009), available at https://www.power-eng.com/environmental-emissions/a-variety-of-

Exhibit	Description of Exhibits
	hg-capture-solutions-are-available/ (“Variety of Hg Capture Solutions”)
1107	Modern Power Systems, “Full scale tests show KNXTM is effective for mercury control” (October 1, 2009), available at https://www.modernpowersystems.com/analysis/full-scale-tests-show-knxtm-is-effective-for-mercury-control/ (“KNXTM is effective”)
1108	File History of U.S. Patent Application No. 16/509,071, which ultimately issued as U.S. Patent No. 10,926,218 (“ ’218 Patent File History ”)
1109	U.S. Patent Pub. No. 2019/0336913 to Olson et al. (published Nov. 7, 2019) (“ Published ’071 Application ”)

Other than prosecution histories, EX1019-EX1023, EX1025-EX1026, EX1108 all citations to exhibits reference original page numbers found in the underlying document, and all emphases are added.

TABLE OF CHALLENGED CLAIMS

Claim Element	Claim Language from '218 Patent
1(Preamble)	1. A method of separating mercury from a mercury-containing gas, the method comprising:
1(a)	combusting coal in a combustion chamber, to provide the mercury-containing gas,
1(b)	wherein the coal comprises added HI, an iodide salt, or a combination thereof, added to the coal before the coal enters the combustion chamber, or the combustion chamber comprises added HI, an iodide salt, or a combination thereof, or a combination thereof;
1(c)	injecting a sorbent comprising activated carbon into the mercury-containing gas downstream of the combustion chamber,
1(d)	wherein a weight ratio of the HI, iodide salt, or the combination thereof added to the coal, added to the combustion chamber, or a combination thereof, to an amount of the sorbent injected into the mercury-containing gas is from about 1:100 to about 30:100;
1(e)	contacting mercury in the mercury-containing gas with the sorbent; and
1(f)	separating the sorbent contacted with the mercury from the mercury-containing gas.
2	2. The method of claim 1, wherein the coal comprises the added HI, the iodide salt, or a combination thereof, added to the coal before the coal enters the combustion chamber.
3	3. The method of claim 1, wherein the combustion chamber comprises the added HI, the iodide salt, or a combination thereof.
4	4. The method of claim 1, wherein the coal is combusted in the combustion chamber at a coal-combustion facility, wherein the HI, iodide salt, or combination thereof, is added to the coal before the coal enters the combustion chamber, wherein the addition of the HI, iodide salt, or combination

Claim Element	Claim Language from '218 Patent
	thereof, to the coal is performed at the coal-combustion facility.
6	6. The method of claim 1, wherein the combustion chamber is a coal combustion chamber that is used to produce electricity.
7	7. The method of claim 1, wherein the combustion chamber is a coal combustion furnace.
8	8. The method of claim 1, wherein the coal comprises a subbituminous coal.
9	9. The method of claim 1, wherein the coal comprises a lignite coal.
10	10. The method of claim 1, further comprising measuring the mercury content of the mercury-containing gas; and modifying, in response to the measured mercury content of the mercury-containing gas, an injection rate of injecting the sorbent into the mercury-containing gas, an amount of the HI, the iodide salt, or a combination thereof, added to the coal or the combustion chamber, or a combination thereof.
11	11. The method of claim 10, wherein the measuring of the mercury content of the mercury-containing gas comprises continuous measurement.
12	12. The method of claim 1, further comprising modifying, in response to a measured mercury content, an injection rate of injecting the sorbent into the mercury-containing gas, an amount of the HI, the iodide salt, or a combination thereof, added to the coal or the combustion chamber, or a combination thereof.
13	13. The method of claim 1, wherein the sorbent contacted with the mercury comprises the element iodine and mercury.
14	14. The method of claim 1, comprising removing greater than 70 wt % of the mercury in the mercury-containing gas.

Claim Element	Claim Language from '218 Patent
15	15. The method of claim 1, comprising removing greater than 70 wt % of the mercury in the mercury-containing gas with the sorbent.
16	16. The method of claim 1, wherein the combination of the contacting of the mercury in the mercury-containing gas with the sorbent and the separating of the sorbent contacted with the mercury from the mercury-containing gas decreases the amount of elemental mercury in the mercury-containing gas.
17	17. The method of claim 1, wherein the sorbent injected into the mercury-containing gas is a sorbent obtained by contacting a sorbent with a halogen or halide promoter prior to injection of the sorbent into the mercury-containing gas.
18	18. The method of claim 1, wherein the sorbent injected into the mercury-containing gas is free of contact with a halogen or halide promoter prior to injection of the sorbent into the mercury-containing gas.
19	19. The method of claim 1, further comprising injecting an additive comprising a compound comprising Ca, Na, or a combination thereof, into the mercury-containing gas downstream of the combustion chamber.
20	20. The method of claim 1, wherein the mercury-containing gas is a flue gas.
21	21. The method of claim 1, wherein the injection of the sorbent into the mercury-containing gas occurs upstream of a particulate separator or a scrubber.
22	22. The method of claim 21, wherein the particulate separator is an electrostatic precipitator, a baghouse, a fabric filter, or a combination thereof.
23	23. The method of claim 1, wherein the coal comprises added halide sorbent enhancement additive that comprises the HI, iodide salt, or combination thereof.
24	24. The method of claim 1, wherein the coal and/or the combustion chamber comprises the iodide salt.
25(Preamble)	25. A method for reducing mercury in a mercury containing gas, the method comprising:
25(a)	combusting coal in a combustion chamber, the coal comprising an additive comprising added HI, an iodide salt,

Claim Element	Claim Language from '218 Patent
	or a combination thereof, to form the mercury-containing gas;
25(b)	collecting mercury in the mercury-containing gas with an injected sorbent comprising activated carbon,
25(c)	wherein a weight ratio of the HI, iodide salt, or the combination thereof added to the coal, added to the combustion chamber, or a combination thereof, to an amount of the sorbent injected into the mercury-containing gas is from about 1:100 to about 30:100.
26(Preamble)	26. A method of separating mercury from a mercury-containing gas, the method comprising:
26(a)	combusting coal in a combustion chamber, to provide the mercury-containing gas,
26(b)	wherein the coal comprises added HI, an iodide salt, or a combination thereof, added to the coal before the coal enters the combustion chamber, or the combustion chamber comprises added HI, an iodide salt, or a combination thereof, or a combination thereof;
26(c)	injecting a sorbent comprising activated carbon into the mercury-containing gas downstream of the combustion chamber such that the activated carbon reacts with the halogen or halide promoter in the mercury-containing gas to form a promoted sorbent,
26(d)	wherein a weight ratio of the HI, iodide salt, or the combination thereof added to the coal, added to the combustion chamber, or a combination thereof, to an amount of the sorbent injected into the mercury-containing gas is from about 1:100 to about 30:100;
26(e)	contacting mercury in the mercury-containing gas with the promoted sorbent;
26(f)	separating the promoted sorbent contacted with the mercury from the mercury-containing gas;
26(g)	measuring the mercury content of the mercury-containing gas;

Claim Element	Claim Language from '218 Patent
	and modifying, in response to the measured mercury content of the mercury-containing gas, an injection rate of injecting the sorbent into the mercury-containing gas, an amount of the HI, the iodide salt, or a combination thereof, added to the coal or the combustion chamber, or a combination thereof.

I. INTRODUCTION

Petitioners request IPR of Claims 1-4 and 6-26 of U.S. Patent 10,926,218 (“**218 Patent**” or “**Challenged Patent**”). EX1001. The Petition is supported by the expert declaration of Dr. Stephen Niksa.¹ EX1002 (declaration); EX1003 (CV).

II. MANDATORY NOTICES [37 C.F.R. §42.8(A)(1)]

A. REAL PARTY-IN-INTEREST [37 C.F.R. §42.8(B)(1)]

The real parties-in-interest are the Petitioners: PacifiCorp; Interstate Power & Light Company; MidAmerican Energy Company; WEC Energy Group, Inc.; and Wisconsin Power & Light Company (collectively, “**Petitioners**”).

Petitioners also identify the following real-parties-in-interest (in addition to the Petitioners themselves): Alliant Energy Corporation; Alliant Energy Corporate Services, Inc; and Berkshire Hathaway Energy Company. These entities were previously parties to the lawsuit in the Southern District of Iowa where they have been accused of infringing the Challenged Patent.

Petitioner PacifiCorp identifies the following additional real-parties-in-interest: Berkshire Hathaway Energy Company; MidAmerican Funding, LLC; MHC Inc.; and PPW Holdings LLC.

¹ Named inventor of the Challenged Patent, Mr. Pavlish, admitted that Dr. Niksa is knowledgeable in the field. EX1097, 253:21–254:17.

Petitioner Interstate Power & Light Company identifies the following additional real-parties-in-interest: Alliant Energy Corporation and Alliant Energy Corporate Services, Inc.

Petitioner MidAmerican Energy Company identifies the following additional real-parties-in-interest: MidAmerican Funding, LLC and MHC Inc.

Petitioner Wisconsin Power & Light Company identifies the following additional real-parties-in-interest: Alliant Energy Corporation; Alliant Energy Corporate Services, Inc.; and Madison Gas and Electric Company.

Other than Petitioners and the above-identified real-parties-in-interest, no other person or entity is funding this petition, advising on strategy for this petition, or exercising any control over Petitioners' decision to file the petition (or the arguments included therein).

Petitioner WEC Energy Group, Inc., out of an abundance of caution, also identifies Wisconsin Public Service Corporation as a potential real party-in-interest to the Petitioner WEC Energy Group, Inc. This potential real-party-in-interest is not funding this petition, advising on strategy for this petition, or exercising any control over Petitioners' decision to file the petition (or the arguments included therein).

B. RELATED MATTERS [37 C.F.R. §42.8(B)(2)]

Petitioners are concurrently filing a second petition against the Challenged Patent. The current petition assumes *arguendo* that the Challenged Claims of the

'218 Patent have priority to August 30, 2004, the earliest-filed Provisional Application, and that the pre-AIA statute applies. The second petition asserts a priority date of no earlier than April 12, 2018, the filing date of Application No. 15/951,970, because the earlier-filed applications to which the '218 Patent claims priority do not contain written-description support for the Challenged Claims.

Petitioners previously filed two petitions against U.S. Patent No. 10,343,114 (“the '114 Patent”), a counterpart with substantially similar claims. Petitioners also filed two petitions against each of: U.S. Patent Nos. 10,596,517 (“the '517 Patent”); U.S. Patent No. 10,668,430 (“the '430 Patent”); U.S. Patent No. 10,589,225 (“the '225 Patent”); U.S. Patent No. 10,933,370 (“the '370 Patent”)—counterpart patents with substantially similar claims:

- *Berkshire Hathaway Energy Co. et al. v. Birchtech Corp.*, IPR2025-00274, Paper 1 (P.T.A.B. Jan. 17, 2025).
- *Berkshire Hathaway Energy Co. et al. v. Birchtech Corp.*, IPR2025-00278, Paper 1 (P.T.A.B. Jan. 17, 2025).
- *Berkshire Hathaway Energy Co. et al. v. Birchtech Corp.*, IPR2025-00280, Paper 1 (P.T.A.B. Jan. 24, 2025).
- *Berkshire Hathaway Energy Co. et al. v. Birchtech Corp.*, IPR2025-00281, Paper 1 (P.T.A.B. Jan. 24, 2025).
- *Berkshire Hathaway Energy Co. et al. v. Birchtech Corp.*, IPR2025-00422, Paper 1 (P.T.A.B. Feb. 11, 2025).
- *Berkshire Hathaway Energy Co. et al. v. Birchtech Corp.*, IPR2025-00423, Paper 1 (P.T.A.B. Feb. 11, 2025).

- *PacifiCorp et al. v. Birchtech Corp.*, IPR2025-00424, Paper 1 (P.T.A.B. Mar. 4, 2025).
- *PacifiCorp et al. v. Birchtech Corp.*, IPR2025-00425, Paper 1 (P.T.A.B. Mar. 4, 2025).
- *PacifiCorp et al. v. Birchtech Corp.*, IPR2025-00687, Paper 1 (P.T.A.B. Mar. 24, 2025).
- *PacifiCorp et al. v. Birchtech Corp.*, IPR2025-00687, Paper 1 (P.T.A.B. Mar. 24, 2025).

Though no petitions for IPR have previously been filed against the '218 Patent, the Board previously granted institution of IPR on two petitions against the related '114 Patent that had been filed by NRG, Vistra, and Talen in the following proceedings:

- *NRG Energy, Inc. et al. v. Midwest Energy Emissions Corp.*, IPR2020-00832, Paper 17, 2020 WL 6277239 (P.T.A.B. Oct. 26, 2020). EX1026, 16-63.
- *NRG Energy, Inc. et al. v. Midwest Energy Emissions Corp.*, IPR2020-00834, Paper 18, 2020 WL 6277747 (P.T.A.B. Oct. 26, 2020). EX1026, 64-108.

Prior to institution, Vistra and Midwest Energy Emissions Corp. (“ME2C” or “Patent Owner” (“PO”)) filed a joint motion to terminate as to Vistra as a result of settlement. Shortly after institution, before ME2C filed any patent owner response (37 CFR §42.120), the remaining petitioners (NRG and Talen) and ME2C jointly requested that the proceedings be terminated pursuant to a settlement. EX1026, 1-10.

After NRG, Vistra, and Talen filed the petitions in IPR2020-00832 and IPR2020-00834, AEP Generation Resources Inc. filed two petitions which it characterized as “copycat” petitions. AEP stated that if the petitions were granted in IPR2020-00832 and IPR2020-00834, then AEP “will file a motion for joinder under 37 CFR §§42.22 and 42.122(b) to join the instituted prior IPRs.” IPR2020-01294 and IPR2020-01295, Paper 2 (July 15, 2020). AEP withdrew its petitions prior to institution. EX1026, 12-15.

The Board also granted institution of IPR on two petitions against U.S. Patent No. 8,168,147 (“the ’147 Patent”)—a parent patent to the ’218 Patent with overlapping priority-date issues—that had been filed by NRG, Vistra, and Talen in the following proceedings:

- *NRG Energy, Inc. et al. v. Midwest Energy Emissions Corp.*, IPR2020-00926, Paper 19, 2020 WL 7061347 (P.T.A.B. Dec. 2, 2020).
- *NRG Energy, Inc. et al. v. Midwest Energy Emissions Corp.*, IPR2020-00928, Paper 17, 2020 WL 7074473 (P.T.A.B. Dec. 2, 2020).

As with the IPR2020-00832 and IPR2020-00834 proceedings, the IPR2020-00926 and IPR2020-00928 proceedings were jointly terminated pursuant to settlement shortly after institution.

Patent Owner has asserted the Challenged Patent in district court in the following matters:

- *Midwest Energy Emissions Corp. v. Tucson Electric Power Co. et al.*, No. 3:24-cv-08145-DJH (D. Ariz.) (filed July 17, 2024).

- *Midwest Energy Emissions Corp. v. Berkshire Hathaway Energy Co. et al.*, No. 4:24-cv-00248 (S.D. Iowa) (filed July 17, 2024).
- *Midwest Energy Emissions Corp. v. Ameren Corp. et al.*, No. 4:24-cv-00980 (E.D. Mo.) (filed July 17, 2024).
- *In re Midwest Energy Emissions Corp. Pat. Litig.*, No. 4:24-md-3132 (S.D. Iowa) (consolidating the Iowa, Arizona, and Missouri cases on Dec. 17, 2024).
- *Midwest Energy Emissions Corp. v. Berkshire Hathaway Energy Co., et al.*, No. 2:25-cv-00015 (D. Wy.) (filed Jan. 14, 2025).
- *Midwest Energy Emissions Corp. v. Wisconsin Power & Light Co.*, No. 3:25-cv-00026 (W.D. Wis.) (filed Jan. 14, 2025).
- *Birchtech Corp. f/k/a/ Midwest Energy Emissions Corp. v. Evergy, Inc., et al.*, No. 4:25-cv-00050 (W.D. Mo.) (filed Jan. 23, 2025).
- *Midwest Energy Emissions Corp. v. Evergy, Inc. et al.*, No. 4:25-cv-00046 (S.D. Iowa) (filed Feb. 6, 2025).

Other than WEC (who is not a defendant in any case), Petitioners have been defendants in the Iowa case. On January 10, 2025, the district court in Iowa granted a motion to dismiss, dismissing Berkshire Hathaway Energy (“BHE”) outright from the litigation, transferred PacifiCorp to the District of Wyoming, and transferred Wisconsin Power & Light Co. to the District of Wisconsin. *See In re Midwest Energy Emissions Corp. Pat. Litig.*, No. 4:24-md-3132, ECF 19 (S.D. Iowa Jan. 10, 2025).

According to U.S. Patent & Trademark Office Patent Center, the ’218 Patent was filed as App. No. 16/509,071 (“the ’071 Application”) on July 11, 2019, and purports to claim priority as follows:

- Continuation of U.S. Patent Application No. 15/997,091 filed on June 4, 2018 (“the ’091 Application”) and issued on March 24, 2020, as U.S. Patent No. 10,596,517, which is a:
- Continuation of U.S. Patent Application No. 15/974,343, filed on May 8, 2018 (“the ’343 Application”) and issued on June 2, 2020, as U.S. Patent No. 10,668,430, which is a:
- Continuation of U.S. Patent Application No. 15/951,970, filed on April 12, 2018 (“the ’970 Application”) and issued on March 2, 2021, as U.S. Patent No. 10,933,370, which is a:
- Continuation of U.S. Patent Application No. 14/712,558, filed on May 14, 2015 (“the ’558 Application”) and issued on March 17, 2020, as U.S. Patent No. 10,589,225, which is a:
- Continuation of U.S. Patent Application No. 14/318,270, filed on June 27, 2014 (“the ’270 Application”) and issued on September 12, 2017, as U.S. Patent No. 9,757,689, which is a:
- Continuation of U.S. Patent Application No. 13/966,768, filed on August 14, 2013 (“the ’768 Application”) and issued on September 2, 2014, as U.S. Patent No. 8,821,819, which is a:
- Continuation of U.S. Patent Application No. 13/427,665, filed on March 22, 2012 (“the ’665 Application”) and issued on August 20, 2013, as U.S. Patent No. 8,512,655, which is a:
- Continuation of U.S. Patent Application No. 12/419,219, filed on April 6, 2009 (“the ’219 Application”) and issued on May 1, 2012, as U.S. Patent No. 8,168,147, which is a:
- Continuation of U.S. Patent Application No. 12/201,595, filed on Aug. 29, 2008 (“the ’595 Application”) and abandoned on September 30, 2010, which is a:
- Division of U.S. Patent Application No. 11/209,163, filed on Aug. 22, 2005 (“the ’163 Application”) and issued on September 24, 2008, as U.S. Patent No. 7,435,286, which is a non-provisional of:
- U.S. Provisional Patent Application No. 60/605,640, filed on August 30, 2004 (the “Provisional”).

The prior proceedings all involved ME2C. On November 7, 2024, ME2C filed a notice with the USPTO that it had changed its name to Birchtech Corp. *See* Reel 069187, Frame 0413. Yet, ME2C is still proceeding in the district-court litigations as a plaintiff under the ME2C name.

