

UNITED STATES PATENT AND TRADEMARK OFFICE

PATENT TRIAL AND APPEAL BOARD

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

Petitioners

v.

Birchtech Corp.

Patent Owner

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IPR2025-00423  
Patent No. 10,668,430

**PETITION FOR *INTER PARTES* REVIEW**

**TABLE OF CONTENTS**

|                                                                                                |     |
|------------------------------------------------------------------------------------------------|-----|
| TABLE OF CONTENTS .....                                                                        | i   |
| TABLE OF AUTHORITIES .....                                                                     | iv  |
| TABLE OF EXHIBITS.....                                                                         | vii |
| TABLE OF CHALLENGED CLAIMS.....                                                                | xxi |
| I. INTRODUCTION .....                                                                          | 1   |
| II. MANDATORY NOTICES [37 C.F.R. §42.8(A)(1)].....                                             | 1   |
| A. Real Party-In-Interest [37 C.F.R. §42.8(b)(1)] .....                                        | 1   |
| B. Related Matters [37 C.F.R. §42.8(b)(2)].....                                                | 3   |
| C. Lead and Back-Up Counsel [37 C.F.R. §42.8(b)(3)].....                                       | 7   |
| D. Service Information [ 37 C.F.R. §42.8(b)(4)] .....                                          | 10  |
| III. FEES .....                                                                                | 10  |
| IV. REQUIREMENTS FOR <i>INTER PARTES</i> REVIEW [37 C.F.R. §42.104(a),<br>(b)(1)-(b)(3)] ..... | 10  |
| A. Standing.....                                                                               | 10  |
| B. Identification of Challenged Claims and Grounds.....                                        | 11  |
| C. Claim Construction [37 CFR §42.104(b)(3)].....                                              | 11  |
| V. OVERVIEW OF '430 PATENT .....                                                               | 11  |
| A. Level of Ordinary Skill .....                                                               | 11  |
| B. The Alleged Invention of the '430 Patent.....                                               | 12  |
| C. Prosecution History of the '430 Patent .....                                                | 12  |
| D. State of the Art .....                                                                      | 16  |
| 1. Mercury and Halogens.....                                                                   | 16  |
| 2. Coal-Fired Power Plants .....                                                               | 16  |
| 3. EPA Regulations.....                                                                        | 17  |
| 4. Mercury Removal Using Activated Carbon and Halogens.....                                    | 18  |
| VI. THE '430 PRIORITY DATE IS NOT ENTITLED TO PRIORITY<br>BEFORE THE ASSERTED ART .....        | 19  |
| A. Requirements to Demonstrate Priority.....                                                   | 21  |
| B. The Newly-Introduced Limitations in the '343 Application .....                              | 22  |

|       |                                                                                 |     |
|-------|---------------------------------------------------------------------------------|-----|
| C.    | No Support In Parent Applications for Newly-Introduced Limitations .....        | 24  |
| D.    | PO Cannot Rely on the Provisional for Support .....                             | 28  |
| 1.    | The Reference to the Provisional Is Not Clear and Is Ineffective .....          | 29  |
| 2.    | The Provisional Cannot Be Incorporated Because It Is “Essential Material” ..... | 30  |
| 3.    | Provisional Does Not Support the ’430 Patent Claims.....                        | 39  |
| VII.  | THE ASSERTED REFERENCES .....                                                   | 44  |
| A.    | Sjostrom and Eckberg .....                                                      | 45  |
| B.    | Olson-646 and Olson-235 .....                                                   | 48  |
| VIII. | FOUNDATIONS 1-2: OBVIOUSNESS OF THE CHALLENGED CLAIMS...48                      |     |
| A.    | Overview of EX1010 (“Sjostrom”) [Foundations 1-2].....                          | 48  |
| B.    | Overview of EX1011 (“Eckberg”) [Foundation 1].....                              | 49  |
| C.    | Overview of EX1012 (“Olson-646”) [Foundation 2] .....                           | 51  |
| D.    | Analogous Art .....                                                             | 52  |
| E.    | Overview of the Combinations and Reasons to Combine .....                       | 53  |
| 1.    | Foundation 1 .....                                                              | 54  |
| 2.    | Foundation 2 .....                                                              | 56  |
| F.    | Disclosure and Teachings of the Combinations.....                               | 58  |
| 1.    | Independent Claim 1 .....                                                       | 58  |
| 2.    | Claims Depending from Claim 1 .....                                             | 69  |
| 3.    | Independent Claim 28 .....                                                      | 97  |
| 4.    | Independent Claim 29 .....                                                      | 99  |
| IX.   | FOUNDATION 3: ANTICIPATION BY OLSON-235.....                                    | 103 |
| 1.    | Independent Claim 1 .....                                                       | 104 |
| 2.    | Claims Depending from Claim 1 .....                                             | 106 |
| 3.    | Independent Claim 28 .....                                                      | 112 |
| 4.    | Independent Claim 29 .....                                                      | 113 |
| X.    | THE BOARD SHOULD NOT DISCRETIONARILY DENY INSTITUTION.....                      | 115 |

|                                 |     |
|---------------------------------|-----|
| XI. CONCLUSION.....             | 117 |
| CERTIFICATE OF COMPLIANCE ..... | 119 |
| CERTIFICATE OF SERVICE .....    | 120 |