C. LEAD AND BACK-UP COUNSEL [37 C.F.R. §42.8(B)(3)]

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D. SERVICE INFORMATION [37 C.F.R. §42.8(B)(4)]

Petitioners may be served at lead counsel's address provided above and consent to e-mail service, provided it is made to all the following e-mail addresses:

dtobin@mwe.com; boaks@mwe.com; PacifiCorp-PTAB-ME2C@mwe.com;

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III. FEES

Payment for fees is authorized from Deposit Account 50-0417.

IV. REQUIREMENTS FOR *INTER PARTES* REVIEW [37 C.F.R. §42.104(A), (B)(1)-(B)(3)]

A. STANDING

Petitioners certify the '218 Patent is eligible for IPR, and Petitioners are not barred or estopped from requesting IPR challenging the identified claims on the grounds herein.

B. IDENTIFICATION OF CHALLENGED CLAIMS AND GROUNDS

There is a reasonable likelihood that the petitioned claims are unpatentable as follows:

Ground	'218 Claims	Basis for Challenge
1.	1-4, 6-26	§103: Obvious over Vosteen589 (EX1005) and Starns (EX1008)
2.	1-4, 6-26	§103: Obvious over Vosteen589 (EX1005) and Mass-EPA (EX1009)
3.	1, 3, 6-18, 20-26	§103: Obvious over Lissianski (EX1014) and Starns (EX1008)
4.	1, 3, 6-26	§103: Obvious over Lissianski (EX1014) and Mass-EPA (EX 1009)

Ground	'218 Claims	Basis for Challenge
5.	2, 4, 6, 23-25	§103: Obvious over Lissianski (EX1014), Starns (EX1008), and Vosteen589 (EX1005)
6	2, 4, 6, 23-25	§103: Obvious over Lissianski (EX1014), Mass-EPA (EX 1009), and Vosteen589 (EX1005)

EX1002 ¶13.

C. CLAIM CONSTRUCTION [37 CFR §42.104(B)(3)]

Petitioners do not, at this time, contend that any term requires construction. All terms have been accorded their plain and ordinary meaning. EX1002 ¶¶213-216.

V. OVERVIEW OF '218 PATENT

A. LEVEL OF ORDINARY SKILL

A person of ordinary skill in the art (“POSITA”) would have at least a bachelor’s degree in chemical engineering, mechanical engineering, or a related field of study with at least two years of experience implementing pollution control in power generation plants for natural gas, coal, and/or industrial waste incineration. EX1002 ¶¶48-51.

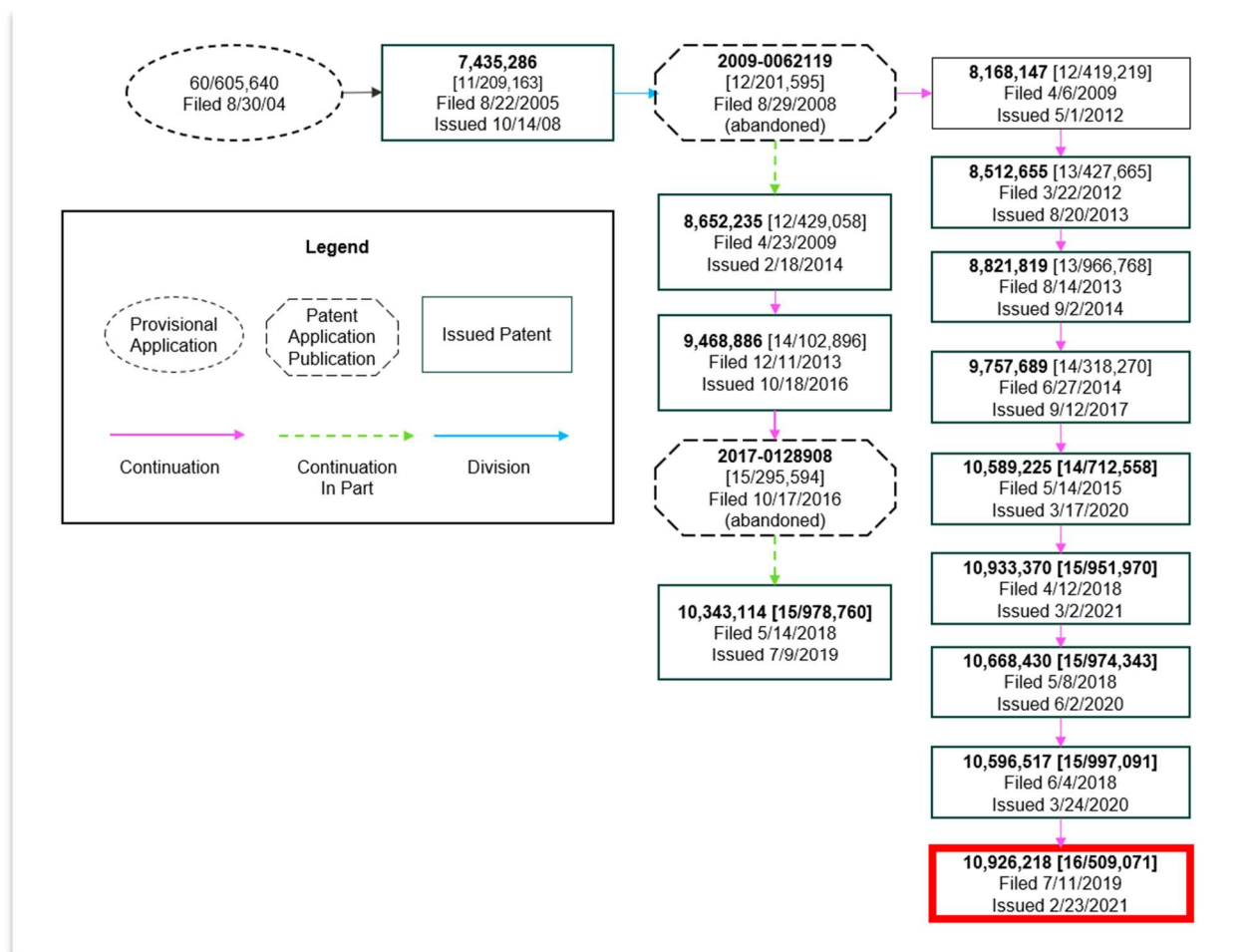
B. THE ALLEGED INVENTION OF THE '218 PATENT

The '218 Patent relates to removing mercury from flue gas. EX1001, 1:46-50. The Patent admits that known “mercury control methods” included injecting activated-carbon sorbent, including “expos[ing] a finely powdered activated carbon

to a molecular bromine gas at an elevated temperature or to HBr to produce a sorbent with good mercury removal ability.” EX1001, 2:10-15, 30:36-40. Each independent claim includes: adding HI and/or iodide salt to the combustion chamber and/or coal; contacting mercury in the mercury-containing gas with activated-carbon sorbent, added within a range of weight ratios compared with the additive; and separating the sorbent from the mercury-containing gas. Even this combination was known in the art. EX1002 ¶¶152-156, 209-212.

C. PROSECUTION HISTORY OF THE '218 PATENT

The '218 Patent was filed July 11, 2019, as Application 16/509,071 (“’071 Application”) (EX1108), stemming through ten earlier non-provisional applications to App. No. 60/605,640 (the “Provisional”) (EX1020) filed August 30, 2004. EX1002 ¶¶157-170.



EX1004 (annotated). In 15/951,970 (4/12/2018), PO significantly amended the specification. See EX1063-EX1064 (redline comparisons).

During prosecution of 16/509,071, the claims were amended in November 2020 to add a weight ratio:

Independent claim 1 is presently amended to recite “...wherein a weight ratio of I⁻ in the added HI₂ iodide salt, or the combination thereof entering the combustion chamber to an amount of the sorbent injected into the mercury-containing gas is from 1:100 to 30:100....” Independent claims 28 and 29 are correspondingly amended. Support can be found in the present published US application at paragraphs [0021], [0025], and [0072].

EX1108, 171-198. Applicants then distinguished prior art based on this Amendment. EX1108, 172-173. Two months earlier, in September 2020, PO argued to the PTAB for a parent to the '218 Patent (seeking an earlier invention date) “that the 1%-30% range limitation is not entitled to any patentable weight,” as the “range presented nothing more than optimization of result-effective variables that would have been obvious to a POSITA.” EX1105 (IPR2020-00926, Paper 13), 34-35. The '218 Patent examiner was not provided with this information and ultimately allowed the claims based on the 1-30 ratio. EX1002 ¶¶164-170; EX1108, 111; *see Belcher Pharms., LLC v. Hospira, Inc.*, 11 F.4th 1345 (Fed. Cir. 2021) (“alleged critical improvement over the prior art was therefore already within the public domain, just not before the examiner”).

D. STATE OF THE ART

The inquiry into whether the “differences between the invention and the prior art would have rendered the invention obvious to a [POSITA] necessarily depends on such artisan’s knowledge,” including “assessment of the background knowledge possessed” by a POSITA. *Koninklijke Philips N.V. v. Google LLC*, 948 F.3d 1330, 1337 (Fed. Cir. 2020) (citations omitted). The subjects below would have been “within the general knowledge of a skilled artisan” by 2004. *Id.* at 1338. EX1002 ¶52.

1. Mercury and Halogens

It was known that halogens exist in nature as diatomic molecules (e.g., Cl_2 , I_2), hydrohalides (e.g., hydrogen iodide), and other halides (e.g., sodium chloride or potassium iodide). EX1040; EX1002 ¶¶53-68 (chemistry fundamentals). It was known that mercury generally exists as elemental (Hg^0) and oxidized (Hg_2^{2+} (mercurous) or Hg^{2+} (mercuric)). EX1052, 2-1; EX1002 ¶65.

2. Coal-Fired Power Plants

It was known that pulverized-coal firing was performed by feeding particle-sized coal to a combustion chamber, known as a “boiler.” EX1027, 11-13, 12-2, 12-8, 13-1, 18-1. Combustion gases with entrained particles, mercury (Hg), and other pollutants are referred to as flue gases. EX1027, 19-1; EX1053, 1.1-1 to 1.1-11; EX1002 ¶¶69-77 (discussing EX1027, Plate 8, 8-3, 13-3–13-5, 18-2, 18-3, 19-6).

Various downstream components were used to control undesirable flue-gas constituents, including electrostatic precipitators (“ESP”) for particulates. EX1027, 33-1–33-7; EX1053, 1.1-6–1.1-9; EX1037; EX1045; EX1002 ¶78-96, 212.

3. EPA Regulations

It was known that mercury posed health concerns. EX1051, ES-27, 7-45; EX1052, 2-6; EX1053, 1.1-1 to 1.1-11. In 2000, the EPA announced plans to further regulate mercury emissions. EX1039, 2-8. The EPA passed the Clean Air Mercury

Rule in 2005, but gave the industry advanced notice. EX1039, 8; EX1050; EX1055-EX1058. The power-generation industry mobilized a massive response to evaluate mercury-emissions controls in the early 2000s. EX1039; EX1049; EX1002 ¶¶116-128.

4. Mercury Removal Using Activated Carbon and Halogens

By 1998, “[a]ctivated carbons ha[d] been the most thoroughly studied sorbent for the capture of mercury.” EX1038, 22; *see* EX1060, 2-54; EX1002 ¶98. The named inventors admitted that “activated carbon was the most common [or heavily] studied sorbent for mercury control.” EX1096 (Holmes), 41:5-9; EX1095 (Olson), 114:21-25; *see* EX1097 (Pavlish), 210:4-18; EX1001, 2:5-10, 28:11-19 (known “mercury control methods” included activated carbon). EX1002 ¶¶97-115, 209-211.

By 1934, halogens were known to improve activated carbon in removing mercury. *See* EX1029, 1:33-41; *see* EX1002 ¶132. By 1999, researchers demonstrated that flue-gas mercury chemically bonded with halogenated activated-carbon sorbents. EX1043, 119; EX1041, 804, 1212-1213; EX1042, 255-262; EX1070, iii-viii, 238, 259, 391. By 2004, these findings were generalized to interpret capturing elemental and oxidized mercury on activated-carbon sorbents. EX1044, 4-5; EX1062 at 2-3 (halides “improve[d] Hg capture both by conversion of the Hg^0 to the more easily removed Hg^{2+} forms and by enhancing the reactivity

of Hg⁰ with activated carbons”). It was known that halogens improved effectiveness of activated carbon in removing mercury. EX1002 ¶¶129-151 (state of the art, supported by EX1005-EX1006, EX1008, EX1012-EX1014, EX1028, EX1046-EX1048; EX1106-1107).

VI. THE ASSERTED REFERENCES

Petitioner asserts four prior-art references in this petition:

Reference	Prior-Art Status (pre-AIA)
Vosteen589 , EX1005 US2004/0013589A1	§102(e) Filed: 7/24/2002
Starns , EX1008	§§102(a)-(b) Presented 6/24/2002 at AWMA, mailed to attendees in Summer 2002, and available for purchase online at least by August 2002
Mass-EPA , EX1009	§§102(a)-(b) Published December 2002 and publicly accessible at least by 1/6/2003
Lissianski , EX1014	§102(e) Filed: 1/6/2004

If PO seeks to swear behind any asserted references, PO bears the burden to produce evidence of entitlement to priority before the actual filing date. *PowerOasis, Inc. v. T-Mobile USA, Inc.*, 522 F.3d 1299, 1304-05 (Fed. Cir. 2008). Petitioner may rebut such arguments at that time, including that the '218 Patent cannot claim priority to any pre-AIA parent application, so PO cannot swear behind references; or that Vosteen589 is §102(b) (pre-AIA) prior art.

**VII. GROUNDS 1-2: OBVIOUSNESS OVER
VOSTEEN589/STARNS/MASS-EPA**

Ground 1 asserts obviousness of Claims 1-4 and 6-26 over Vosteen589 (EX1005) and Starns (EX1008), and Ground 2 asserts obviousness of Claims 1-4 and 6-26 over Vosteen589 and Mass-EPA (EX1009). EX1002 ¶280.

A. OVERVIEW OF EX1005 (“VOSTEEN589”)

Vosteen589 (filed 7/24/2002) describes removing “mercury from the flue gases” in “bituminous coal-fired or lignite-fired power stations.” EX1005 ¶¶[0007]-[0008]. Vosteen589 adds “bromine and/or a bromine compound and/or a mixture of various bromine compounds” directly to coal. EX1005 ¶¶[0006], [0013]. Vosteen589 recognizes that “[i]odine compounds oxidize mercury more effectively compared with bromine compounds. However, from economic aspects, bromine compounds are preferably used in the inventive process.” EX1005 ¶[0016]. Accordingly, Vosteen589 proposes that an “iodine compound can be fed ... as a supplement to, or partial replacement of, the added bromine compound.” EX1005

¶[0016]. Downstream of the combustion chamber, “activated carbon” (a “dry sorbent”) is used with the “dry or semi-dry adsorption-based emission control stage.”

EX1005 ¶¶[0019]-[0020]; EX1002 ¶¶217-218, 220-221.

B. OVERVIEW OF EX1008 (“STARNS”) AND EX1009 (“MASS-EPA”)

A printed publication qualifies as prior art “so long as the relevant public has a means of accessing” it. *GoPro, Inc. v. Contour IP Holding LLC*, 908 F.3d 690, 693 (Fed. Cir. 2018). Each reference meets the *GoPro* standard and qualifies as a printed publication under 35 U.S.C. §§102(a)-102(b) (pre-AIA). EX1002 ¶¶233, 237.

1. Starns (Grounds A1, A3, A5)

Starns was delivered at the June 2002 Air & Waste Management Conference in Baltimore, Maryland (“AWMA”).

Technical Program
Monday, June 24, 2002

AE-1c Panel

Results from Full-Scale Mercury Control Testing: Overview and Panel Discussion

Sponsoring Committee: AE-1

Chair: Sharon Sjostrom, Apogee

Co-Chair: C. Jean Bustard, ADA-ES

Panel will begin at 1:30 p.m.

1:30 p.m. Travis Starns, ADA-ES: Full Scale Tests of Mercury Control with Sorbent Injection and an ESP at Wisconsin Electric's Pleasant Prairie Power Plant

EX1081; EX1098, 20; *see* EX1073. Dr. Niksa attended the conference and confirms that hundreds of other POSITAs attended, including engineers, technical staff from

R&D organizations, and government officials (EPA and DOE). EX1002 ¶¶228-231, 235; EX1078-EX1084; EX1098.

AWMA published a CD with the conference papers, including Starns, and Dr. Niksa received his copy in Summer 2002. EX1002 ¶¶229, 232. Dr. Niksa's copy (containing EX1008) is shown below:



EX1077. Further corroborating public accessibility, the AWMA online “bookstore” allowed the public to purchase the CD at least by August 6, 2002 (corresponding to

Internet Archive date stamp of “20020806”). EX1085-EX1086; EX1098, 4, 6.² The CD indexed publications by session (topic) and author:



² EX1091 (explaining date stamps of Internet Archive).

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AUTHOR	PAPER TITLE	PAPER NUMBER
Spencer, Mary <i>Environmental Management Directorate</i>	■ Pollution Prevention in Weapon System Test and Evaluation	43433
Srivastava, Ravi K. <i>U.S. EPA</i>	■ Controlling Multiple Emissions from Coal-fired Power Plants	45376
Stallings, John H. <i>US Air Force</i>	■ Department of Defense Integrates P2 into Wapons Systems Development: Toward a Green Life Cycle	41784
Starns, Travis <i>ADA-ES, LLC</i>	■ Full-Scale Test of Mercury Control with Sorbent Injection and an ESP at Wisconsin Electric's Pleasant Prairie Power Plant	43249

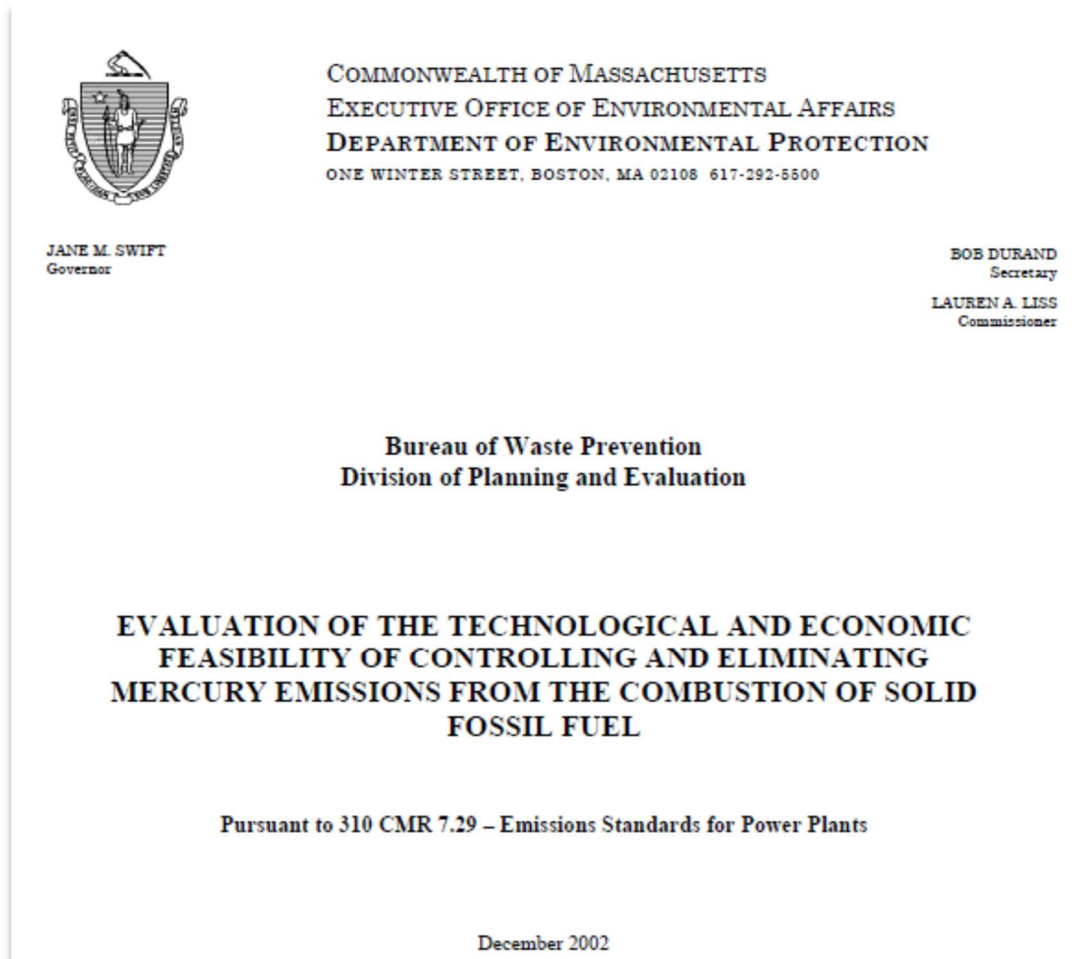
Session AE-1c Results from Full-Scale Mercury Control Testing: Overview and Panel Discussion		
PAPER NUMBER	PAPER TITLE AUTHOR(S)	Return To AE-1c in the Session Listing
43249	Full-Scale Test of Mercury Control with Sorbent Injection and an ESP at Wisconsin Electric's Pleasant Prairie Power Plant <i>Travis Starns, Jean Bustard, Michael Durham, Charles Lindsey, Cameron Martin,, Richard Schlager, Brian Donnelly, Sharon Sjostrom, Paul Harrington, Sheila Haythornthwaite, Richard Johnson, Ed Morris, Ramsay Chang, and Scott Renninger</i>	

EX1073-EX1076. Starns (EX1008) is paper 43249. EX1076, 19; EX1002

¶¶232-234.

2. Mass-EPA (Grounds A2, A4, A6)

Mass-EPA was authored by Bureau of Waste Prevention (“BWP”), a division of the Massachusetts Department of Environmental Protection. Its cover reflects its status as a government document:³



³ Mass-EPA was published December 2002 by the State of Massachusetts pursuant to 310 Code of Massachusetts Regulations 7.29. EX1009, 1; EX1099, 21. Mass-EPA is admissible under FRE 803(8) and 902(1)(A).

EX1009, 1. BWP provided for “health, safety, [and] welfare of its citizens” by “[d]irect[ing] the use of the most advanced treatment technology of wastes/emissions.” EX1087; EX1099, 6. Within BWP was the Planning and Evaluation Division, handling “long range ... pollution planning and evaluation,” including an “Air Program Planning Unit.” EX1088; EX1099, 8. A POSITA would have looked to publications from the Air Program Planning Unit, since it provided “shared and integrated environmental, engineering and program data, which will be accessible to all.” EX1088-EX1089; EX1099, 8-10; EX1002 ¶237.

The “Air Program Planning Unit Publications” page was organized by subject—with descriptive, text-searchable, titles—and made available for download Mass-EPA (EX1009) as the “mercfeas.pdf” file:

Other Air Quality Publications	
Evaluation of the Technological and Economic Feasibility of Controlling and Eliminating Mercury Emissions from the Combustion of Solid Fossil Fuel mercfeas.doc 728 KB  mercfeas.pdf 534 KB 	Mercury Control Feasibility Evaluation prepared in accordance with 310 CMR 7.29(5)(a)3.a. (December 2002)

EX1090; EX1099, 12. As reflected in the date stamp from Internet Archive (“20021220143210”), the “mercfeas.pdf” file was available for download by December 20, 2002.⁴ EX1091; EX1002 ¶¶237-239.

Because Mass-EPA was commissioned pursuant to a State of Massachusetts regulation (EX1009, 1), a POSITA would have been motivated to study the document to operate power plants in Massachusetts and as a harbinger of future federal regulations concerning nationwide mercury removal. EX1002 ¶240.

C. ANALOGOUS ART

The field of endeavor of the Challenged Patent is “removal of pollutants from flue gas or product gas from a gasification system,” more specifically removal of “mercury...from gas streams generated during the burning or gasification of fossil fuels.” EX1001, 1:46-50. The specific problem faced by the inventors was needing “more economical and effective mercury removal technology.” EX1001, 2:43-44; EX1002 ¶¶219, 236, 241.

Vosteen589, Starns, and Mass-EPA are analogous art to the ’218 Patent, as they are in the same field of endeavor and reasonably pertinent to the problems the

⁴ Mass-EPA is available for download from the State of Massachusetts: <https://www.mass.gov/doc/evaluation-of-technological-economic-feasibility-of-controlling-eliminating-mercury-emissions/download>.

inventors faced. Vosteen589 improves previous mercury-removal techniques at power stations that were “not sufficiently effective” and were “relatively expensive.” EX1005 ¶¶[0001], [0004]; EX1002 ¶219. Starns and Mass-EPA remove mercury at coal-fired power plants using activated-carbon sorbent. EX1008, 2; EX1009, Abstract, 4, 32; EX1002 ¶¶236, 241.

D. OVERVIEW OF THE COMBINATIONS AND REASONS TO COMBINE

A POSITA would have been motivated to combine Vosteen589 with Starns (Ground 1) and with Mass-EPA (Ground 2), with reasonable expectation of success, because all three references are directed towards the same goal (removing mercury from flue gases) and are interoperable. EX1002 ¶281.

Vosteen589 uses a “dry emission control system” for the “flue gas,” which works “based on the adsorption of ionic mercury compounds.” EX1005 ¶¶[0018], [0019] (“mercury sorption stage”), [0007] (mercury “is readily adsorbable to a range of adsorbents”). “Adsorption” is a process where adsorbate (e.g., atoms/ions/molecules) in a fluid (typically gas) bind to a sorbent’s surface. Vosteen589 discloses “finely pulverulent slaked lime/activated carbon” sorbent. EX1005 ¶[0019]. For the coal-fired power plant, a “dry electrostatic precipitator (ESP) is used.” EX1005 ¶[0034]; EX1002 ¶282.

Though Vosteen589 discloses activated-carbon sorbent and particulate-control devices (ESPs), Vosteen589 does not fully disclose certain implementational

details, such as how sorbent is introduced. Starns and Mass-EPA supply these details, including hardware and control processes. A POSITA would have been motivated to use activated-carbon injection (as in Starns and Mass-EPA) with Vosteen589, with reasonable expectation of success, because activated-carbon injection was well-known, as admitted by the '218 Patent and its inventors. EX1001, 2:10-15, 30:36-40; *see* EX1096 (Holmes), 41:5-9; EX1095 (Olson), 114:21-25; EX1097 (Pavlish), 210:4-18. Each combination represents combining prior art elements (activated-carbon sorbent) according to known methods (injection into flue gas) to yield predictable results (mercury removal). EX1002 ¶283.

Starns and Mass-EPA provide details of activated-carbon injection (“ACI”), including how sorbent-injection rate affects mercury removal, where to inject sorbent, and how to remove sorbent with an ESP. A POSITA would have looked to Starns (Ground 1) and Mass-EPA (Ground 2) for practical applications of Vosteen589’s processes for adding halogens to improve mercury removal on activated-carbon sorbents. A POSITA would have used “injection” (described by Starns and Mass-EPA) to introduce activated-carbon sorbent into mercury-containing flue gas of Vosteen589, particularly embodiments using an ESP in the dry-emission system (disclosed in Vosteen589, Starns, and Mass-EPA). As described below, both Starns and Mass-EPA tout ACI as “mature” technology. Using halides (Vosteen589) with activated-carbon sorbent (Vosteen589, Starns, and

Mass-EPA) would yield predictable results of improved mercury removal (compared to activated carbon alone) with lowered sorbent costs. EX1002 ¶¶287, 292.

1. Ground 1 (Combining Vosteen589 with Starns)

A POSITA would have been motivated to use the ACI of Starns in the dry-emission system of Vosteen589. Starns states:

The most mature, retrofit technology available today is the injection of sorbents such as powdered activated carbon (PAC) into the flue gas upstream of the particle control equipment. The gas-phase mercury in the flue gas contacts the sorbent and attaches to its surface.

EX1008, 2. Starns provides details for PAC “injection equipment” with a “bulk-storage silo and twin blower/feeder trains.” EX1002 ¶¶284-285.



EX1008, 7-8. “A PLC [(programmable logic controller)] is used to control system operation and adjust injection rates.” EX1008, 7. “Primary variables” to control mercury removal include “injection concentration” of the sorbent. EX1008, 10. As ACI was a “mature” technology, the combination of Vosteen589 and Starns represents combining prior art elements according to known methods to yield predictable results of removing mercury. EX1002 ¶¶285-288.

2. Ground 2 (Combining Vosteen589 with Mass-EPA)

A POSITA would have been motivated to use the ACI of Mass-EPA with the dry-emission system of Vosteen589. Like Vosteen589, Mass-EPA pertains to systems for removing mercury from flue gas of coal-combustion plants:

Mercury can be captured and removed from gas by injection of a sorbent into the exhaust system and subsequent collection of the particulates in a PM control device. Availability of low-cost and efficient sorbents and effective particulate collection are key in implementation of this type of mercury control.

EX1009, 32 (section entitled “Sorbent Injection”). Mass-EPA focuses on the same, mature, sorbent as Vosteen589:

Activated carbon (AC) has been the most extensively studied sorbent for mercury adsorption. Currently, AC seems to be the most likely candidate to reach commercialization for mercury removal in the near future.

EX1009, 32. A POSITA would be additionally motivated to use ACI, because the “estimated costs for powdered activated carbon injection-based technology, which most likely will reach commercialization for mercury control before other

technologies, is within the current control costs for NO_x” (another type of pollutant). EX1009, 58. As ACI was ready for commercialization by 2002, years before the ’218 Patent’s earliest possible priority date, the combination of Vosteen589 and Mass-EPA represents combining prior-art elements according to known methods to yield predictable results of removing mercury. EX1002 ¶¶289-293.

Mass-EPA provides an express motivation to combine: “improving mercury adsorption efficiency of activated carbons has been ongoing with the goal of improving carbon to mercury injection rates and reducing control costs.” EX1009, 39. Using halogens (Vosteen589) with ACI (Mass-EPA) would yield predictable results of improved mercury-adsorption efficiency, achieving the Mass-EPA’s stated goal of “reducing control costs.” EX1002 ¶294.

E. DISCLOSURE AND TEACHINGS OF THE COMBINATIONS

Grounds 1 and 2 largely rely on the common disclosure of Vosteen589, with certain claim limitations disclosed by Starns (Ground 1) and by Mass-EPA (Ground 2). EX1002 ¶295.

1. Independent Claim 1

a. Element 1(Pre): “A method of separating mercury from a mercury-containing gas, the method comprising”

Vosteen589 discloses “removing mercury from flue gases.” EX1005, Title, cl. 1; *see* ¶¶[0007]-[0008], Abstract. Flue gas is a mercury-containing gas, and

“removing mercury” refers to separating the mercury from mercury-containing gas to reduce emissions. EX1002 ¶¶296-298.

b. Element 1(a): “combusting coal in a combustion chamber, to provide the mercury-containing gas;”

Vosteen589 discloses “a coal-fired power station,” including a “combustion chamber.” EX1005 ¶[0005]; *see* ¶¶[0034], [0046]-[0048], Figs. 7-9. The combustion chamber (i.e., boiler/furnace) combusts coal to form the mercury-containing flue gas. EX1002 ¶¶299-301.

c. Element 1(b): “the coal comprises added HI, an iodide salt, or a combination thereof, added to the coal before the coal enters the combustion chamber, or the combustion chamber comprises added HI, an iodide salt, or a combination thereof, or a combination thereof;”

Vosteen589 mixes halide additives with coal in the combustion chamber and/or upstream of combustion chamber:

removing mercury from flue gases of ... power stations ..., in which bromine and/or a bromine compound and/or a mixture of various bromine compounds is fed to the if appropriate multistage furnace....

[A]n aqueous solution of hydrogen bromide [HBr] or an alkali metal bromide, in particular sodium bromide [NaBr], or an aqueous solution of the alkali metal bromide is used.

The bromine compound, for example, sodium bromide, can be added in solid form, for example **as salt**, or liquid form, for example as aqueous solution, to the ... coal or the like to be burnt, upstream of the furnace. ... The addition can also be made to a plant section upstream of the furnace, for example, ... to a coal mill.

EX1005 ¶¶[0006], [0009], [0013].

Vosteen589 cites three Br-containing examples above: aqueous hydrogen bromide (HBr, hydrobromic acid), solid sodium bromide (NaBr, salt), and aqueous sodium bromide (NaBr, salt water). Vosteen589 then teaches using iodide in a similar manner as the bromide compounds. “Iodine compounds oxidize mercury more effectively compared with bromine compounds,” though the iodine compounds are costlier; accordingly, use an “iodine compound ... as a supplement to, or partial replacement of, the added bromine compound,” and the “process proceeds” with both bromide compounds and iodide compounds. EX1005 ¶[0016].

Vosteen589 further discloses the use of iodine-containing compounds in Vosteen589’s claims:

1. ... removing mercury from flue gases of ... power stations ... characterized in that bromine and/or a bromine compound and/or a mixture of various bromine compounds is fed to the if appropriate multistage furnace and/or to the flue gas in a plant section downstream of the furnace, ...
2. Process according to claim 1, characterized in that the bromine compound is an aqueous solution of hydrogen bromide and/or an alkali metal bromide, in particular sodium bromide, and/or an aqueous solution of alkali metal bromide.
6. Process according to one of claims 1 to 5, characterized in that the combustion is carried out additionally in the presence of ... iodine and/or an iodine compound and/or a mixture of various iodine compounds.

EX1005, cls. 1-2, 6. Thus, Vosteen589 discloses, or at least renders obvious, applying iodide compounds in the same locations (i.e., to the coal or to the combustion chamber) as the bromide compounds, so the two can be mixed together. EX1002 ¶¶302-304.

A POSITA would have found it obvious that “iodine compound and/or a mixture of various iodine compounds” would include hydrogen iodide (HI) and/or an iodine salt (each are examples of an iodine compound) in order to facilitate mixing with homologous bromide compounds. EX1002 ¶305.

First, Vosteen589 discloses three preferred bromide compounds: (i) sodium bromide (NaBr) “in solid form, for example, as salt”; (ii) sodium bromide in “liquid form, for example as aqueous solution”; or (iii) “aqueous solution of hydrogen bromide.” EX1005 ¶¶[0009], [0014], [0016], claims 1-2. EX1002 ¶306.

Second, the preferred bromide compounds (e.g., HBr and NaBr) are in “a mixture” with iodide compounds, as they are “a supplement to, or partial replacement of, the added bromine compound.” EX1005 ¶[0016]. Accordingly, a POSITA would have mixed like materials, such as using: aqueous hydroiodic acid (HI) to mix with aqueous hydrobromic acid (HBr); solid NaBr powder to mix with solid NaI powder; or aqueous iodide salt solutions (e.g., NaI) to mix with aqueous

bromide salt solutions (e.g., NaBr or “alkali metal bromide”).⁵ A POSITA would have been further motivated to use an iodide salt and/or HI, because each are readily dissolvable in water, which facilitates their ability to be “sprayed” onto the coal or “into one of the combustion chambers.” EX1005 ¶[0013]; EX1002 ¶307.

Third, the choice of which “iodine compound” to use would be a matter of routine experimentation, and the ’218 Patent does not identify any special characteristics of “HI [or] iodide salt” or any unexpected and non-obvious result, as compared to other iodine compounds. EX1002 ¶308.

d. Element 1(c): “injecting a sorbent comprising activated carbon into the mercury-containing gas downstream of the combustion chamber,”

This element is disclosed by Vosteen589 with Starns (Ground 1) and with Mass-EPA (Ground 2). EX1002 ¶309.

i. Grounds 1-2

Vosteen589 discloses a “dry emission control system” for the “flue gas,” which works “based on the adsorption of ionic mercury compounds.” EX1005 ¶¶[0017]-[0019]; *see* ¶¶[0005]-[0007] (“removal of mercury from the flue gases in a flue gas emission control system downstream of the combustion”); ¶[0019]

⁵ It was known to mix iodide salt solutions with coal. *See, e.g.*, EX1062 at 2-3, 10 (“screening tests of several oxidation additives including...potassium iodide”).

(“mercury sorption stage”). One exemplary sorbent is “finely pulverulent slaked lime/activated carbon.” EX1005 ¶¶[0019]. Starns and Mass-EPA disclose how and where to introduce the activated-carbon sorbent into the flue gas. EX1002 ¶¶310-312.

ii. Ground 1

Starns describes hardware and control processes for “injecting activated carbon ahead of particle control devices (PCD) to remove mercury.” EX1008, 2. The “injection equipment” includes a “bulk-storage silo and twin blower/feeder trains.”



EX1008, 7-8. Starns describes “injection of sorbents such as powdered activated carbon (PAC) into the flue gas upstream of the particle control equipment.”

EX1008, 2. “Four sorbents were” evaluated, and “[a]ll four sorbents were PACs.”

EX1008, 9. EX1002 ¶313.

iii. Ground 2

Mass-EPA describes activated carbon as “the most extensively studied sorbent for mercury adsorption” (EX1009, 32) and discloses “activated carbon injection” in numerous places. *See generally* EX1009, 31-56. The “sorbent particles ... contact the Hg in the flue gas.” EX1009, 21; *see* 6-7, 21-23, 33; EX1002 ¶314.

e. Element 1(d): “a weight ratio of the HI, iodide salt, or the combination thereof added to the coal, added to the combustion chamber, or a combination thereof, to an amount of the sorbent injected into the mercury-containing gas is from about 1:100 to about 30:100;”

Claim Element 1(d) is obvious over Vosteen589 and Starns (Ground 1) and Vosteen589 and Mass-EPA (Ground 2). Vosteen589 teaches the halide-concentration in mercury-containing flue gas, and Starns and Mass-EPA describe the sorbent concentration. EX1002 ¶¶315-328.

Claim Element 1(d) is merely a workable range for combining conventional materials (e.g., iodide halide) being used in a conventional way (to oxidize mercury and promote activated carbon) with a conventional sorbent (activated carbon). Nothing in the '218 Patent specification attributes significance to the claimed range or demonstrates it “achieves unexpected results.” The range presents nothing more

than optimization of “result-effective” variables that would have been obvious to a POSITA. *In re Applied Materials, Inc.*, 692 F.3d 1289, 1297-98 (Fed. Cir. 2012); *see Pfizer Inc. v. Sanofi Pasteur Inc.*, 94 F.4th 1341, 1347 (Fed. Cir. 2024) (“decades-old legal principle that “where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation”); EX1002 ¶328. Patent Owner previously admitted this is correct concerning U.S. Patent 8,168,147 (parent to Challenged Patent):

[T]he inventors reduced all aspects of the '147 patent claims to practice except for the claimed ratio of 1-30 grams of promoter per 100 grams of sorbent (i.e., a 1%-30% ratio). ... [T]his range limitation is entitled to no patentable weight.