**TABLE OF AUTHORITIES**

|                                                                                                                                         | <b>Page(s)</b> |
|-----------------------------------------------------------------------------------------------------------------------------------------|----------------|
| <b>Cases</b>                                                                                                                            |                |
| <i>In re Applied Materials, Inc.</i> ,<br>692 F.3d 1289 (Fed. Cir. 2012) .....                                                          | 58, 79         |
| <i>Ariad Pharms., Inc. v. Eli Lilly &amp; Co.</i> ,<br>598 F.3d 1336 (Fed. Cir. 2010) .....                                             | 41             |
| <i>Becton, Dickinson &amp; Co. v. B. Braun Melsungen AG</i> ,<br>IPR2017-01586, Paper 8 (Dec. 15, 2017) .....                           | 116            |
| <i>Bj’s Wholesale Club Holdings, Inc. v. Walmart Apollo, LLC</i> ,<br>No. IPR2022-01564, 2024 WL 1558422 (P.T.A.B. Apr. 10, 2024) ..... | 19             |
| <i>Callaway Golf Co. v. Acushnet Co.</i> ,<br>576 F.3d 1331 (Fed. Cir. 2009) .....                                                      | 29             |
| <i>DDR Holdings, LLC v. Priceline.com LLC</i> ,<br>122 F.4th 911 (Fed. Cir. 2024) .....                                                 | 28             |
| <i>Droplets, Inc. v. E*TRADE Bank</i> ,<br>887 F.3d 1309 (Fed. Cir. 2018) .....                                                         | 28             |
| <i>Fresenius USA, v. Baxter Int’l</i> ,<br>582 F.3d 1288 (Fed. Cir. 2009) .....                                                         | 105            |
| <i>GoPro, Inc. v. Contour IP Holding LLC</i> ,<br>908 F.3d 690 (Fed. Cir. 2018) .....                                                   | 45             |
| <i>Koninklijke Philips N.V. v. Google LLC</i> ,<br>948 F.3d 1330 (Fed. Cir. 2020) .....                                                 | 16             |
| <i>Lockwood v. Am. Airlines, Inc.</i> ,<br>107 F.3d 1565 (Fed. Cir. 1997) .....                                                         | <i>passim</i>  |
| <i>Maquet Cardiovascular LLC v. Abiomed, Inc.</i> ,<br>627 F. Supp. 3d 72 (D. Mass. 2022) .....                                         | 32             |

|                                                                                                                                                  |               |
|--------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| <i>Midwest Energy Emissions Corp. v. Arthur J. Gallagher</i> ,<br>No. 19-1334-CJB, 2023 WL 7411160 (D. Del. Nov. 3, 2023) .....                  | 29            |
| <i>Mueller Sys., LLC v. Rein Tech, Inc.</i> ,<br>IPR2020-00100, 2020 WL 2478524 (P.T.A.B. May 12, 2020) .....                                    | 19            |
| <i>NRG Energy, Inc. et al. v. Midwest Energy Emissions Corp.</i> ,<br>IPR2020-00832, Paper 17, 2020 WL 6277239 (P.T.A.B. Oct. 26,<br>2020) ..... | 4, 30, 31, 35 |
| <i>NRG Energy, Inc. et al. v. Midwest Energy Emissions Corp.</i> ,<br>IPR2020-00834, Paper 18, 2020 WL 6277747 (P.T.A.B. Oct. 26,<br>2020) ..... | 4             |
| <i>NRG Energy, Inc. et al. v. Midwest Energy Emissions Corp.</i> ,<br>IPR2020-00926, Paper 19, 2020 WL 7061347 (P.T.A.B. Dec. 2,<br>2020) .....  | 5             |
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| <i>Tronzo v. Biomet, Inc.</i> ,<br>156 F.3d 1154 (Fed. Cir. 1998) .....                                                                          | 21, 104       |
| <i>Zenon Env't., Inc. v. U.S. Filter Corp.</i> ,<br>506 F.3d 1370 (Fed. Cir. 2007) .....                                                         | 29            |
| <i>ZTE (USA), Inc. v. CyWee Grp. Ltd.</i> ,<br>IPR2019-00143, 2021 WL 641742 (P.T.A.B. Feb. 17, 2021) .....                                      | 31            |
| <b>Statutes</b>                                                                                                                                  |               |
| 35 U.S.C. §122(b)(2)(A)(iii) .....                                                                                                               | 30            |
| 35 U.S.C. §314(a) .....                                                                                                                          | 115           |
| 35 U.S.C. §325(d) .....                                                                                                                          | 116           |

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|                          |               |
|--------------------------|---------------|
| 37 C.F.R. §1.57 .....    | <i>passim</i> |
| M.P.E.P. §201.08 .....   | 20, 116       |
| M.P.E.P. §217 .....      | 39            |
| M.P.E.P. §608.01(p)..... | 38            |

**TABLE OF EXHIBITS**

| <b>Exhibit</b> | <b>Description of Exhibits</b>                                                                                                                                                                                                                                                                              |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1001           | U.S. Patent No. 10,668,430 to Olson et al. (filed May 8, 2018) (“ <b>430 Patent</b> ” or “ <b>Challenged Patent</b> ”)                                                                                                                                                                                      |
| 1002           | Declaration of Dr. Stephen Niksa in Support of Petition for <i>Inter Partes</i> Review of U.S. Patent No. 10,668,430 (“ <b>430 Niksa Decl.</b> ”)                                                                                                                                                           |
| 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) (“ <b>Vosteen589</b> ”)                                                                                                                                                                                                    |
| 1006           | U.S. Patent Pub. No. 2008/0107579 to Downs et al. (published May 8, 2008) (“ <b>Downs-Boiler</b> ”)                                                                                                                                                                                                         |
| 1007           | U.S. Patent Prov. App. No. 60/555,353 (filed Mar. 22, 2004) (“ <b>Downs-Boiler-Provisional</b> ”)                                                                                                                                                                                                           |
| 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 <sup>TH</sup> ANNUAL CONFERENCE (Baltimore, MD: June 23-27, 2002) (“ <b>Starns</b> ”) |

| 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) (“<b>Mass-EPA</b>”), available at</p> <p><a href="https://web.archive.org/web/20030411074158/http://www.state.ma.us/dep/bwp/dagc/files/mercfeas.pdf">https://web.archive.org/web/20030411074158/http://www.state.ma.us/dep/bwp/dagc/files/mercfeas.pdf</a></p> <p>and at <a href="https://www.mass.gov/doc/evaluation-of-technological-economic-feasibility-of-controlling-eliminating-mercury-emissions/download">https://www.mass.gov/doc/evaluation-of-technological-economic-feasibility-of-controlling-eliminating-mercury-emissions/download</a></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) (“<b>Sjostrom</b>”)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 1011    | <p>Craig Eckberg et al., “Mercury Control Evaluation of Halogen Injection into a Texas Lignite-Fired Boiler,” Track A, Session A3 (Mercury – Control), Presentation A3c, EUEC: 8TH ELECTRIC UTILITIES ENVIRONMENTAL CONFERENCE (Tucson, Arizona: January 25, 2005) (“<b>Eckberg</b>”)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 1012    | <p>U.S. Patent Pub. No. 2006/0048646 to Olson et al. (published Mar. 9, 2006) (“<b>Olson-646</b>”)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 1013    | <p>U.S. Patent No. 6,953,494 to Nelson (filed May 6, 2003) (“<b>Nelson</b>”)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| 1014    | <p>U.S. Patent No. 7,514,052 to Lissianski et al. (filed Apr. 7, 2009) (“<b>Lissianski</b>”)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

| Exhibit | Description of Exhibits                                                                                                                                         |
|---------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1015    | RESERVED                                                                                                                                                        |
| 1016    | RESERVED                                                                                                                                                        |
| 1017    | RESERVED                                                                                                                                                        |
| 1018    | U.S. Patent No. 8,652,235 to Olson et al. (issued February 18, 2014) ( <b>“Olson-235”</b> )                                                                     |
| 1019    | File History of U.S. Patent Application No. 15/974,343, which ultimately issued as U.S. Patent No. 10,668,430 ( <b>“430 Patent File History”</b> ).             |
| 1020    | File History of U.S. Patent Prov. App. No. 60/605,640 ( <b>“Provisional”</b> )                                                                                  |
| 1021    | File History of U.S. Patent Application No. 11/209,163, which ultimately issued as U.S. Patent No. 7,435,286 ( <b>“163 Application File History”</b> )          |
| 1022    | File History of U.S. Patent Application No. 12/201,595, which ultimately published as 2009/0062119 and was abandoned ( <b>“595 Application File History”</b> )  |
| 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 ( <b>“370 Patent File History”</b> ). |

| Exhibit | Description of Exhibits                                                                                                                                                                                                                          |
|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1024    | File History of U.S. Patent Application No. 15/997,091, which ultimately issued as U.S. Patent No. 10,596,517 ( <b>“517 Patent File History”</b> ).                                                                                              |
| 1025    | File History of U.S. Patent Application No. 12/419,219, which ultimately issued as U.S. Patent No. 8,168,147 ( <b>“147 Patent File History”</b> ).                                                                                               |
| 1026    | File History of U.S. Patent Application No. 15/978,760 (issued as U.S. Patent No. 10,343,114) ( <b>“114 Patent File History”</b> )                                                                                                               |
| 1027    | Babcock & Wilcox, STEAM: ITS GENERATION AND USE, 40th ed. (The Babcock & Wilcox Company: 1992) ( <b>“B&amp;W: Steam”</b> )                                                                                                                       |
| 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) ( <b>“Bustard”</b> ) |
| 1029    | U.S. Patent No. 1,984,164 to Stock et al. (issued Dec. 11, 1934) ( <b>“Stock”</b> )                                                                                                                                                              |
| 1030    | Electric Utilities Environment Conference 2005 Handout ( <b>“EUEC Handout”</b> )                                                                                                                                                                 |
| 1031    | Scan of jacket/cover of CD mailed to conference attendees from EUEC: 8th Electric Utilities Environmental Conference (Tucson, Arizona: January 23-26, 2005) ( <b>“EUEC CD Scan”</b> )                                                            |