EX1105 (IPR2020-00926, Paper 13), 34.

Petitioners' expert testified—and ME2C does not dispute—that the 1%-30% range limitation is not entitled to any patentable weight. See Ex. 1003 at ¶ 369 (“Through routine process optimization and routine experimentation, a POSITA would have adjusted the rate of addition of the promoter and/or the rate of addition of the sorbent material to achieve a range from about 1 g to about 30 g of promoter per 100 grams of the sorbent material ... The range presented nothing more than optimization of result-effective variables that would have been obvious to a POSITA.”).

EX1105, 35.

To the extent the Board gives this claim limitation any patentable weight, despite PO's arguments to the contrary, this claim limitation is further obvious over the disclosures of Vosteen589 and Starns/Mass-EPA.

Vosteen589 discloses two values for “total bromine content (Br_{tot}) in the boiler flue gas”: 43 and 75 mg/M³ S.T.P.db. EX1005 ¶¶[0031], [0046], [0048], Fig. 8. This refers to milligrams Br per cubic meter of mercury-containing flue gas, on a dry basis, at standard temperature and pressure. Vosteen589 teaches substituting iodine-containing compounds for bromine-containing compounds, so a POSITA would have been motivated (at least as a starting point) to substitute 1 mole elemental iodine for every 1 mole elemental bromine. The molecular weight of Br is 79.9 g/mol, and the molecular weight of I is 126.9 g/mol. Thus, 43 mg of Br_{total} equates to 68.3 mg I_{total}. EX1002 ¶316.

Vosteen589 discloses using activated carbon (EX1005 ¶[0019]), but does not disclose the gas-phase concentration. As Dr. Niksa explains with source citations, it was routine in the industry to use injection rates of around 10 pounds sorbent per MMacf flue gas to capture mercury. EX1002 ¶317; *see* ¶¶114-115. This is the value used by Starns (Ground 1) and Mass-EPA (Ground 2) for ACI. EX1008, 20; EX1009, 12, 73; EX1002 ¶¶318-319.

Dr. Niksa explains how a POSITA would have been readily capable of converting between units of I_{total} concentration in the flue gas (Vosteen589) and sorbent concentration in the flue gas (Starns and Mass-EPA), then dividing the two to determine a weight ratio. The above calculations involve fundamental precepts taught in undergraduate chemistry, such as unit conversions (e.g., between L and ft³

and pounds to grams) and the ideal gas law ($PV=nRT$). Dividing the two numbers—the I_{total} concentration taught by Vosteen589 (68.3 mg/m^3 S.T.P. db) and the activated-carbon concentration of Starns and Mass-EPA (10 lb/MMacf each)—provides a mercury-containing gas comprising about 27.5 grams of the element I per 100 grams of activated-carbon sorbent. EX1002 ¶¶320-326.

As discussed above, it would have been obvious for the “iodine compound” in Vosteen589 to be either NaI (salt) or HI. Converting from the weight of I in the additive, to the weight of additive itself (NaI or HI), is likewise within the ability of a POSITA, involving multiplying by the ratios of molecular masses (e.g., 126.9 grams I in: 149.89 grams of NaI and 127.9 grams HI). For every 100 grams sorbent, there would be: 27.7 grams HI additive and 32.5 grams NaI. Both are within the claimed range of “about 1:100-30:100.” Further, as Dr. Niksa explains, the calculations are based on assuming a 1:1 molar replacement of I with Br. A POSITA would be motivated to use less HI or NaI than the amounts calculated above (i.e., the NaI ratio would fall within 1:100-30:100), because: (i) Vosteen589 identifies iodine as a “partial replacement” of the bromine, so there would be a mixture of both bromine and iodine compounds used, leading to the use of less iodine compound per 100 grams of sorbent than calculated above; and (ii) as Vosteen589 states, “Iodine compounds oxidize mercury more effectively compared with bromine compounds,”

meaning less iodine compound would be needed than as calculated above assuming a 1:1 replacement for the bromine compound. EX1005 ¶[0016]; EX1002 ¶¶325-326.

If a POSITA were to use the highest sorbent injection rate tested in Chart 2 of Mass-EPA (Ground 2), which is 30 lb/MMacf, there would be a ratio of 10.8 grams NaI and 9.2 grams HI for every 100 grams of sorbent, both of which are within the claimed 1:100-30:100 ratio. EX1002 ¶327.

It would have been obvious to try other ratios, such as by decreasing halogen concentration (e.g., because Vosteen589 says iodine is more “effective” at oxidizing mercury) as part of routine process optimization to achieve the desired mercury removal. EX1002 ¶328.

f. Element 1(e): “contacting mercury in the mercury-containing gas with the sorbent”

This element is disclosed by Vosteen589 with Starns (Ground 1) and with Mass-EPA (Ground 2). EX1002 ¶329.

i. Grounds 1-2

Vosteen589 discloses a “dry emission control system” for the “flue gas,” which works “based on the adsorption of ionic mercury compounds.” EX1005 ¶¶[0017]-[0019]; *see* ¶¶[0005]-[0007] (“removal of mercury from the flue gases in a flue gas emission control system downstream of the combustion”); ¶[0019] (“mercury sorption stage”). The flue-gas mercury is adsorbed, and thus contacted,

with activated-carbon sorbent to form a mercury-sorbent composition. Starns and Mass-EPA confirm that upon activated-carbon injection, contact between mercury and sorbent occurs. EX1002 ¶¶329-330.

ii. Ground 1

Starns describes that “gas-phase mercury in the flue gas contacts the sorbent and attaches to its surface.” EX1008, 2; EX1002 ¶331.

iii. Ground 2

Mass-EPA describes that the “sorbent particles ... contact the Hg in the flue gas.” EX1009, 21; *see* 33; EX1002 ¶332.

g. Element 1(f): “separating the sorbent contacted with the mercury from the mercury-containing gas.”

i. Grounds 1-2

Vosteen589 discloses “removing mercury ... from flue gases.” EX1005 ¶[0005]. Vosteen589 “clean[s] gas downstream of the ... dry flue gas emission control system,” meaning the mercury-sorbent composition has been separated from the mercury-containing gas. EX1005 ¶[0022]; *see* ¶[0006], cl.1. The mercury-sorbent composition is separated downstream from the combustion chamber by a particle-control device, such as ESP or fabric filter. EX1005 ¶¶[0019], [0033]-[0034], [0039], [0042], [0047]-[0049], cl. 8. EX1002 ¶333.

ii. Ground 1

Starns recommends “using activated carbon injection upstream of an ESP.” EX1008, 20. “[U]pstream of the particle control equipment” (ESP), the “gas-phase mercury in the flue gas contacts the sorbent and attaches to its surface,” and the mercury-sorbent composition is then removed by the ESP. EX1008, 2; EX1002 ¶334.

iii. Ground 2

In Mass-EPA, “[t]he particulate-bound form of mercury can be readily captured in the particulate matter (PM) control devices, i.e., electrostatic precipitators (ESPs) and fabric filters (FFs).” EX1009, 20. A “particulate-bound” mercury refers to the mercury-sorbent composition. “An ESP or a FF is always installed downstream of a ... dry injection point to remove the sorbent from the flue gas.” EX1009, 27; EX1002 ¶335.

2. Claims Depending from Claim 1

- a. Claims 2-3: “the [cl. 2-coal; cl. 3-combustion chamber] comprises the added HI, the iodide salt, or a combination thereof, [cl. 2- added to the coal before the coal enters the combustion chamber].”**

As described for Element 1(b), Vosteen589 discloses addition of iodine compounds directly to the coal upstream of the combustion chamber (which is then added to the combustion chamber), or directly to the combustion chamber. As

further described, it would have been obvious for these iodine compounds to be an iodide salt (e.g., NaI) or hydrogen iodide (HI). EX1002 ¶¶336-337.

b. Claims 4, 6-7:

4: “the coal is combusted in the combustion chamber at a coal-combustion facility, wherein the HI, iodide salt, or combination thereof, is added to the coal before the coal enters the combustion chamber, wherein the addition of the HI, iodide salt, or combination thereof, to the coal is performed at the coal-combustion facility.”

6: “the combustion chamber is a coal combustion chamber that is used to produce electricity.”

7: “the combustion chamber is a coal combustion furnace.”

i. Grounds 1-2

As described for Element 1(a), the combustion chamber is a “multistage furnace,” into which the coal and iodide compounds are fed. EX1005 Abstract, ¶[0013], cl. 1; EX1002 ¶342.

As described for Element 1(b) and Claim 2, the iodide compounds are added to the coal upstream of the combustion chamber. The addition is performed at a coal-combustion facility, such as the “coal-fired power station of Bayer AG.” EX1005 ¶¶[0034], [0045], Fig. 9; EX1002 ¶338. This “power station” produces

electricity. EX1005, Abstract, ¶¶[0001]-[0003], [0005], [0008], [0032], [0034], [0045]-[0047], cl. 1; EX1002 ¶339.

ii. Ground 1

Claim 6 is further obvious over Starns. Starns discloses sorbent injection at “Wisconsin Electric’s Pleasant Prairie Power Plant,” which produces electricity. EX1008, Title, 4; EX1002 ¶340.

iii. Ground 2

Claim 6 is further obvious over Mass-EPA, whose audience was “model-plant scenarios representative of coal-fired electric utility power plants operating in the United States.” EX1009, 53; *see* 8; EX1002 ¶341.

c. Claim 8: “the coal comprises a subbituminous coal.”

i. Grounds 1-2

Vosteen589 describes combustion of coal in “power stations, for example bituminous coal-fired or lignite-fired power stations.” EX1005 ¶[0008]. A POSITA would have understood that the four broad classifications of coal, organized from highest to lowest rank are: anthracite; bituminous; subbituminous; and lignite. In general, bituminous and anthracite coals have the highest native-halogen levels (which help remove mercury), whereas lignite (and subbituminous) coals tend to have much lower levels. EX1002 ¶69. A POSITA would recognize that mercury-control technology directed at both bituminous coals and lignite (the extreme ends

of halogen content) would also work for the intermediate-rank subbituminous coals.
EX1002 ¶343.

ii. Ground 1

Claim 8 is further obvious, because Starns removed mercury for units that “fire a variety of Powder River Basin (PRB) low sulfur, sub-bituminous coals.” EX1008, 4; EX1002 ¶344.

iii. Ground 2

Claim 8 is further obvious, because Mass-EPA discloses “Powder River Basin (PRB) subbituminous coal” was burned at a facility that achieved “73% mercury removal upon injection of sorbent.” EX1009, 24, 29, 77; EX1002 ¶345.

d. Claim 9: “the coal comprises a lignite coal”

i. Grounds 1-2

Vosteen589 describes combustion of coal in “power stations, for example bituminous coal-fired or lignite-fired power stations.” EX1005 (Vosteen589) ¶[0008]; EX1002 ¶346.

ii. Ground 2

Claim 9 is further obvious over Mass-EPA, which removes mercury from “lignite” coal. EX1009, 9, 19, 24-25, 39; EX1002 ¶347.

e. Claims 10-12:

10: “measuring the mercury content of the mercury-containing gas; and modifying, in response to the measured mercury content of the mercury-containing gas, an injection rate of injecting the sorbent into the mercury-containing gas, an amount of the HI, the iodide salt, or a combination thereof, added to the coal or the combustion chamber, or a combination thereof.”

11: “the measuring of the mercury content of the mercury-containing gas comprises continuous measurement.”

12: “modifying, in response to a measured mercury content, an injection rate of injecting the sorbent into the mercury-containing gas, an amount of the HI, the iodide salt, or a combination thereof, added to the coal or the combustion chamber, or a combination thereof.”

These claims are disclosed by Vosteen589 alone (Grounds 1-2), and in combination with Starns (Ground 1) and Mass-EPA (Ground 2). All three references disclose continuously measuring mercury content. Based on the mercury measurements, Vosteen589 achieves mercury-removal targets by modifying halogen-injection rates, and Starns and Mass-EPA modify sorbent-injection rates. Each control scheme satisfies Claims 10-12. EX1002 ¶¶348-358.

i. Grounds 1-2

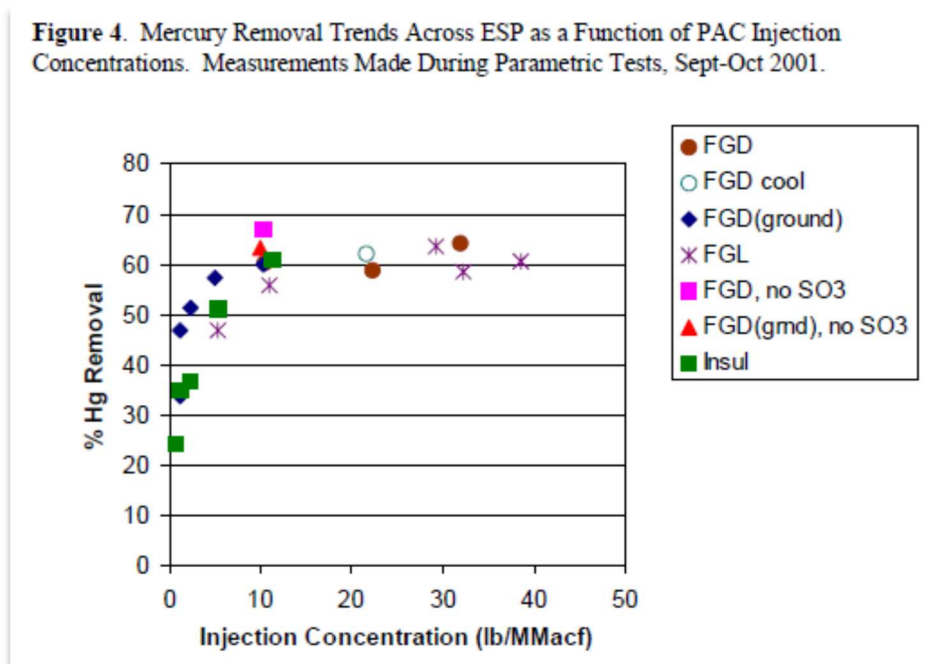
Vosteen589 discloses that “mercury content of the flue gas ... is measured continuously downstream of the flue gas emission control system and on the basis of the measured mercury content the amount of bromine fed and/or bromine compounds and/or the mixture of bromine compounds ... is controlled.” EX1005 ¶[0022]; *see id.* (measuring and controlling based on “total mercury in the clean gas”), Figs. 2-8 (showing mercury measurements). Such a control scheme is also used with iodide compounds. EX1005, claims 1, 6, 10. A POSITA would have modified the halogen addition rate to keep mercury below the “strict limiting values [that] exist for the legally permissible emission of mercury” to avoid regulatory penalties. EX1005 ¶[0002]; EX1002 ¶348; *see* ¶¶116-121.

Claims 10-12 are further obvious over Starns (Ground 1) and Mass-EPA (Ground 2). Each modifies sorbent-injection rate into the flue gas based on mercury-content measurements. A POSITA would have modified sorbent-injection rate, either in place of the control scheme of Vosteen589 (modifying halogen rate) or in addition to that control scheme (e.g., modifying both sorbent rate and halogen rate) for additional process flexibility. EX1002 ¶¶349, 352. It would have been obvious that modifying sorbent-injection rate would be performed as part of routine process control and optimization to account for variances in the coal. EX1002 ¶¶351, 356. Upon reviewing the measured-mercury data presented in Starns (Ground 1) and

Mass-EPA (Ground 2), a POSITA would have understood that adding excessive sorbent would be wasteful and adding insufficient sorbent may not achieve mercury-removal targets, and would have modified sorbent-injection rate accordingly. EX1002 ¶¶350, 355.

ii. Ground 1

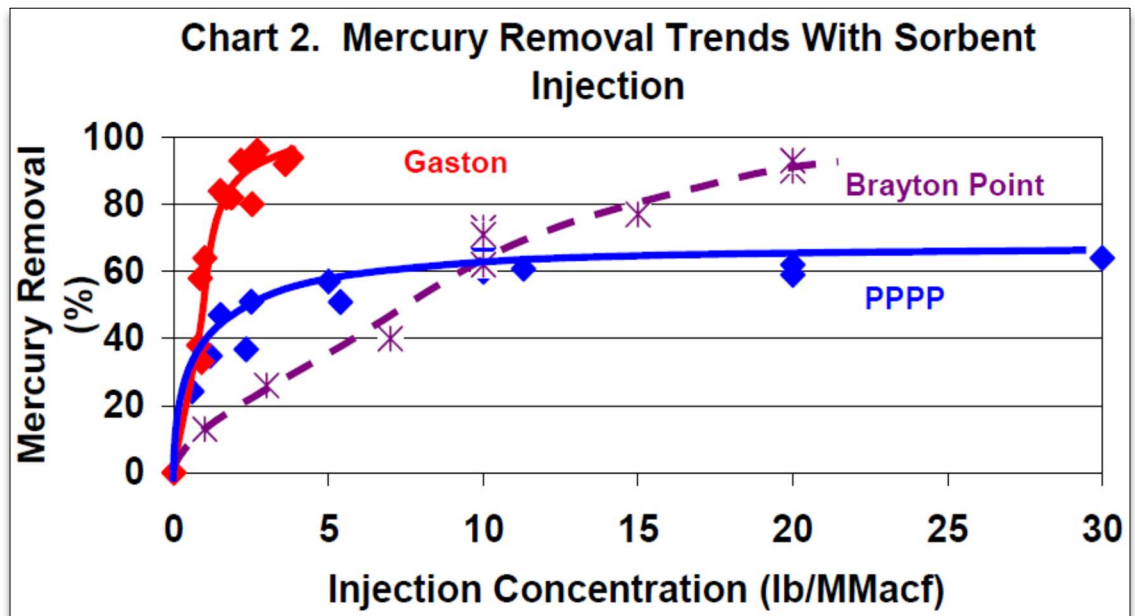
Starns discloses a mercury monitor that “operate[d] continuously,” and “[m]ercury removal was monitored as a function of the sorbent injection concentration.” EX1008, 8, 11. Starns controls mercury content (Y-axis) based on modifying sorbent-injection rate (X-axis), such as 1-10 lb/MMacf (pounds sorbent per-million actual ft³ flue gas). EX1008, 7, 11, 13, 20, Figs. 3-6.



EX1008, Figs. 4-5; EX1002 ¶350.

iii. Ground 2

Mass-EPA discloses using “continuous emissions monitoring systems (CEMS) to monitor stack-level Hg emissions.” EX1009, 60. Mass-EPA measures mercury content to select sorbent-injection rates. EX1009, 11-12, 33, 50, 60, 73 (“mercury removal as a function of [sorbent] injection rate”).