| Exhibit | Description of Exhibits                                                                                                                                                                                                                                     |
|---------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1032    | Redline comparison between U.S. Patent Pub. No. 2008/0107579 (Downs-Boiler, EX1006) and U.S. Patent Prov. Appl. No. 60/555,353 (Downs-Boiler-Provisional, EX1007), using Downs-Boiler-Provisional as the original version ( <b>“Downs-Boiler-Redline”</b> ) |
| 1033    | U.S. Patent No. 8,512,655                                                                                                                                                                                                                                   |
| 1034    | U.S. Patent No. 8,821,819                                                                                                                                                                                                                                   |
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| 1036    | CRC Handbook of Chemistry and Physics, 86th Ed.; Lide, D.R., ed. ( <b>“CRC Press: March 2005”</b> )                                                                                                                                                         |
| 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) ( <b>“Power Plant Evaluation”</b> )                        |
| 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) ( <b>“Granite”</b> )                                                                                                         |
| 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&amp;D Program Review</i> (April 2003) ( <b>“Feeley”</b> )                                                           |
| 1040    | Oxtoby et al., PRINCIPLES OF MODERN CHEMISTRY, 4 <sup>th</sup> ed. (Saunders College Publishing: 1999) ( <b>“Oxtoby”</b> )                                                                                                                                  |

| Exhibit | Description of Exhibits                                                                                                                                                                                                                                                                                                                                                                |
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| 1041    | N.N. Greenwood and A. Earnshaw, CHEMISTRY OF THE ELEMENTS, 2nd ed. (Butterworth-Heinemann: 1997) (“ <b>Greenwood</b> ”)                                                                                                                                                                                                                                                                |
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| 1043    | Frank E. Huggins et al., “XAFS Examination of Mercury Sorption on Three Activated Carbons,” <i>Energy &amp; Fuels</i> 1999(13), p. 114-121 (1999) (“ <b>XAFS</b> ”)                                                                                                                                                                                                                    |
| 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) (“ <b>Hg Speciation</b> ”)                                                                                                                                                                                                 |
| 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) (“ <b>Laudal</b> ”)                                                                                                                                                        |
| 1046    | U.S. Patent No. 4,196,173 to DeJong (“ <b>DeJong</b> ”)                                                                                                                                                                                                                                                                                                                                |
| 1047    | U.S. Patent No. 5,695,726 to Lerner (“ <b>Lerner</b> ”)                                                                                                                                                                                                                                                                                                                                |
| 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 &amp; Waste Management Association</i> , 48(12), 1166–1174.<br><a href="https://doi.org/10.1080/10473289.1998.10463753">https://doi.org/10.1080/10473289.1998.10463753</a> (“ <b>Carey</b> ”) |

| Exhibit | Description of Exhibits                                                                                                                                                                                                                                                                                                                                                                             |
|---------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1049    | NETL - Mercury Emissions Control, February, 2003, available at <a href="https://web.archive.org/web/20030315093905fw_/http://www.netl.doe.gov/coalpower/environment/mercury/control-tech/inactive.html">https://web.archive.org/web/20030315093905fw_/http://www.netl.doe.gov/coalpower/environment/mercury/control-tech/inactive.html</a> (“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 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 <a href="https://www3.epa.gov/ttn/utox/eurtc1.pdf">https://www3.epa.gov/ttn/utox/eurtc1.pdf</a> (“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 <a href="https://www.epa.gov/sites/production/files/2015-09/documents/volume1.pdf">https://www.epa.gov/sites/production/files/2015-09/documents/volume1.pdf</a> (“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 <a href="https://www3.epa.gov/ttn/chief/ap42/ch01/index.html">https://www3.epa.gov/ttn/chief/ap42/ch01/index.html</a> (last visited Nov. 20, 2024) (“Chapter 1 of AP-42”)                                                                                                                |
| 1054    | U.S. DOE, Mercury Emissions Control - Regulatory Drivers (Jan. 24, 2003), available at <a href="https://web.archive.org/web/20030416142937/http://www.netl.doe.gov/coalpower/environment/mercury/regs.html">https://web.archive.org/web/20030416142937/http://www.netl.doe.gov/coalpower/environment/mercury/regs.html</a> (“Mercury Emissions Control”)                                            |

| Exhibit | Description of Exhibits                                                                                                                                                                                                                                                                                                                                                           |
|---------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1055    | Clean Air Mercury Rule: Basic Information, available at <a href="https://web.archive.org/web/20050920005951/http://www.epa.gov/mercuryrule/basic.htm">https://web.archive.org/web/20050920005951/http://www.epa.gov/mercuryrule/basic.htm</a> (“Clean Air Mercury Rule”)                                                                                                          |
| 1056    | EPA Newsroom, “EPA Announces First-Ever Rule to Reduce Mercury Emissions from Power Plants” (Mar. 15, 2005), available at <a href="https://archive.epa.gov/epapages/newsroom_archive/newsreleases/91ab7266e65751b985256fc50067d9b0.html">https://archive.epa.gov/epapages/newsroom_archive/newsreleases/91ab7266e65751b985256fc50067d9b0.html</a> (“3/15/2005 EPA Press Release”) |
| 1057    | EPA Newsroom, “Public Comment Period Begins for Proposed Power Plant Regulations” (Jan. 29, 2004), available at <a href="https://archive.epa.gov/epapages/newsroom_archive/newsreleases/4daf1d46e8dd755c85257036005511f9.html">https://archive.epa.gov/epapages/newsroom_archive/newsreleases/4daf1d46e8dd755c85257036005511f9.html</a> (“1/29/2004 EPA Press Release”)           |
| 1058    | EPA Newsroom, “EPA Supplements Proposal to Reduce Power Plant Mercury Emissions,” (Feb. 24, 2004), available at <a href="https://archive.epa.gov/epapages/newsroom_archive/newsreleases/5810096dabfc9eba85256e440078905f.html">https://archive.epa.gov/epapages/newsroom_archive/newsreleases/5810096dabfc9eba85256e440078905f.html</a> (“2/24/2004 EPA Press Release”)           |
| 1059    | Sharon Sjostrom et al., “Field Studies of Mercury Control Using Injected Sorbents,” AWMA ANNUAL MEETING, Session Ae-1b (2002) (“Field Studies of Mercury Control”)                                                                                                                                                                                                                |
| 1060    | 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 <a href="https://www3.epa.gov/airtoxics/112nmerc/volume8.pdf">https://www3.epa.gov/airtoxics/112nmerc/volume8.pdf</a> (“EPA 1997 Mercury Study Report Vol. VIII”)                                         |

| Exhibit | Description of Exhibits                                                                                                                                                         |
|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1061    | EUEC 2005 home page, available at <a href="https://web.archive.org/web/20050303090129/http://www.euec.com/">https://web.archive.org/web/20050303090129/http://www.euec.com/</a> |
| 1062    | Charlene R. Crocker et al., “Mercury Control with the Advanced Hybrid Particulate Collector Technical Progress Report,” U.S. DOE-NETL (Nov. 2003) (“ <b>Crocker</b> ”)          |
| 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    | File History of U.S. Patent Application No. 14/712,558, which ultimately issued as U.S. Patent No. 10,589,225 (“ <b>’225 Patent File History</b> ”)                             |
| 1069    | U.S. Patent Pub. No. 2018/0257030 to Olson et al. (published Sep. 13, 2018) (“ <b>Published ’343 Application</b> ”)                                                             |

| Exhibit | Description of Exhibits                                                                                                                                                                                                                        |
|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1070    | Roop Chand Bansal, et al., ACTIVE CARBON (Marcel Dekker: 1988). ( <b>“Bansal”</b> )                                                                                                                                                            |
| 1071    | <i>Midwest Energy Emissions Corp., et al. v. Arthur J. Gallagher &amp; Co., et al.</i> , No. 1:19-cv-01334-CJB, Dkt. No. 440 (D. Del. June 24, 2022). ( <b>“Dkt No. 440”</b> )                                                                 |
| 1072    | <i>Midwest Energy Emissions Corp., et al. v. Arthur J. Gallagher &amp; Co., et al.</i> , No. 1:19-cv-01334-CJB, Dkt. No. 447 (D. Del. July 12, 2022). ( <b>“Dkt No. 447”</b> )                                                                 |
| 1073    | Welcome Page of CD mailed to conference attendees of the 2002 Air & Waste Management’s Association’s 95 <sup>th</sup> Annual Conference & Exhibition (Baltimore, Maryland: June 23-27, 2002) ( <b>“AWMA CD Scan”</b> )                         |
| 1074    | Main Menu of CD mailed to conference attendees of the 2002 Air & Waste Management’s Association’s 95 <sup>th</sup> Annual Conference & Exhibition (Baltimore, Maryland: June 23-27, 2002) ( <b>“AWMA CD Scan, Main Menu”</b> )                 |
| 1075    | Author Index of CD mailed to conference attendees of the 2002 Air & Waste Management’s Association’s 95 <sup>th</sup> Annual Conference & Exhibition (Baltimore, Maryland: June 23-27, 2002) ( <b>“AWMA CD Scan, Author Index”</b> )           |
| 1076    | Papers by Session of CD mailed to conference attendees of the 2002 Air & Waste Management’s Association’s 95 <sup>th</sup> Annual Conference & Exhibition (Baltimore, Maryland: June 23-27, 2002) ( <b>“AWMA CD Scan, Papers by Session”</b> ) |