EX1009, 12. Mass-EPA summarized its testing as determining “mercury removal as a function of [sorbent] injection rate.” EX1009, 73; *see* EX1009, 13. A POSITA would have been motivated to modify sorbent-injection rate to target “an overall reduction of 75%.” EX1009, 5; EX1002 ¶¶353-355.

f. Claim 13: “the sorbent contacted with the mercury comprises the element iodine and mercury.”

As described for Elements 1(e)-1(f), mercury adsorbs onto sorbent to form a mercury-sorbent composition. The composition includes the element iodine, because as Vosteen589 discloses, mercury in the flue gas is oxidized by bromine-containing species to form HgBr_2 , and “[m]ercury bromide HgBr_2 adsorbs more strongly to dry sorbents.” EX1005 ¶¶[0017]-[0019]. Vosteen589 states that “[i]odine compounds oxidize mercury more effectively compared with bromine compounds.” EX1015 ¶[0016]. Accordingly, once adsorbed, the sorbent comprises mercury and the element iodine.⁶ EX1002 ¶¶359-362.

g. Claims 14-16:

14: “removing greater than 70 wt% of the mercury in the mercury-containing gas.”

15: “removing greater than 70 wt% of the mercury in the mercury-containing gas with the sorbent.”

16: “the combination of the contacting of the mercury in the mercury-containing gas with the sorbent and the separating of the sorbent contacted with the mercury from the mercury-

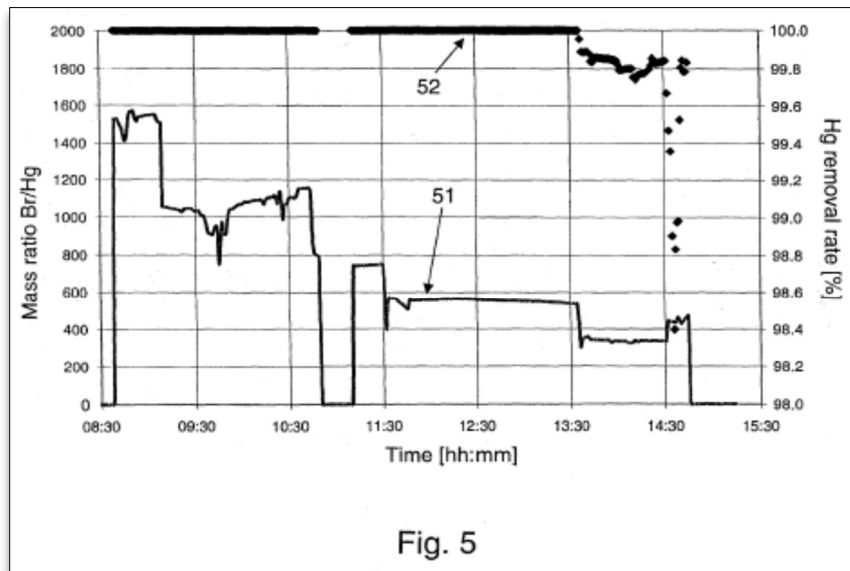
⁶ To the extent PO narrowly construes the claim to require the sorbent first contact iodine before contacting mercury, such a read would be unsupported. Nevertheless, the claim is still obvious for the reasons discussed *infra* Claim 17.

containing gas decreases the amount of elemental mercury in the mercury-containing gas.”

Claims 14-16 is obvious over Vosteen589 and Starns (Ground 1) and Vosteen589 and Mass-EPA (Ground 2). Each reference achieves greater than 70 wt% mercury removal.

i. Grounds 1-2

Vosteen589 discloses “substantially complete removal of mercury (Hg), from flue gases.” EX1005 ¶[0005]; *see* ¶[0037]. More than 98.0% “Hg removal” is shown below (right axis):



EX1005, Fig. 5; *see* ¶¶[0028], [0042]; EX1002 ¶363.

Regarding Claim 15 and Claim 16, Vosteen589 converts approximately 90% of elemental mercury to oxidized mercury. EX1005 ¶¶[0048]-[0049]. At that high

conversion-rate, nearly 90% of the total mercury content (oxidized+elemental) would be removed on the sorbent (and thus the amount of elemental mercury in the mercury-containing gas decreases). EX1005 ¶[0007] (oxidized (“ionic”) mercury is “readily adsorbable”). Vosteen589 discloses plants that “do not have a wet flue gas emission control system [(scrubber)], but solely have a dry emission control system having a mercury sorption stage.” EX1005 ¶[0019]. Such plants depend on the sorbent, particularly when burning lignite coal (i.e., low levels of unburnt carbon). EX1005 ¶[0008] (“lignite-fired power station”). EX1002 ¶¶364, 368, 372.

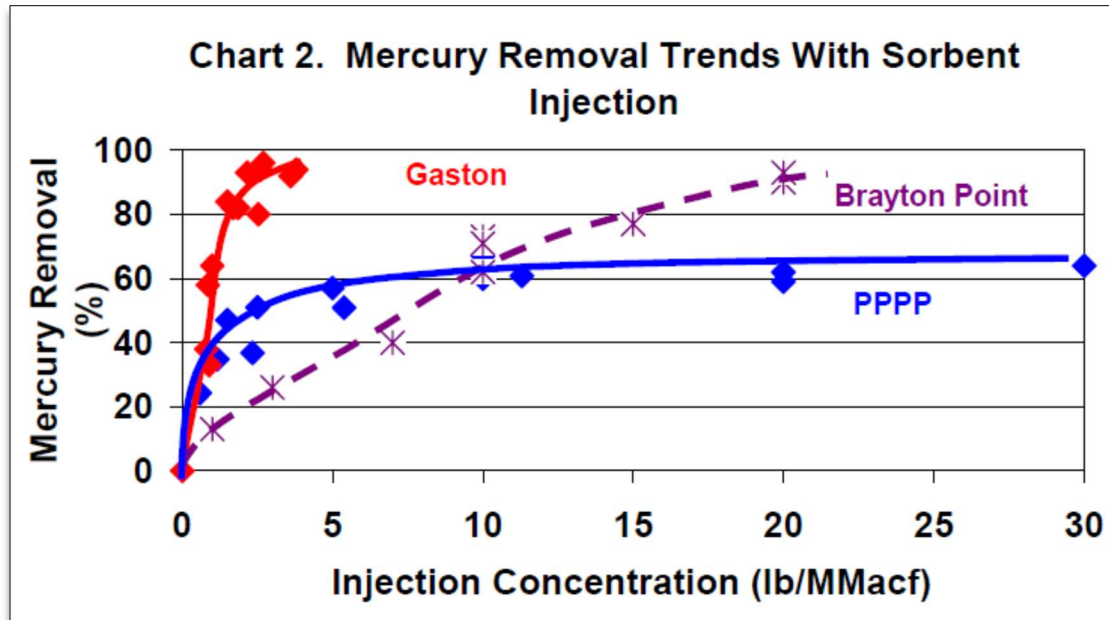
Vosteen589 further renders Claims 14-15 obvious, because Vosteen589 discloses removing sufficient mercury to comply with regulatory requirements. EX1005 ¶¶[0002], [0015]. A POSITA would have been motivated, with reasonable expectation of success through routine process optimization, to adjust the halide addition rate and/or ACI rate to meet and surpass (e.g., for safety margin) well-known regulatory proposals calling for at least 70% mercury removal. *See supra* §V.D.3; *Koninklijke*, 948 F.3d at 1337; EX1002 ¶¶367, 371.

ii. Ground 1

Claims 14-15 would be further obvious over Starns, which discloses removing 70% mercury when using 10 lb/MMacf of activated carbon with solely dry-emission controls. EX1008, 2, 20. When combined with the halogen improvements of Vosteen589, the removal would be even greater. EX1002 ¶¶365, 369.

iii. Ground 2

Claims 14-15 would be further obvious over Mass-EPA, which discloses removing more than 70% mercury with dry-emission systems.



EX1009, 11-12 (Chart 2); *see* EX1009, 70, 74. When combined with the halogenation of Vosteen589, the removal would be even greater. EX1002 ¶¶366, 370.

h. Claim 17: “the sorbent injected into the mercury-containing gas is a sorbent obtained by contacting a sorbent with a halogen or halide promoter prior to injection of the sorbent into the mercury-containing gas.”

i. Grounds 1-2

Claim 17 is obvious over Vosteen589 and Starns (Ground 1) and Mass-EPA (Ground 2). A POSITA would have known that for coals with higher native-mercury

content (or lower native-halogen content), additional mitigation may be needed to further reduce mercury emissions. EX1002 ¶¶373-375. A POSITA would have been motivated to try, with reasonable expectation of success, pre-halogenating sorbent before injection into the mercury-containing flue gas. For example, it was known since the 1930s to remove mercury vapors by injecting halogen-impregnated activated-carbon sorbents into a mercury-containing flue gas. *Supra* §V.D.4. Though more expensive, such pre-halogenation would have been beneficial for coals with higher native-mercury content (or lower native-halogen content) to reduce mercury emissions. EX1002 ¶375; *Koninklijke*, 948 F.3d at 1337.

ii. Ground 2

Claim 17 is further obvious over Mass-EPA, which discloses two alternative sorbents to inject into a flue gas: “activated carbon (or the impregnated activated carbon).” EX1009, 32. Exemplary forms of the impregnated (pre-halogenated) sorbent include “chlorine-impregnated activated carbon” and “[m]odified activated carbons ... doped with ... chlorine and iodine,” which “provide higher mercury adsorption capacity.” EX1009, 33-34 & n.44. Chlorine and iodine are halogen or halide promoters. EX1002 ¶374.

i. Claim 18: “the sorbent injected into the mercury-containing gas is free of contact with a halogen or halide promoter prior to injection of the sorbent into the mercury-containing gas.”

Claim 18 is obvious over Vosteen589 and Starns (Ground 1) and Vosteen589 and Mass-EPA (Ground 2).

As discussed above for Claim Element 1(c), each combination injects activated-carbon sorbent into the mercury-containing flue gas. Vosteen589 does not characterize the sorbent as having been pre-halogenated prior to injection. A POSITA would have selected halogen-free sorbent due to its lower cost (compared to pre-brominated PAC), particularly for applications (e.g., types of coal) that do not require enhanced removal. EX1002 ¶¶376, 69-71.

Regarding Ground 1, Starns discloses Norit “Darco FGD”: a “standard powdered activated carbon (FGD) ... supplied by Norit Americas ... as the benchmark sorbent.” EX1008, 3. Regarding Ground 2, Mass-EPA discloses the same activated-carbon sorbent: “Norit America’s ‘Darco FGD.’” EX1009, 73-74; EX1002 ¶377.

Regarding Grounds 1-2, a POSITA would have recognized that Norit Darco FGD is substantially free of halogen and halide promotion. EX1002 ¶¶141, 377 (discussing EX1048, chemical analysis of Norit FGD as halogen-free).

j. Claim 19: “injecting an additive comprising a compound comprising Ca, Na, or a combination thereof, into the mercury-containing gas downstream of the combustion chamber.”

Claim 19 is obvious over Vosteen589 and Starns (Ground 1) and Vosteen589 and Mass-EPA (Ground 2). EX1002 ¶378.

i. Grounds 1-2

Vosteen589 discloses mixing “lime” and “slaked lime” with activated carbon and adding to flue gas. EX1005 ¶[0019]. Lime contains calcium oxide, CaO, and slaked lime contains calcium hydroxide, Ca(OH)₂. EX1002 ¶¶58, 131. A POSITA would have been motivated to mix the lime and slaked lime with activated-carbon sorbent, as they adsorb other flue-gas constituents that would otherwise compete with mercury for binding sites on the activated-carbon sorbent. EX1002 ¶379.

ii. Ground 1

Claim 19 is obvious over Starns. Starns refers to “injection of sorbents such as powdered activated carbon (PAC) into the flue gas.” EX1008, 2. When activated-carbon sorbent is mixed with lime or slaked lime (as in Vosteen589), that lime or slaked lime would also be injected into the mercury-containing flue gas. EX1002 ¶380.

iii. Ground 2

Claim 19 is further obvious over Mass-EPA. “Increased removal of mercury from gas has been demonstrated by co-injection of activated carbon and calcium-based sorbents.” EX1009, 32. Other alkaline sorbents include: “activated carbon was co-injected with either sodium carbonate or lime [calcium oxide] for SO₂ control. With either of these sorbents, an improvement in the adsorption of gaseous Hg by the activated carbon was reported.” EX1009, 37. Sodium carbonate (Na₂CO₃) contains Na, and lime contains CaO. EX1002 ¶381.

k. Claim 20. “the mercury-containing gas is a flue gas.”

Vosteen589 discloses this claim. Its title is “Process for Removing Mercury from Flue Gases.” EX1005, Title, Abstract, cl. 1; EX1002 ¶382.

l. Claims 21-22:

21: “the injection of the sorbent into the mercury-containing gas occurs upstream of a particulate separator or a scrubber.”

22. “the particulate separator is an electrostatic precipitator, a baghouse, a fabric filter, or a combination thereof.”

i. Grounds 1-2

These claims are obvious over Vosteen589 and Starns (Ground 1) and Mass-EPA (Ground 2).

Vosteen589 discloses an electrostatic precipitator (ESP), a type of particulate separator to remove the mercury/sorbent composition. EX1005 ¶¶[0019], [0033]-[0039], [0042], [0047]-[0049], cl. 8, Fig. 9 (item 96). A POSITA would have known that the sorbent must be injected upstream of the ESP (as discussed for Element 1(c)) so that the ESP can function to collect the sorbent. *Supra* §V.D.2; EX1005, ¶¶[0003], [0006]; EX1002 ¶¶383-384, 388.

ii. Ground 1

Starns recommends “using activated carbon injection upstream of an ESP.” EX1008, 20; EX1002 ¶385.

iii. Ground 2

These claims are obvious over Vosteen589 and Mass-EPA. The approaches “demonstrated or under investigation to control mercury” included an “ElectroStatic Precipitator (ESP).” EX1009, 7. Mass-EPA teaches injecting activated carbon “upstream of an ESP.” EX1009, 32, 53-54; EX1002 ¶¶386-387.

m. Claims 23-24:

23: “the coal comprises added halide sorbent enhancement additive that comprises the HI, iodide salt, or combination thereof.”

24: “the coal and/or the combustion chamber comprises the iodide salt.”

As discussed for Element 1(b), Vosteen589 applies iodine compounds to the combustion chamber and to the coal upstream of the combustion chamber, and it would have been obvious that these iodine compounds include HI and/or iodide salt. EX1005 ¶¶[0006], [0009], [0013]-[0014]. The coal and combustion chamber thus comprise these materials. EX1002 ¶¶389-390.

3. Independent Claim 25

Claim 25 is similar to Claim 1, but removes a number of limitations, as shown below:

~~125.~~ A method ~~of separating for reducing~~ mercury ~~from in~~ a mercury -containing gas, the method comprising:

combusting coal in a combustion chamber, ~~to provide the mercury-containing gas, wherein~~

the coal ~~comprising an additive comprising~~ comprises added HI, an iodide salt, or a combination thereof, ~~added to the coal before the coal enters the combustion chamber, or~~

~~the combustion chamber comprises added HI, an iodide salt, or a combination thereof, or to form the mercury-containing gas;~~

~~a combination thereof;~~

~~injecting a~~ collecting mercury in the mercury-containing gas with an injected sorbent comprising activated carbon ~~into the mercury-containing gas downstream of the combustion chamber,~~ wherein a weight ratio of the HI, iodide salt, or the combination thereof added to the coal, added to the combustion chamber, or a combination thereof, to an amount of the sorbent injected into the mercury-containing gas is from about 1:100 to about 30:100~~;~~.

~~contacting mercury in the mercury-containing gas with the sorbent; and~~

~~separating the sorbent contacted with the mercury from the mercury-containing gas.~~

Claim 25 is obvious for the reasons described for Claim 1. The differences in claim language are discussed below. EX1002 ¶¶391-395.

Preamble: Claim 25 recites “for reducing,” whereas claim 1 recites “separating” mercury. Separating mercury from the mercury-containing gas reduces the amount of mercury in the mercury-containing gas. EX1002 ¶392.

Element 25(a): As discussed for Claim Element 1(b), Vosteen589 adds the iodine-containing chemicals directly to the coal. EX1002 ¶393.

Element 25(b): As discussed for Claim Elements 1(e)-1(f), the combination of Vosteen589 and Starns/Mass EPA collects mercury by adsorbing it onto injected activated-carbon sorbent. EX1002 ¶394.

4. Independent Claim 26

Claim 26 is nearly identical to Claims 1 and 10, with minor changes, as shown below:

~~1~~26. A method of separating mercury from a mercury-containing gas, the method comprising:
combusting coal in a combustion chamber, to provide the mercury-containing gas, wherein
the coal comprises added HI, an iodide salt, or a combination thereof, added to the coal before
the coal enters the combustion chamber, or
the combustion chamber comprises added HI, an iodide salt, or a combination thereof, or
a combination thereof;
injecting a sorbent comprising activated carbon into the mercury-containing gas downstream of
the combustion chamber such that the activated carbon reacts with the halogen or halide
promoter in the mercury-containing gas to form a promoted sorbent, wherein a weight ratio of
the HI, iodide salt, or the combination thereof added to the coal, added to the combustion
chamber, or a combination thereof, to an amount of the sorbent injected into the mercury-
containing gas is from about 1:100 to about 30:100;
contacting mercury in the mercury-containing gas with the promoted sorbent; ~~and~~
separating the promoted sorbent contacted with the mercury from the mercury-containing gas;
~~10. The method of claim 1, further comprising~~
measuring the mercury content of the mercury-containing gas; and
modifying, in response to the measured mercury content of the mercury-containing gas,
an injection rate of injecting the sorbent into the mercury-containing gas,
an amount of the HI, the iodide salt, or a combination thereof, added to the coal or the
combustion chamber, or
a combination thereof.

Claim 26 is obvious for the reasons described for Claims 1 and 10. EX1002 ¶¶396-406.

Regarding Element 26(c), when halogens and carbon contact one another (e.g., upon Vosteen589’s adsorption), they react to form a promoted sorbent. It was well-known in the art that halogens (including iodine) “promoted” activated-carbon sorbents because they increased the ability of the activated carbon to bind with the mercury. *See supra* §V.D.4; EX1002 ¶¶129-151, 400-402; EX1095 (Olson), 231:3-9; *see* 98:23-100:3. The “promotion” of activated carbon by halogens is a form of reaction. EX1095, 45:16-25, 174:7-14; *see* EX1092, 156 (labeled as limitation 24e, O’Keefe explaining how adding halogens to coal would contact and react with sorbent).

VIII. GROUNDS 3-4: OBVIOUSNESS OVER LISSIANSKI/STARNES/MASS-EPA

Ground 3 asserts obviousness of Claims 1, 3, 6-18, and 20-26 over Lissianski (EX1014) and Starnes (EX1008). Ground 4 asserts obviousness of Claims 1, 3 and 6-26 over Lissianski (EX1014) and Mass-EPA (EX1009). EX1002 ¶407.

A. OVERVIEW OF EX1014 (“LISSIANSKI”)

Lissianski (filed 1/6/2004 and issued 4/7/2009) is entitled, “Method for Removal of Mercury Emissions from Coal Combustion.” Lissianski describes injecting aqueous salt solutions of ammonium halides (referred to as “halogen agent”)—including NH_4Cl , NH_4Br , or NH_4I —into a combustion chamber to help

oxidize mercury. EX1014, Abstract, 4:14-29, Figs. 1-2. The halogen agent “allows for improved efficiency of mercury removal by activated carbon (AC) injection.” EX1014, 3:45-49; *see* 3:20-22, claim 8. EX1002 ¶¶222-223, 225-227.

B. ANALOGOUS ART

Starns and Mass-EPA are analogous art. *Supra* §VII.C. Lissianski is analogous art to the '218 Patent as it is in the same field of endeavor and reasonably pertinent to the problems the inventors faced. EX1001, 1:46-50, 2:43-44. Lissianski adds halogens to improve the effectiveness of activated carbon in mitigating mercury at power stations. EX1014, 3:45-49, claim 8; EX1002 ¶224.

C. OVERVIEW OF THE COMBINATIONS AND REASONS TO COMBINE

A POSITA would have been motivated to combine Lissianski with Starns (Ground 3) and Lissianski with Mass-EPA (Ground 4), with reasonable expectation of success, because all three references are directed towards the same goal—i.e., removing mercury from coal-combustion flue gases—and are interoperable. EX1002 ¶408.

As described above and further below, Lissianski enhances the effectiveness of mercury removal with PAC injection by adding halogen agents (NH₄I) to the coal or combustion chamber. EX1014, Abstract, 4:14-29, Figs. 1-2. Lissianski, however, does not fully disclose all details about implementing that PAC injection system, such as injection rates or which activated-carbon to use. Starns and Mass-EPA

supply these details, such as hardware and control processes. A POSITA would have been motivated to combine, with reasonable expectation of success, because ACI was well-known in the art, as admitted by the '218 Patent. EX1001, 2:13-21, 28:22-33; *see* EX1096 (Holmes), 41:5-9; EX1095 (Olson), 114:21-25; EX1097 (Pavlish), 210:4-18. Each combination represents combining prior art elements (activated-carbon sorbent in Lissianski and Starns/Mass-EPA) according to known methods (injection into flue gas in Lissianski and Starns/Mass-EPA) to yield predictable results (mercury removal). EX1002 ¶¶409-413.

1. Ground 3 (Combination of Lissianski with Starns)

Additional reasons to use the activated-carbon injection (ACI) of Starns are described above regarding Ground 1. *See supra* §VII.D.1. For example, Starns refers to ACI as the “most mature, retrofit technology available today” (EX1008, 2) and discloses the hardware and control processes for ACI into the flue gas of Lissianski. EX1002 ¶¶414-417.

2. Ground 4 (Combination of Lissianski with Mass-EPA)

Additional reasons to use the ACI of Mass-EPA are described above regarding Ground 2. *See supra* §VII.D.2. For example, Mass-EPA refers to ACI as “the most extensively studied sorbent for mercury adsorption.” EX1009, 32. Mass-EPA discloses the hardware and control processes for ACI and other sorbent additives to the flue gas. EX1002 ¶¶418-423.

D. DISCLOSURE AND TEACHINGS OF THE COMBINATIONS

Grounds 3 and 4 largely rely on the common disclosure of Lissianski, with certain claim limitations disclosed by Starns (Ground 3) and by Mass-EPA (Ground 4). EX1002 ¶424.

1. Independent Claim 1

a. Element 1(Pre): “A method of separating mercury from a mercury-containing gas, the method comprising”

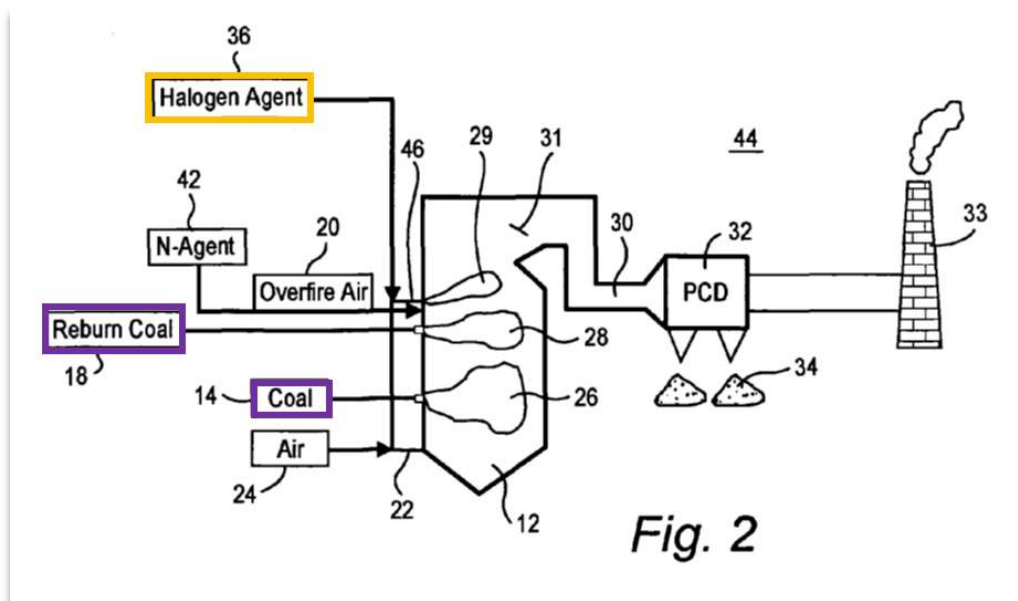
Lissianski is entitled, “Method for Removal of Mercury Emissions from Coal Combustion.” EX1014, Title. “Removal of Mercury” refers to separating mercury from mercury-containing gas. The mercury is removed “with an adsorbent in the flue gas.” EX1014, Abstract. The adsorbed mercury is “collect[ed],” which is a form of separating it from the flue gas. EX1014, claim 1, 32; EX1002 ¶425.

b. Element 1(a): “combusting coal in a combustion chamber, to provide the mercury-containing gas;”

Lissianski discusses combusting coal to form the mercury-containing gas. For example, the title is, “Method for Removal of Mercury Emissions from Coal Combustion.” *See* EX1014, Abstract (“A method to reduce emissions in flue gas due to combustion of coal in the combustion unit”); claims 1, 32. The term “flue gas” refers to mercury-containing gas. Lissianski refers to the combustion chamber as “furnace 12” or, alternatively, as “boiler 12.” EX1014, 1:1-6; EX1002 ¶426.

- c. **Element 1(b): “the coal comprises added HI, an iodide salt, or a combination thereof, added to the coal before the coal enters the combustion chamber, or the combustion chamber comprises added HI, an iodide salt, or a combination thereof, or a combination thereof;”**

Lissianski describes adding ammonium halides (referred to as “halogen agent” and annotated gold)—including NH_4I —into a combustion chamber to help oxidize mercury. EX1014, Abstract, 4:14-29. Combustion chamber 12 is shown below:



EX1014, Fig. 2 (annotated); *see* 4:30-36 (halogens injected “into the boiler along with the OFA”). NH_4I is an iodide salt. In the combustion chamber, the “hot flue gas causes the additive to thermally decompose to form ... HI which results in more significant mercury oxidation.” EX1014, 3:42-47; EX1002 ¶¶427-428.

Lissianski confirms that the injection of the NH_4I is into the combustion chamber. As shown in Figure 2, the halogen agent is “injected ... into the boiler along with the OFA 20 into the burnout zone 29,” and the “[o]verfire air (OFA) is injected into the OFA burnout zone 29 **to complete combustion.**” EX1014, 4:9-10; 4:30-36; EX1002 ¶428.

Furthermore, Lissianski illustrates that the halogen agent is mixed with coal upstream of the combustion chamber, in that the arrow from halogen agent in Figure 2 extends vertically to the bottom of the figure, indicating junctions between the halogen agent and overfire air 20, reburn coal 18, primary coal 14, and primary air 24.⁷ EX1002 ¶429.

⁷ Reburn is a technique in which a portion of pulverized coal that would normally be burnt as primary fuel is instead injected into a second combustion zone, in the upper part of the combustion chamber. This allows the reburn coal to react with unburned materials and associated NO_x , and helps reduce overall NO_x emissions. EX1014, 4:5-9, 4:43-69; EX1002 ¶429.

d. Element 1(c): “injecting a sorbent comprising activated carbon into the mercury-containing gas downstream of the combustion chamber,”

i. Grounds 3-4

Lissianski discloses “mercury removal by activated carbon injection,” a type of particulate sorbent material. EX1014, 3:21-22; *see* EX1014, 3:45-49, cl. 7; *see* claim 32 (“adsorbing the oxidized mercury generated by the combustion of the coal with an adsorbent in the flue gas”). A POSITA would have understood that the active carbon injection occurs into the mercury-containing gas, downstream of the combustion chamber. For instance, a POSITA would have understood that the activated carbon is used to adsorb mercury in the flue gas. EX1014, 3:42-49; EX1002 ¶¶430-431.

ii. Ground 3

Starns confirms “injection of sorbents such as powdered activated carbon (PAC) into the flue gas.” EX1008, 2; *see* 7-9. EX1002 ¶432; *see supra* §VII.E.1.d.ii (Ground 1, additional disclosure of Starns).

iii. Ground 4

Mass-EPA discloses “activated carbon injection” in numerous places. *See* EX1009, 31-56. EX1002 ¶433; *see supra* §VII.E.1.d.iii (Ground 2, additional disclosure of Mass-EPA).

- e. **Element 1(d): “a weight ratio of the HI, iodide salt, or the combination thereof added to the coal, added to the combustion chamber, or a combination thereof, to an amount of the sorbent injected into the mercury-containing gas is from about 1:100 to about 30:100;”**

Claim Element 1(d) is obvious over the combinations of Lissianski with Starns (Ground 3) and Lissianski with Mass-EPA (Ground 4). Lissianski identifies halogen concentration in the mercury-containing flue gas, and Starns and Mass-EPA describe the sorbent concentration. EX1002 ¶¶434-445.

Lissianski discloses modeling of mercury oxidation, based on supplying halogen-containing additives to the mercury-containing gas at 0.3 ppm and/or 3 ppm.

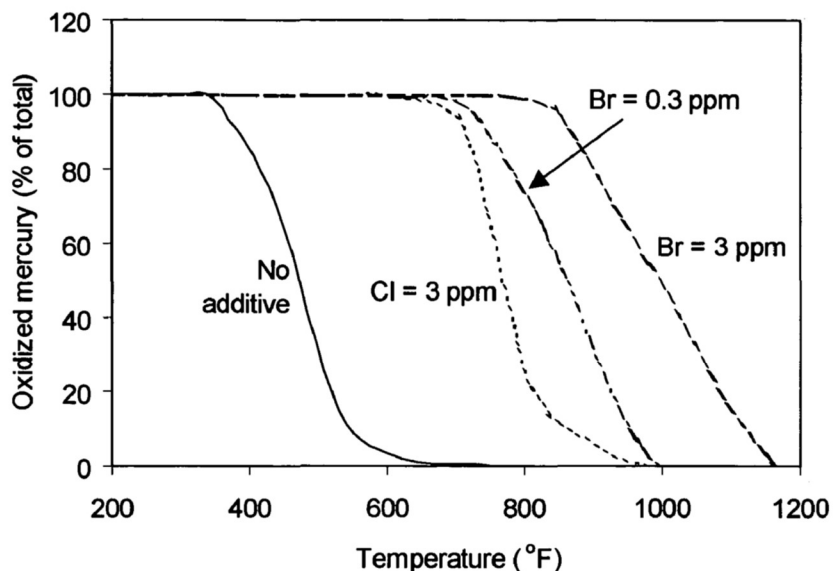


Fig. 9

EX1014, Fig. 9; *see* 6:63-7:6 (describing the modeling). Regarding Figure 9, Lissianski discusses that “iodine containing compounds also should be strong mercury oxidizing additives.” EX1014, 7:1-6. Thus, a POSITA would be motivated to try the same concentrations for the iodine-containing chemicals, either 3 ppm or 0.3 ppm.⁸ EX1002 ¶435.

As Dr. Niksa explains, and as taught by Lissianski, mercury oxidation tends to proceed more effectively at lower temperatures (i.e., as the temperature increases, the fraction of oxidized mercury is lower compared to elemental mercury) and higher halogen concentrations. Given the emphasis in Lissianski of increasing the fraction of oxidized mercury, a POSITA would have been motivated to select the 3 ppm value for halogen-agent concentration injected into the combustion chamber. *See, e.g.*, EX1014, Abstract, 1:14-51, 2:2-13, 3:12-50, 6:53-7:6, claim 1; EX1002 ¶436. Dr. Niksa explains how a POSITA would have been able to calculate gas-phase concentration of halogen agent based on the data presented by Lissianski. A POSITA would have understood that, as compared to the halogen concentration of native coal, nearly all the gas-phase concentration of I comes from the halogen agent (NH₄I). EX1014, 1:53-67; EX1002 ¶436.

⁸ Because ppm is on a molar basis, then 1 ppm I = 1 ppm NH₄I = 1 ppm HI. EX1002 ¶436.

Lissianski discloses activated carbon injection, but not its gas-phase concentration. As Dr. Niksa explains with source citations, it was routine to use injection rates of around 10 pounds/MMacf of flue gas to capture mercury. EX1002 ¶437; *see* ¶¶114-115. This is the ACI rate disclosed by Starns (Ground 3) and by Mass-EPA (Ground 4). EX1008, 20; EX1009, 12, 73; EX1002 ¶¶438-439.

Dr. Niksa explains how a POSITA would have been readily capable of converting between units of ppm I (Lissianski) and sorbent concentration (Starns and Mass-EPA), and then dividing the two to determine a ratio. This involves fundamental precepts taught in undergraduate chemistry, such as unit conversions (e.g., between Liters and ft³ and pounds to grams) and the ideal gas law ($PV=nRT$). Dr. Niksa performs the unit conversions, including at the actual flue-gas temperatures disclosed by Starns (EX1008, 10) and Mass-EPA (EX1009, 26). The 3.0 ppm of halogen agent (e.g., NH₄I) added to the combustion chamber in Lissianski, and the well-known injection rate of 10 pounds sorbent per MMacf (as disclosed in Starns and Mass-EPA), provides 7.9 grams ammonium iodide per 100 grams of sorbent. This is within the claimed range of 1:100-30:100. It would have been obvious to try other ratios, such as by increasing halogen concentration (while reducing activated-carbon injection rates), or decreasing halogen concentration (while increasing activated-carbon injection) as part of routine process optimization to achieve the desired mercury removal. EX1002 ¶¶440-445.

Claim Element 1(d) is merely an attempt to claim a workable range for a conventional halide (HI, iodide salt) being used in a conventional way (to oxidize mercury and promote activated carbon) with a conventional sorbent (activated carbon). Nothing in the '218 Patent specification attributes significance to the claimed range or establishes that the claimed range “achieves unexpected results.” The range presents nothing more than optimization of “result-effective” variables that would have been obvious to a POSITA. *Applied Materials*, 692 F.3d at 1297-98; *Pfizer*, 94 F.4th at 1347 (“decades-old legal principle that “where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation”); EX1002 ¶445. PO previously admitted for a parent of the '218 Patent that the “claimed ratio of 1-30 grams promoter per 100 grams of sorbent ... is entitled to no patentable weight,” as it “presented nothing more than optimization of result-effective variables that would have been obvious to a POSITA.” EX1105, 34-35.

f. Element 1(e): “contacting mercury in the mercury-containing gas with the sorbent”

i. Grounds 3-4

Lissianski discloses “adsorbing the oxidized mercury generated by the combustion of the coal with an adsorbent in the flue gas.” EX1014, 2:10-12. Lissianski further describes that “[o]xidized mercury ... is water soluble and is easily

adsorbed on high carbon fly ash or activated carbon.” EX1014, 1:35-36; *see* claim 32 (“adsorbing the oxidized mercury generated by the combustion of the coal with an adsorbent in the flue gas”). The “adsorbing” process that Lissianski describes refers to a process by which adsorbate (e.g., atoms/ions/molecules) in a fluid (typically a gas) are bound to the surface of a sorbent, and thus by definition the sorbent contacts mercury in the mercury-containing gas to form a mercury-sorbent composition. EX1002 ¶446.

ii. Ground 3

Starns further confirms that by “injection of sorbents such as powdered activated carbon (PAC) into the flue gas,” the “gas-phase mercury in the flue gas contacts the sorbent and attaches to its surface.” EX1008, 2. EX1002 ¶447.

iii. Ground 4

Mass-EPA confirms that “sorbent particles ... contact the Hg in the flue gas.” EX1009, 21 n.25; *see* 33 (“mercury to contact the AC [(activated carbon)] particle”). EX1002 ¶448.

a. Element 1(f): “separating the sorbent contacted with the mercury from the mercury-containing gas.”

Lissianski discloses this claim element. Lissianski discloses “collecting the adsorbent with the oxidized mercury in a combustion waste treatment system.” EX1014, 2:13-14; *see* claim 32 (similar language). The act of “collecting” the

adsorbent separates the sorbent from the mercury-containing gas. Lissianski discloses a particulate collection system, such as PCD 32 in Figures 1-2 shown above. EX1002 ¶449. This claim limitation would be further obvious over Starns (Ground 3) and Mass-EPA (Ground 4), which disclose separating the mercury-sorbent composition with an ESP. EX1002 ¶¶450-451.

2. Claims Depending from Claim 1

a. Claim 3: “the combustion chamber comprises the added HI, the iodide salt, or a combination thereof.”

As described for Element 1(b), Lissianski discloses adding NH₄I (ammonium iodide salt) to the combustion chamber, which thermally decomposes inside the combustion chamber to form “HI.” EX1014, Abstract, 3:42-47, 4:14-29, Figs. 1-2, claim 32; EX1002 ¶452.

b. Claims 6-7:

6: “the combustion chamber is a coal combustion chamber that is used to produce electricity.”

7: “the combustion chamber is a coal combustion furnace.”

i. Grounds 3-4

As described for Element 1(a), the combustion chamber that combusts coal is a “furnace,” into which the coal and iodine compound are fed. EX1014 Abstract, ¶[0013], cl. 1. The process takes place at a “coal fired power plant,” which produces electricity. EX1014, 2:53-64, 4:1-3, 4:30-31, 4:42-43; EX1002 ¶¶453 456.

ii. Ground 3

Claim 6 is further obvious over Starns. Starns discloses sorbent injection at “Wisconsin Electric’s Pleasant Prairie Power Plant,” which produces electricity. EX1008, Title, 4; EX1002 ¶454.

iii. Ground 4

Claim 6 is further obvious over Mass-EPA, discussing “coal-fired electric utility power plants operating in the United States.” EX1009, 53; *see* 8; EX1002 ¶455.

c. Claims 8-9:

8: “the coal comprises a subbituminous coal.”