| Exhibit | Description of Exhibits                                                                                                                                                                                                                                                                                                                         |
|---------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1077    | Scan of jacket/cover of CD mailed to conference attendees of the 2002 Air & Waste Management's Association's 95th Annual Conference & Exhibition (Baltimore, Maryland: June 23-27, 2002) ( <b>"AWMA CD Photo"</b> )                                                                                                                             |
| 1078    | AWMA Website (Internet Archive), available at <a href="https://web.archive.org/web/20020613041559/http://www.awma.org/about/overview.htm">https://web.archive.org/web/20020613041559/http://www.awma.org/about/overview.htm</a> (AWMA Overview)                                                                                                 |
| 1079    | AWMA Website (Internet Archive), available at <a href="https://web.archive.org/web/20020527005933/http://www.awma.org/">https://web.archive.org/web/20020527005933/http://www.awma.org/</a> (AWMA Homepage, advertising AWMA 2002 Conference)                                                                                                   |
| 1080    | AWMA Website (Internet Archive), available at <a href="https://web.archive.org/web/20020604012426/http://www.awma.org:80/about/">https://web.archive.org/web/20020604012426/http://www.awma.org:80/about/</a> (AWMA About Page)                                                                                                                 |
| 1081    | AWMA Website (Internet Archive), available at <a href="https://web.archive.org/web/20020601173851/http://www.awma.org/ACE2002/tech-program/MondayPM.asp#AE-1c">https://web.archive.org/web/20020601173851/http://www.awma.org/ACE2002/tech-program/MondayPM.asp#AE-1c</a> (AWMA Technical Program Schedule for June 24, 2002 for Session AE-1C) |
| 1082    | AWMA Website (Internet Archive), available at <a href="https://web.archive.org/web/20020616091740/http://www.awma.org/ACE2002/exhibition/list.asp">https://web.archive.org/web/20020616091740/http://www.awma.org/ACE2002/exhibition/list.asp</a> (AWMA 2002 Conference list of exhibitors)                                                     |
| 1083    | AWMA Website (Internet Archive), available at <a href="https://web.archive.org/web/20020601121532/http://www.awma.org/ACE2002/top10list.asp">https://web.archive.org/web/20020601121532/http://www.awma.org/ACE2002/top10list.asp</a> (AWMA 2002 Conference Top Ten Reasons)                                                                    |

| Exhibit | Description of Exhibits                                                                                                                                                                                                                                                                                                                                                     |
|---------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1084    | AWMA Website (Internet Archive), available at <a href="https://web.archive.org/web/20020610093515/http://www.awma.org/ACE2002/welcome.asp">https://web.archive.org/web/20020610093515/http://www.awma.org/ACE2002/welcome.asp</a> (AWMA 95th Annual Conference and Exhibition Welcome Page)                                                                                 |
| 1085    | AWMA Website (Internet Archive), available at <a href="https://web.archive.org/web/20020806044928/http://www.awma.org:80/pubs/bookstore/ItemInfo.asp?OrderCode_s=VIP-110-CD">https://web.archive.org/web/20020806044928/http://www.awma.org:80/pubs/bookstore/ItemInfo.asp?OrderCode_s=VIP-110-CD</a> (AWMA Bookstore Page, Order form for 2002 AWMA Conference CD)         |
| 1086    | AWMA Website (Internet Archive), available at <a href="https://web.archive.org/web/20020806041256/http://www.awma.org:80/pubs/bookstore/">https://web.archive.org/web/20020806041256/http://www.awma.org:80/pubs/bookstore/</a> (AWMA Bookstore Homepage)                                                                                                                   |
| 1087    | State of Massachusetts Mass-EPA (Internet Archive) (dated Jan. 6, 2003), available at <a href="https://web.archive.org/web/20030106044457/http://www.state.ma.us/dep/bwp/about.htm">https://web.archive.org/web/20030106044457/http://www.state.ma.us/dep/bwp/about.htm</a> (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 <a href="https://web.archive.org/web/20021221040816/http://www.state.ma.us/dep/bwp/bwpprogs.htm">https://web.archive.org/web/20021221040816/http://www.state.ma.us/dep/bwp/bwpprogs.htm</a> (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 <a href="https://web.archive.org/web/20030106024342/http://www.state.ma.us/dep/bwp/bwppubs.htm">https://web.archive.org/web/20030106024342/http://www.state.ma.us/dep/bwp/bwppubs.htm</a> (describing the publications by program of the Mass Bureau of Waste Prevention)             |

| Exhibit | Description of Exhibits                                                                                                                                                                                                                                                                                                                                                                             |
|---------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1090    | State of Massachusetts Mass-EPA (Internet Archive) (dated Dec. 20, 2002), available at <a href="https://web.archive.org/web/20021220143210/http://www.state.ma.us/dep/bwp/daqc/daqcpubs.htm#ecp">https://web.archive.org/web/20021220143210/http://www.state.ma.us/dep/bwp/daqc/daqcpubs.htm#ecp</a> (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 <a href="https://archive.org/legal/affidavit.php">https://archive.org/legal/affidavit.php</a>                                                                                                                                                                                                             |
| 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 &amp; 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 &amp; 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 &amp; 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 &amp; 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 &amp; 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 &amp; 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                                                                   |

Other than prosecution histories, EX1019-EX1026, EX1068, all citations to exhibits reference original page numbers found in the underlying document, and all emphases are added.