9: “the coal comprises a lignite coal.”

i. Grounds 3-4

Lissianski controls mercury emissions from “coal from the Powder River Basin (hereinafter PRB) and lignite coals.” EX1014, 1:53-55; *see* claim 3 (“Powder River Basin coal or lignite coal”). PRB is a type of subbituminous coal. EX1002 ¶¶457, 460.

i. Ground 3

Claim 8 is further obvious over Starns, which removed mercury for units that “fire a variety of Powder River Basin (PRB) low sulfur, sub-bituminous coals.” EX1008, 4; EX1002 ¶458.

ii. Ground 4

Claim 8 is further obvious over Mass-EPA, which discloses “Powder River Basin (PRB) subbituminous coal.” EX1009, 24, 29, 77; EX1002 ¶459.

d. Claims 10-12:

10: “measuring the mercury content of the mercury-containing gas; and modifying, in response to the measured mercury content of the mercury-containing gas, an injection rate of injecting the sorbent into the mercury-containing gas, an amount of the HI, the iodide salt, or a combination thereof, added to the coal or the combustion chamber, or a combination thereof.”

11: “the measuring of the mercury content of the mercury-containing gas comprises continuous measurement.”

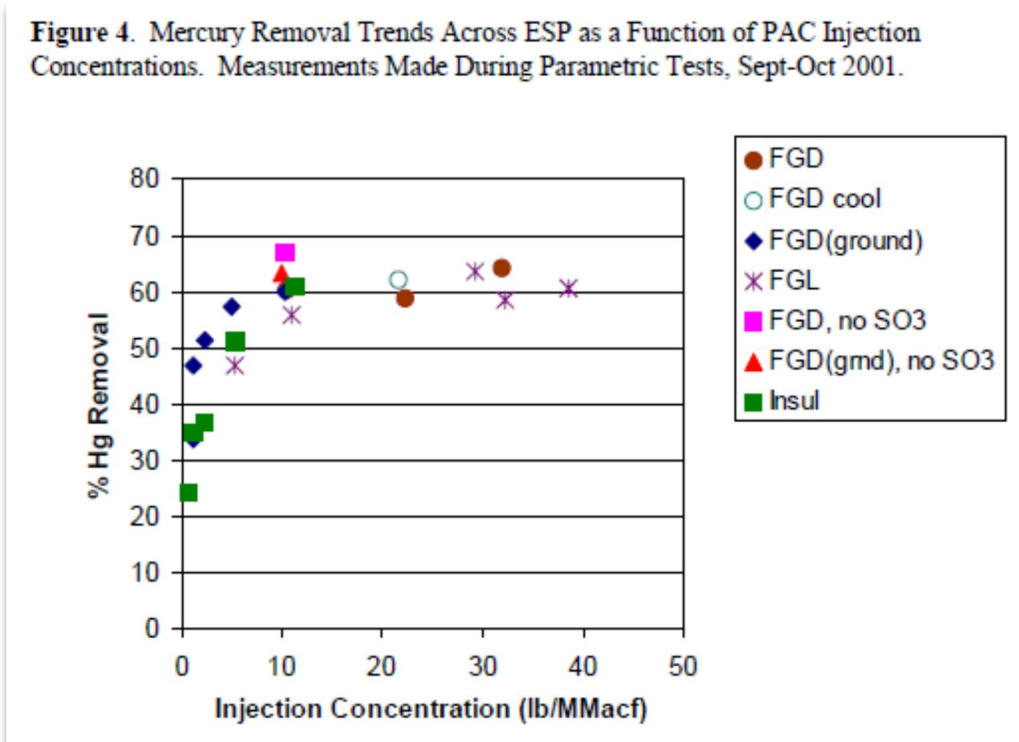
12: “modifying, in response to a measured mercury content, an injection rate of injecting the sorbent into the mercury-containing gas, an amount of the HI, the iodide salt, or a combination thereof, added to the coal or the combustion chamber, or a combination thereof.”

Starns (Ground 3) and Mass-EPA (Ground 4) performs continuous mercury measurement of the mercury-containing gas and, based on the measurements, modify an injection rate of injecting the sorbent into the mercury-containing gas. It would have been obvious to modify sorbent-injection rate as part of routine process control and optimization to account for variances in the coal. EX1002 ¶¶464-465,

470. Upon reviewing the measured-mercury data presented in Starns (Ground 3) and Mass-EPA (Ground 4), a POSITA would have understood that adding excessive sorbent would be wasteful and adding insufficient sorbent may not achieve mercury-removal targets, and would have modified sorbent-injection rate accordingly. EX1002 ¶¶461-472.

i. Ground 3

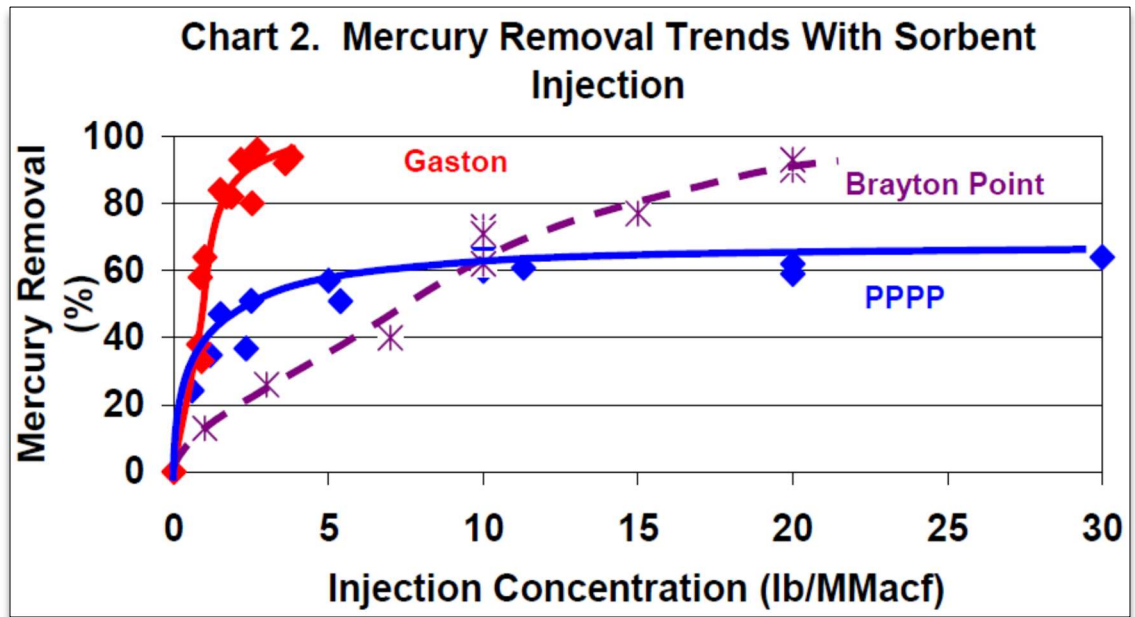
Starns discloses a mercury monitor “operate[d] continuously,” and “[m]ercury removal was monitored as a function of the sorbent injection concentration.” EX1008, 8, 11. Starns controls mercury content (Y-axis) based on modifying sorbent-injection rate (X-axis), such as 1-10 lb/MMacf (pounds sorbent per-million actual ft³ of flue gas). EX1008, 7, 11, 13, 20, Figs. 3-6.



EX1008, Figs. 4-5; EX1002 ¶¶463-464.

ii. Ground 4

Mass-EPA discloses using “continuous emissions monitoring systems (CEMS) to monitor stack-level Hg emissions.” EX1009, 60. Mass-EPA measures mercury content to select sorbent-injection rates. EX1009, 11-12, 33, 50, 60, 73 (“mercury removal as a function of [sorbent] injection rate”):



EX1009, 12. Mass-EPA summarized its testing as determining “mercury removal as a function of [sorbent] injection rate.” EX1009, 73; *see* EX1009, 13. A POSITA would have been motivated to modify sorbent-injection rate to achieve “an overall reduction of 75%.” EX1009, 5; EX1002 ¶¶467-469.

e. Claim 13: “the sorbent contacted with the mercury comprises the element iodine and mercury.”

As described for Elements 1(e)-1(f), mercury adsorbs onto sorbent to form a mercury-sorbent composition. The composition also includes the element iodine, because as Lissianski discloses, mercury is oxidized by the halide. EX1014, 1:35-

36, 2:10-12. Accordingly, once adsorbed, the sorbent comprises mercury and the element iodine.⁹ EX1002 ¶¶473-475.

f. Claims 14-16:

14: “removing greater than 70 wt% of the mercury in the mercury-containing gas.”

15: “removing greater than 70 wt% of the mercury in the mercury-containing gas with the sorbent.”

16: “the combination of the contacting of the mercury in the mercury-containing gas with the sorbent and the separating of the sorbent contacted with the mercury from the mercury-containing gas decreases the amount of elemental mercury in the mercury-containing gas.”

Claims 14-16 are obvious over Lissianski and Starns (Ground 3) and Lissianski and Mass-EPA (Ground 4). Each reference achieves greater than 70 wt% mercury removal. EX1002 ¶¶476-485.

⁹ To the extent PO narrowly construes the claim to require the sorbent first contact iodine before contacting mercury, such a read would be unsupported. Nevertheless, the claim is still obvious for the reasons discussed *infra* Claim 17.

i. Grounds 3-4

Regarding Claim 16, Lissianski discloses that the halide additive provides “a decrease in the concentration of elemental mercury (Hg^0) from 60% to about 30% of total mercury indicating that the additive oxidized some mercury.” EX1014, 5:26-28. The oxidized mercury “is more easily collected by emission control devices than is elemental mercury.” EX1014, 1:22-25; *see* 2:10-13, Figs. 4-5, 8-9 (showing decrease in elemental mercury and increase in oxidized mercury). EX1002 ¶485.

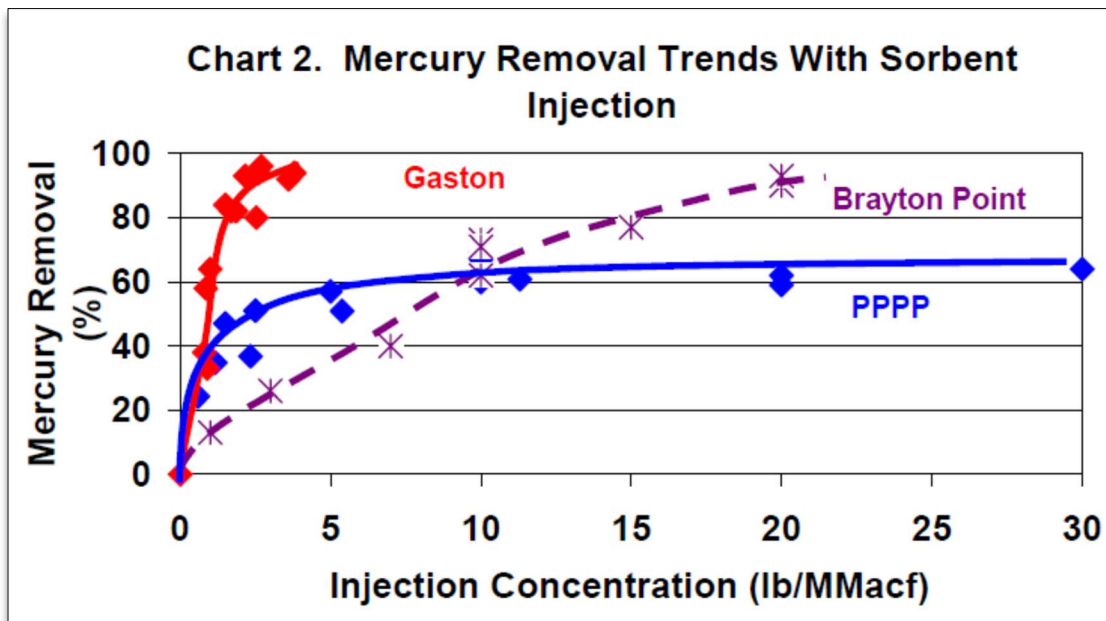
Lissianski discloses that the oxidized mercury “is easily adsorbed on high carbon fly ash or other activated carbon. ... Mercury control is generally most effective when the mercury in the flue gas is mostly oxidized.” EX1014, 1:35-42; *see* 3:20-23 (“By increasing the fraction of oxidized mercury, the halogen additive increases the amount of mercury removal by activated carbon injection ...”); *see* 3:47-50 (similar). In view of emissions regulations calling for 70% mercury removal (*see supra* §V.D.3), a POSITA would have expected that the amount of mercury removed would be over 70%, including on the sorbent. A POSITA would have been motivated, with reasonable expectation of success through routine process optimization, to adjust the halide addition rate and/or ACI rate to meet and surpass (e.g., for safety margin) well-known regulatory proposals calling for at least 70% mercury removal. *See supra* §V.D.3; *Koninklijke*, 948 F.3d at 1337; EX1002 ¶¶477, 480, 481, 484.

ii. Ground 3

Claims 14-15 would be further obvious over Starns, which discloses removing 70% mercury when using 10 lb/MMacf of activated carbon with solely dry-emission controls. EX1008, 2, 20. When combined with the halide improvements of Lissianski, the removal would be even greater. EX1002 ¶¶478, 482.

iii. Ground 4

Claims 14-15 would be obvious over Mass-EPA, which discloses removing more than 70% mercury with dry-emission systems.



EX1009, 11-12 (Chart 2); *see* EX1009, 70, 74. When combined with the halogenation of Lissianski, the removal would be even greater. EX1002 ¶¶479, 483.

g. Claim 17: “the sorbent injected into the mercury-containing gas is a sorbent obtained by contacting a sorbent with a halogen or halide promoter prior to injection of the sorbent into the mercury-containing gas.”

i. Grounds 3-4

Claim 17 is obvious over Lissianski and Starns (Ground 3) and Mass-EPA (Ground 4). A POSITA would have known that for coals with higher native-mercury content (or lower native-halogen content), additional mitigation may be needed to further reduce mercury emissions. EX1002 ¶¶486-488. A POSITA would have been motivated to try, with reasonable expectation of success, pre-halogenating sorbent before injection into the mercury-containing flue gas. For example, it was known since the 1930s to remove mercury vapors by injecting halogen-impregnated activated-carbon sorbents into a mercury-containing flue gas. *Supra* §V.D.4. Though more expensive, such pre-halogenation would have been beneficial for coals with higher native-mercury content (or lower native-halogen content) to reduce mercury emissions. EX1002 ¶488; *Koninklijke*, 948 F.3d at 1337.

ii. Ground 4

Claim 17 is further obvious over Mass-EPA, which discloses two alternative sorbents to inject into a flue gas: “activated carbon (or the impregnated activated carbon).” EX1009, 32. Exemplary forms of the impregnated (pre-halogenated) sorbent include “chlorine-impregnated activated carbon” and “[m]odified activated

carbons ... doped with ... chlorine and iodine,” and which “provide higher mercury adsorption capacity.” EX1009, 33-34 & n.44. Chlorine and iodine are halogen or halide promoters. EX1002 ¶487.

h. Claim 18: “the sorbent injected into the mercury-containing gas is free of contact with a halogen or halide promoter prior to injection of the sorbent into the mercury-containing gas.”

Claim 18 is obvious over Lissianski and Starns (Ground 3) and Lissianski and Mass-EPA (Ground 4).

As discussed above for Claim Element 1(c), each combination injects activated-carbon sorbent into the mercury-containing flue gas. Lissianski does not characterize the sorbent as having been pre-halogenated prior to injection. A POSITA would have selected halogen-free sorbent due to its lower cost (compared to pre-halogenated PAC), particularly for applications (e.g., types of coal) that do not require the enhanced removal properties of PAC. EX1002 ¶489.

Regarding Ground 3, Starns discloses Norit “Darco FGD”: a “standard powdered activated carbon (FGD) ... supplied by Norit Americas ... as the benchmark sorbent.” EX1008, 3. Regarding Ground 4, Mass-EPA discloses the same activated-carbon sorbent: “Norit America’s ‘Darco FGD.’” EX1009, 73-74; EX1002 ¶490.

Regarding Grounds 3-4, a POSITA would have recognized that Norit Darco FGD is substantially free of halogen and halide promotion. EX1002 ¶¶141, 490 (discussing EX1048, chemical analysis of Norit FGD).

i. Claim 19: “injecting an additive comprising a compound comprising Ca, Na, or a combination thereof, into the mercury-containing gas downstream of the combustion chamber.”

Claim 19 is obvious over Lissianski and Mass-EPA (Ground 4). Mass-EPA describes that “[i]ncreased removal of mercury from gas has been demonstrated by co-injection of activated carbon and calcium-based sorbents.” EX1009, 32. Other alkaline sorbents include: “activated carbon was co-injected with either sodium carbonate or lime [calcium oxide] for SO₂ control. With either of these sorbents, an improvement in the adsorption of gaseous Hg by the activated carbon was reported.” EX1009, 37. Sodium carbonate (Na₂CO₃) contains Na and lime contains CaO. EX1002 ¶¶491-492.

j. Claim 20: “the mercury-containing gas is a flue gas.”

Lissianski repeatedly characterizes the mercury containing gas as a flue gas. *See, e.g.*, EX1014, Abstract (“reduce emissions in flue gas ... adsorbent in the flue gas”), 1:14-15 (“flue gas generated by combustion”). EX1002 ¶493.

k. Claims 21-22:

21: “the injection of the sorbent into the mercury-containing gas occurs upstream of a particulate separator or a scrubber.”

22. “the particulate separator is an electrostatic precipitator, a baghouse, a fabric filter, or a combination thereof.”

i. Grounds 3-4

These claims are obvious over Lissianski and Starns (Ground 3) and Mass-EPA (Ground 4). EX1002 ¶¶494-499.

Lissianski discloses “adsorbing the oxidized mercury generated by the combustion of the coal with an adsorbent in the flue gas” and then “collecting the adsorbent with the mercury in a combustion waste treatment system.” EX1014, claim 1; *see* Claim 7 (“claim 1 wherein the adsorbent is activated carbon, and the oxidized mercury is adsorbed on the activated carbon”). Lissianski further discloses “a particulate control device (PCD),” such as in the combustion waste system. EX1014, 4:4, Figs. 1-3 (showing PCD 32). A POSITA would have known that the sorbent must be injected upstream of the PCD, so that the PCD can function to collect the sorbent. *Supra* §V.D.2; EX1002 ¶¶495-499. These claims are further obvious over Starns and Mass-EPA, which disclose the location of sorbent injection.

ii. Ground 3

Starns recommends “using activated carbon injection upstream of an ESP.”
EX1008, 20; EX1002 ¶496.

iii. Ground 4

According to Mass-EPA, the approaches “demonstrated or under investigation to control mercury” included an “ElectroStatic Precipitator (ESP).”
EX1009, 7. Mass-EPA teaches injecting activated carbon “upstream of an ESP.”
EX1009, 32, 53-54; EX1002 ¶¶497-498.