**TABLE OF CHALLENGED CLAIMS**

| <b>Claim Element</b> | <b>Claim Language from '430 Patent</b>                                                                                                                                                                                                                                                                                                                                                 |
|----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 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 an additive comprising Br <sub>2</sub> , HBr, a bromide compound, or a combination thereof, wherein the additive is added to the coal before the coal enters the combustion chamber, or<br><br>the combustion chamber comprises an additive comprising Br <sub>2</sub> , HBr, a bromide compound, or a combination thereof or<br><br>a combination thereof; |
| 1(c)                 | injecting a sorbent comprising activated carbon into the mercury-containing gas downstream of the combustion chamber;<br><br>contacting mercury in the mercury-containing gas with the sorbent;<br>and                                                                                                                                                                                 |
| 1(d)                 | separating the sorbent contacted with the mercury from the mercury-containing gas.                                                                                                                                                                                                                                                                                                     |
| 2                    | 2. The method of claim 1, wherein the coal comprises the additive comprising the Br <sub>2</sub> , HBr, the bromide compound, or a combination thereof, wherein the additive is added to the coal before the coal enters the combustion chamber.                                                                                                                                       |
| 3                    | 3. The method of claim 1, wherein the combustion chamber comprises the additive comprising the Br <sub>2</sub> , HBr, the bromide compound, 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                                                                                                                                                                                                                                                           |

| Claim Element | Claim Language from '430 Patent                                                                                                                                                                                                                                                                                                                                                                                                                               |
|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|               | additive comprising the Br <sub>2</sub> , HBr, bromide compound, or combination thereof, is added to the coal before the coal enters the combustion chamber, wherein the addition of the additive comprising the Br <sub>2</sub> , HBr, bromide compound, or combination thereof, to the coal is performed at the coal-combustion facility.                                                                                                                   |
| 6             | 6. The method of claim 1, wherein the combustion chamber is an electric utility coal combustion chamber.                                                                                                                                                                                                                                                                                                                                                      |
| 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<br><br>measuring the mercury content of the mercury-containing gas; and<br><br>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 Br <sub>2</sub> , HBr, the bromide compound, 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 comprises continuous measurement.                                                                                                                                                                                                                                                                                                                                                    |
| 12            | 12. The method of claim 1, further comprising:<br><br>modifying, in response to a measured mercury content,<br><br>an injection rate of injecting the sorbent into the mercury-containing gas, an amount of the Br <sub>2</sub> , HBr, the bromide compound,                                                                                                                                                                                                  |

| Claim Element | Claim Language from '430 Patent                                                                                                                                                                                                                |
|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|               | 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 mercury-containing gas comprises about 1 g to about 30 g of the element bromine per 100 g of the sorbent.                                                                                               |
| 14            | 14. The method of claim 1, wherein the sorbent contacted with the mercury comprises the element bromine and mercury.                                                                                                                           |
| 15            | 15. The method of claim 1, comprising removing greater than 70 wt % of the mercury in the mercury-containing gas.                                                                                                                              |
| 16            | 16. The method of claim 1, comprising removing greater than 70 wt % of the mercury in the mercury-containing gas with the sorbent.                                                                                                             |
| 17            | 17. The method of claim 1, wherein the sorbent in the mercury-containing gas comprises about 1 g to about 30 g of the added Br <sub>2</sub> , HBr, the bromide compound, or a combination thereof, per 100 g of the sorbent.                   |
| 18            | 18. The method of claim 1, wherein the Br <sub>2</sub> , HBr, or the bromide compound is contacted with the sorbent in vapor form, gaseous form, liquid form, or in an organic solvent.                                                        |
| 19            | 19. The method of claim 1, wherein the activated carbon comprises powdered activated carbon, granular activated carbon, or a combination thereof.                                                                                              |
| 20            | 20. 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 the injection of the sorbent into the mercury-containing gas. |
| 21            | 21. The method of claim 1, wherein the sorbent injected into the mercury-containing gas is free of contact with a halogen or halide                                                                                                            |

| Claim Element | Claim Language from '430 Patent                                                                                                                                                                                                                                                                                                                          |
|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|               | promoter prior to injection of the sorbent into the mercury-containing gas.                                                                                                                                                                                                                                                                              |
| 22            | 22. The method of claim 1, wherein the combustion chamber comprises a boiler.                                                                                                                                                                                                                                                                            |
| 23            | 23. The method of claim 1, wherein the mercury-containing gas is a flue gas.                                                                                                                                                                                                                                                                             |
| 24            | 24. The method of claim 1, wherein the injection of the sorbent into the mercury-containing gas occurs upstream of a particulate separator, a scrubber, or a combination thereof.                                                                                                                                                                        |
| 25            | 25. The method of claim 24, wherein the particulate separator comprises a baghouse, an electrostatic precipitator, a fabric filter, or a combination thereof.                                                                                                                                                                                            |
| 26            | 26. The method of claim 1, wherein a halide sorbent enhancement additive comprises the added Br <sub>2</sub> , HBr, bromide compound, or combination thereof.                                                                                                                                                                                            |
| 27            | 27. The method of claim 26, wherein the sorbent enhancement additive comprises the bromide compound.                                                                                                                                                                                                                                                     |
| 28(Preamble)  | 28. A method of separating mercury from a mercury-containing as, the method comprising:                                                                                                                                                                                                                                                                  |
| 28(a)         | combusting coal in a combustion chamber, to provide the mercury-containing gas,                                                                                                                                                                                                                                                                          |
| 28(b)         | wherein the mercury-containing gas comprises a halogen or halide promoter comprising HBr, Br <sup>-</sup> , or a combination thereof, wherein the coal comprises an additive comprising Br <sub>2</sub> , HBr, a bromide compound, or a combination thereof, wherein the additive is added to the coal before the coal enters the combustion chamber, or |