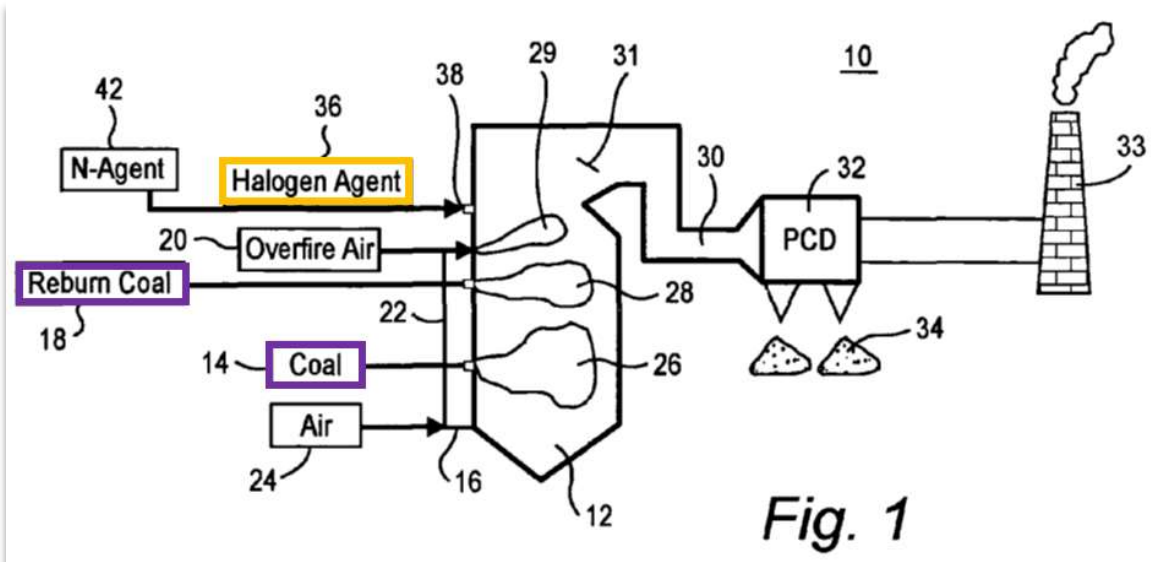
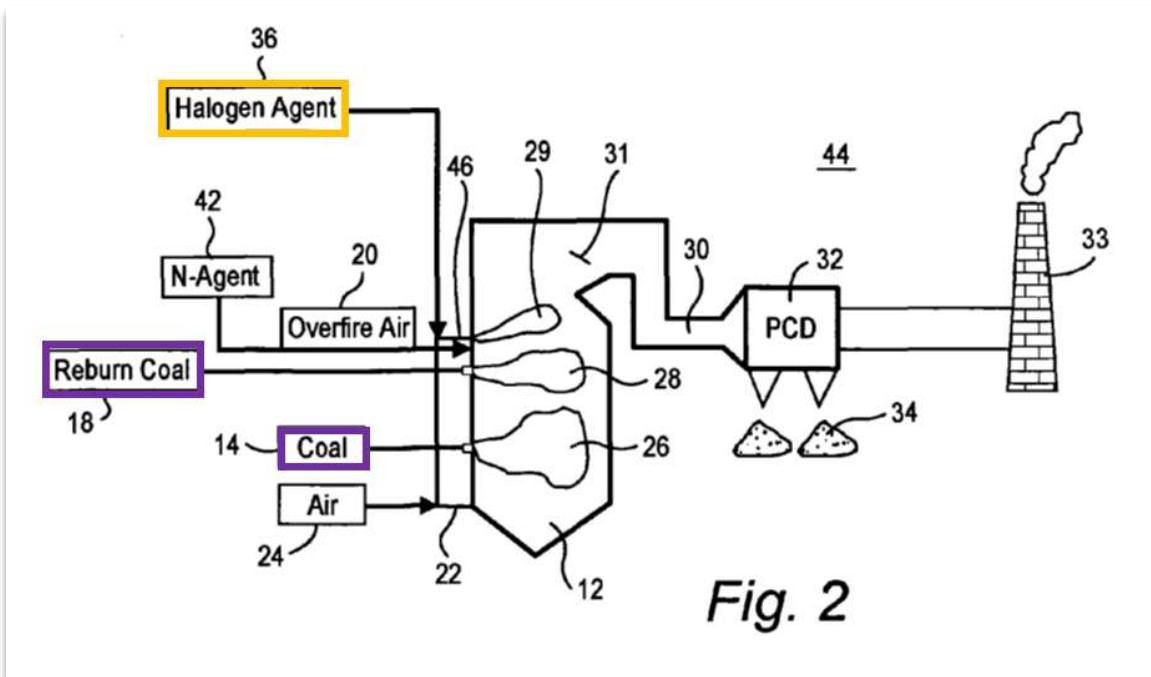
I. Claims 23-24:

23: “the coal comprises added halide sorbent enhancement additive that comprises the HI, iodide salt, or combination thereof.”

24: “the coal and/or the combustion chamber comprises the iodide salt.”

As discussed for Element 1(b), Lissianski applies NH_4I halogen agent directly to the combustion chamber and to the coal, and the ammonium iodide mixes with the coal. EX1002 ¶¶500, 502.

In Figures 1-2 of Lissianski, a mixture of halide agent (item 36, annotated gold) and coal (items 14 and 18, annotated purple) is combusted in combustion chamber 12.



Coal (annotated purple) is added to the combustion chamber in two places:

Most of the coal is burned in a primary combustion zone 26 of the boiler 12. The remaining coal (or fuel) is injected downstream into the reburn zone 28 through the reburn injectors 18 to provide fuel-rich combustion in the reburn zone 28.

EX1014, 4:5-9; *see* 4:43-69 (discussing reburn system).¹⁰ The halogen agent mixes with both the primary coal and reburn coal, because the injectors are designed to ensure thorough mixing between coal and additive by “increas[ing] the penetration of the additive.” EX1014, 4:20-23. In either case, the halogen agent (additive) is in a mixture with coal that is combusted. EX1002 ¶501.

3. Independent Claim 25

Claim 25 is similar to Claim 1, as shown below:

¹⁰ As Dr. Niksa explains, reburn coal is a technique in which a portion of pulverized coal that is normally burnt as primary fuel is first partially burned and then injected into a second combustion zone, in the upper part of the boiler. This allows the reburn coal to react with unburned materials from the primary burn and associated NO_x, and helps reduce overall NO_x emissions from the power plant. EX1002 ¶429.

~~125.~~ A method ~~of separating for reducing~~ mercury ~~from in~~ a mercury -containing gas, the method comprising:

combusting coal in a combustion chamber, ~~to provide the mercury-containing gas, wherein~~

the coal ~~comprising an additive comprising~~ comprises added HI, an iodide salt, or a combination thereof, ~~added to the coal before the coal enters the combustion chamber, or~~

~~the combustion chamber comprises added HI, an iodide salt, or a combination thereof, or to form the mercury-containing gas;~~

~~a combination thereof;~~

~~injecting a~~ collecting mercury in the mercury-containing gas with an injected sorbent comprising activated carbon ~~into the mercury-containing gas downstream of the combustion chamber,~~ wherein a weight ratio of the HI, iodide salt, or the combination thereof added to the coal, added to the combustion chamber, or a combination thereof, to an amount of the sorbent injected into the mercury-containing gas is from about 1:100 to about 30:100~~;~~.

~~contacting mercury in the mercury-containing gas with the sorbent; and~~

~~separating the sorbent contacted with the mercury from the mercury-containing gas.~~

As compared to Claim 1, Claim 25 removes a number of limitations. Claim 25 is obvious for the reasons described for Claim 1. The differences in claim language are discussed below. EX1002 ¶¶503-507.

Preamble: Claim 25 recites “for reducing,” whereas claim 1 recites “separating” mercury. Separating mercury from the mercury-containing gas reduces the amount of mercury in the mercury-containing gas. EX1002 ¶504.

Element 25(a): As discussed for Claims 23-24, Lissianski discloses, or at least renders obvious, that the coal comprises the iodine compounds. EX1002 ¶505.

Element 25(b): As discussed for Claim Elements 1(e)-1(f), the combination of Lissianski and Starns/Mass EPA collects mercury by adsorbing it onto injected activated-carbon sorbent. EX1002 ¶506.

4. Independent Claim 26

Claim 26 is nearly identical to Claims 1 and 10, with minor changes, as shown below:

~~1~~26. A method of separating mercury from a mercury-containing gas, the method comprising:
combusting coal in a combustion chamber, to provide the mercury-containing gas, wherein
the coal comprises added HI, an iodide salt, or a combination thereof, added to the coal before
the coal enters the combustion chamber, or
the combustion chamber comprises added HI, an iodide salt, or a combination thereof, or
a combination thereof;
injecting a sorbent comprising activated carbon into the mercury-containing gas downstream of
the combustion chamber such that the activated carbon reacts with the halogen or halide
promoter in the mercury-containing gas to form a promoted sorbent, wherein a weight ratio of
the HI, iodide salt, or the combination thereof added to the coal, added to the combustion
chamber, or a combination thereof, to an amount of the sorbent injected into the mercury-
containing gas is from about 1:100 to about 30:100;
contacting mercury in the mercury-containing gas with the promoted sorbent; ~~and~~
separating the promoted sorbent contacted with the mercury from the mercury-containing gas;
~~10. The method of claim 1, further comprising~~
measuring the mercury content of the mercury-containing gas; and
modifying, in response to the measured mercury content of the mercury-containing gas,
an injection rate of injecting the sorbent into the mercury-containing gas,
an amount of the HI, the iodide salt, or a combination thereof, added to the coal or the
combustion chamber, or
a combination thereof.

Claim 26 is obvious for the reasons described for Claims 1 and 10. EX1002 ¶¶508-519.

Regarding Element 26(c), when halogens and carbon contact one another (e.g., upon Lissianski's adsorption), they react to form a promoted sorbent. It was well-known in the art that halogens (including iodine) "promoted" activated-carbon sorbents because they increased the ability of the activated carbon to bind with the mercury. *See supra* §V.D.4; EX1002 ¶¶129-151, 512-515; EX1095 (Olson), 231:3-9; *see* 98:23-100:3. The "promotion" of activated carbon by halogens is a form of reaction. EX1095, 45:16-25, 174:7-14; *see* EX1092, 156 (labeled as limitation 24e, O'Keefe explaining how adding halogen-containing ingredients to coal would contact and react with sorbent).

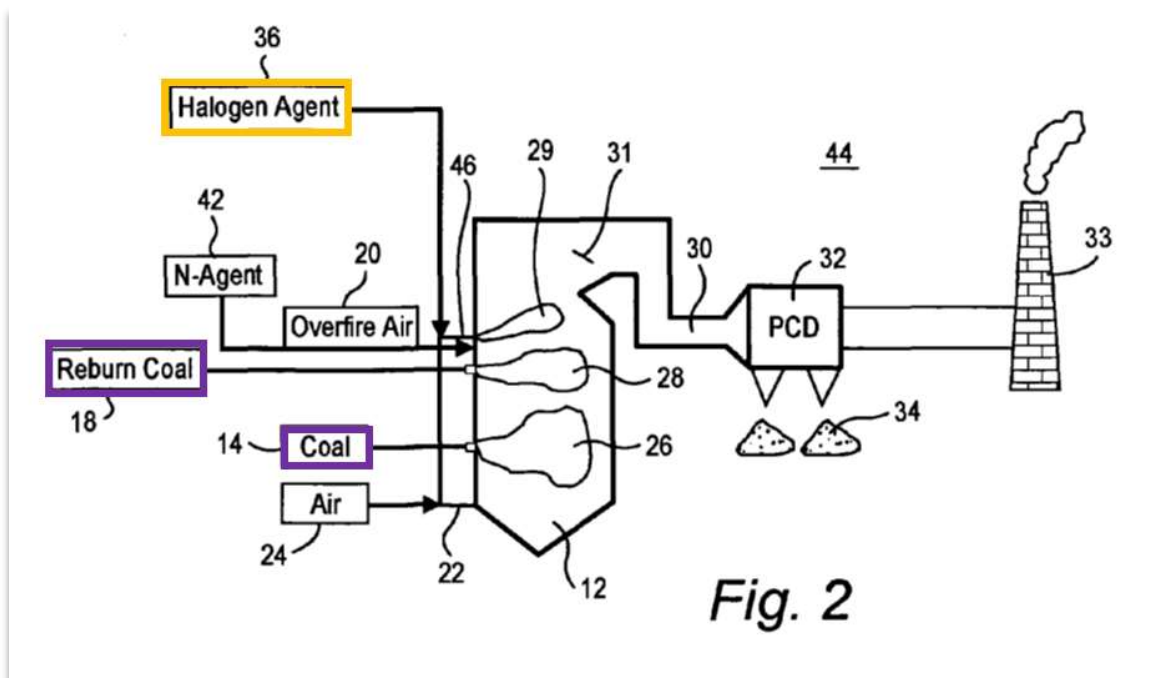
IX. GROUNDS 5-6: OBVIOUSNESS OF GROUNDS 3-4, FURTHER IN VIEW OF VOSTEEN589

Ground 5 asserts obviousness of Claims 2, 4, 6, and 23-25 over Lissianski, Starns, and Vosteen589. Ground 6 asserts obviousness of Claims 2, 4, 6, and 23-25 over Lissianski, Mass-EPA and Vosteen-589. The disclosures and reasons to combine Lissianski with Starns and Lissianski with Mass-EPA are provided in Grounds 3-4, respectively. EX1002 ¶520.

1. Overview of the Combinations and Reasons to Combine

As described for Grounds 3-4, Lissianski injects iodide salts, particularly ammonium iodide (NH₄I), into a combustion chamber to help oxidize mercury.

EX1014, Abstract, 4:14-29, claim 32. Lissianski discloses flexibility in where the iodide salts can be added to the process: “The halogen additives can be co-injected with air, recycled flue gas, nitrogen or another carrier gas to increase the penetration of the additive aqueous solution across the flue gas path and to improve mixing of the additive aqueous solution and flue gas.” EX1014, 4:20-23 (emphasis added). As discussed in Grounds 3-4 (Claim Element 1(b)), Lissianski illustrates that the halogen additives (yellow) are mixed with coal, including primary coal and reburn coal (purple).



EX1014, Fig. 1-2; *see* 4:5-9, 4:20-23, 4:43-69. The arrow from halogen agent in Figure 2 extends vertically to the bottom of the figure, indicating junctions between

the halogen agent and overfire air, reburn coal 18, primary coal 14, and primary air 24. EX1002 ¶521.

A POSITA would have been motivated to combine Lissianski with Vosteen589 to provide implementational details on adding halogens.¹¹ Vosteen589 discloses providing halide additives to the “coal or the like to be burnt, upstream of the furnace.” EX1005 ¶[0013]. Based on the disclosure of Lissianski and Vosteen589, a POSITA would have been motivated to apply the halide additive (e.g., NH_4I) to the coal upstream of the combustion chamber, to increase the residence time of the halogen-containing additive in the flue gas and to improve mixing. The halide additive would thus enter the flue gas while the mercury-containing gas is being created: “As the mercury volatilizes during coal combustion, it enters the flue gas generated by combustion.” EX1014, 1:15-16. Because the coal would contain not only the mercury, but also the halide additive, the mercury would thus enter the flue gas while the additive would “thermally decompose to form ... HI which results in more significant mercury oxidation.” EX1014, 3:45-46. EX1002 ¶522.

A POSITA would have a reasonable expectation of success, because Lissianski and Vosteen589 use similar processes with similar equipment, burn the

¹¹ Motivations to combine with Starns and Mass-EPA are unchanged, as those references pertain largely to the downstream sorbents.

same types of coal, such as lignite. EX1014, 1:53-55; EX1005 ¶[0008]. Both references use the same types of halide additives: Vosteen589 expressly discloses aqueous solutions of “iodine compounds,” and Lissianski discloses an aqueous solution of ammonium iodide (a type of iodine compound). EX1005 ¶¶[0009], [0013], [0016]; EX1014, Abstract, 4:14-31. Both references use these common halide additives to increase the oxidation of mercury, so that the mercury can more easily be removed by downstream processes. EX1005 ¶¶[0007], [0048]-[0049]; EX1014, 1:22-25, 2:10-13, 5:26-28, Figs. 4-5, Figs. 8-9. Last, both references have common equipment, such as spray nozzles to apply the halide additive. EX1005, ¶[0013]; EX1014, 4:14-15. Thus, the combination of Lissianski and Vosteen589 represents nothing more than using one known technique (halide addition) to improve similar devices in the same way to obtain the predictable results of increased mercury oxidation and removal by downstream processes. EX1002 ¶523.

2. Disclosure and Teachings of the Combinations

Elements and claims not mentioned below are disclosed or rendered obvious for the reasons stated above in Grounds 3-4. EX1002 ¶524.

- a. Claim 2: “the coal comprises the added HI, the iodide salt, or a combination thereof, added to the coal before the coal enters the combustion chamber.”**

Vosteen589 discloses applying iodide compounds directly to the “coal or the like to be burnt, upstream of the furnace. ... The addition can also be made to a plant section upstream of the furnace, for example, ... to a coal mill.” EX1005 ¶[0013]; *see* ¶[0016], claims 1, 2, 6; *see supra* §VII.E.1.c. It would have been obvious for the aqueous solution of ammonium iodide (NH₄I) salt in Lissianski to also be applied to the coal, upstream of the combustion chamber, for the reasons discussed *supra* §IX.1. EX1002 ¶525.

b. Claims 4, 6:

4: “the coal is combusted in the combustion chamber at a coal-combustion facility, wherein the HI, iodide salt, or combination thereof, is added to the coal before the coal enters the combustion chamber, wherein the addition of the HI, iodide salt, or combination thereof, to the coal is performed at the coal-combustion facility.”

6: “the combustion chamber is a coal combustion chamber that is used to produce electricity.”

As described for Claim 2, in the combination of Lissianski and Vosteen589, aqueous solutions of NH₄I (an iodide salt) are added to the coal before the coal enters the combustion chamber. The process takes place at a “coal fired power plant,”

which is a plant that produces electricity. EX1014, 2:53-64, 4:1-3, 4:30-31, 4:42-43; EX1005 ¶¶[0034], [0045], Fig. 9; EX1002 ¶¶526-527.

c. Claims 23-25:

23: “the coal comprises added halide sorbent enhancement additive that comprises the HI, iodide salt, or combination thereof.”

24: “the coal and/or the combustion chamber comprises the iodide salt.”

25(b): “the coal comprising an additive comprising added HI, an iodide salt, or a combination thereof”

As discussed for Claims 23-25 in Grounds 3-4, Lissianski applies ammonium iodide to the combustion chamber and to the coal, and it would have been obvious that these iodine compounds mix with the coal (including primary coal and reburn coal). Claims 23-25 would have been further obvious over Vosteen589, which applies the iodide additives to coal, upstream of the combustion chamber. EX1002 ¶¶528-534.

X. CONCLUSION

Petitioners respectfully request that IPR of the '218 Patent be instituted and the Challenged Claims be cancelled.

Respectfully submitted,

April 8, 2025

Date

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CERTIFICATE OF COMPLIANCE

Pursuant to 37 C.F.R. § 42.24(d), the undersigned certifies that the foregoing Petition, exclusive of the exempted portions as provided in 37 C.F.R. § 42.24(a), contains 13,832 words which is no more than 14,000 words and therefore complies with the type-volume limitations of 37 C.F.R. § 42.24(a). 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.

Dated: April 8, 2025

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CERTIFICATE OF SERVICE

In accordance with 37 C.F.R. §§ 42.6(e) and 42.105, the undersigned certifies that on the 8th day of April 2025, a complete and entire copy of the PETITION FOR *INTER PARTES* REVIEW (“petition”), Power of Attorney and related Exhibits were served on Patent Owner at the correspondence address of record for the subject patent,

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via Express Mail or by means at least as fast and reliable as Express Mail.

Additionally, a courtesy copy was served via electronic mail on the Patent Owner’s counsel at the following email address:

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