| Claim Element | Claim Language from '430 Patent                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|               | the combustion chamber comprises an additive comprising Br <sub>2</sub> , HBr, a bromide compound, or a combination thereof, or<br><br>a combination thereof,                                                                                                                                                                                                                                                                                                                                                                        |
| 28(c)         | injecting a sorbent comprising activated carbon into the mercury-containing gas downstream of the combustion chamber; contacting mercury in the mercury-containing gas with the sorbent; and                                                                                                                                                                                                                                                                                                                                         |
| 28(d)         | separating the sorbent contacted with the mercury from the mercury-containing gas.                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 29(Preamble)  | 29. A method of separating mercury from a mercury-containing gas, the method comprising:                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 29(a)         | combusting coal in a combustion chamber, to provide the mercury-containing gas,                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 29(b)         | wherein the mercury-containing gas comprises a halogen or halide promoter comprising HBr, Br <sup>-</sup> , or a combination thereof, wherein<br><br>the coal comprises an additive comprising Br <sub>2</sub> , HBr, a bromide compound, or a combination thereof, wherein the additive is added to the coal before the coal enters the combustion chamber, or<br><br>the combustion chamber comprises an additive comprising Br <sub>2</sub> , HBr, a bromide compound, or a combination thereof, or<br><br>a combination thereof; |
| 29(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;<br><br>contacting mercury in the mercury-containing gas with the promoted sorbent;                                                                                                                                                                                          |

| Claim Element | Claim Language from '430 Patent                                                                                                                                                                                                                                                                                                                                            |
|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 29(d)         | separating the promoted sorbent contacted with the mercury from the mercury-containing gas;                                                                                                                                                                                                                                                                                |
| 29(e)         | measuring the mercury content of the mercury-containing gas; and<br><br>modifying, in response to the measured mercury content, an injection rate of injecting the sorbent into the mercury-containing gas, an amount of the Br <sub>2</sub> , HBr, the bromide compound, 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 6-29 of U.S. Patent 10,668,430 (“**430 Patent**” or “**Challenged Patent**”). EX1001. The Petition is supported by the expert declaration of Dr. Stephen Niksa.<sup>1</sup> 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: Berkshire Hathaway Energy Company; Interstate Power & Light Company; MidAmerican Energy Company; PacifiCorp; 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 and Alliant Energy Corporate Services, Inc. These entities were parties to the lawsuit in the Southern District of Iowa where they have been accused of infringing the Challenged Patent.

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

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<sup>1</sup> 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 PacifiCorp identifies the following additional real-parties-in-interest: MidAmerican Funding, LLC; MHC Inc.; and PPW Holdings LLC.

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 asserts a priority date of no earlier than April 12, 2018, the filing date of the parent '370 Patent (EX1066), because the earlier-filed applications to which the '430 Patent claims priority do not contain written-description support for the Challenged Claims. The other petition assumes *arguendo* that the Challenged Claims of the '430 Patent have priority back to the earliest-filed Provisional Application, August 30, 2004.

Petitioners previously filed two petitions against U.S. Patent No. 10,343,114 (“the '114 Patent”) and two petitions against U.S. Patent No. 10,596,517 (“the '517 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).

Though no petitions for IPR have previously been filed against the '430 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 ’430 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. and MES Inc. v. Arthur J. Gallagher & Co., et al.*, No. 1:19-cv-01334-RGA (D. Del.) (filed July 17, 2019).
- *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).

NRG, Vistra, Talen, and AEP were defendants in the Delaware case. 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 Petitioner Berkshire Hathaway Energy (“BHE”) outright from the litigation and transferring PacifiCorp to the District of Wyoming. *See In re Midwest Energy Emissions Corp. Pat. Litig.*, No. 4:24-md-3132, ECF 19 (S.D. Iowa Jan. 10, 2025). In that same order, the Iowa court transferred Wisconsin Power & Light Co. to the District of Wisconsin.

According to U.S. Patent & Trademark Office Patent Center, the ’430 Patent was filed as App. No. 15/974,343 (“the ’343 Application”) on May 8, 2018, and purports to claim priority as follows:

- 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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Michael.piery@quarles.com; lauren.bolcar@quarles.com.

**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 '430 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 | '430 Claims      | Basis for Challenge                                       |
|--------|------------------|-----------------------------------------------------------|
| 1.     | 1-4, 6-29        | §103: Obvious over Sjostrom (EX1010) and Eckberg (EX1011) |
| 2.     | 1-4, 6-29        | §103: Obvious over Sjostrom and Olson-646 (EX1012)        |
| 3.     | 1, 3, 6-7, 10-29 | §102: Anticipated by Olson-235 (EX1018)                   |

EX1002 ¶13. Grounds 1-2 in this petition correspond to the same combinations as in IPR2020-00832 for the related '114 Patent, which the Board instituted. EX1026, 5.

**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 ¶¶227-229.

**V. OVERVIEW OF '430 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

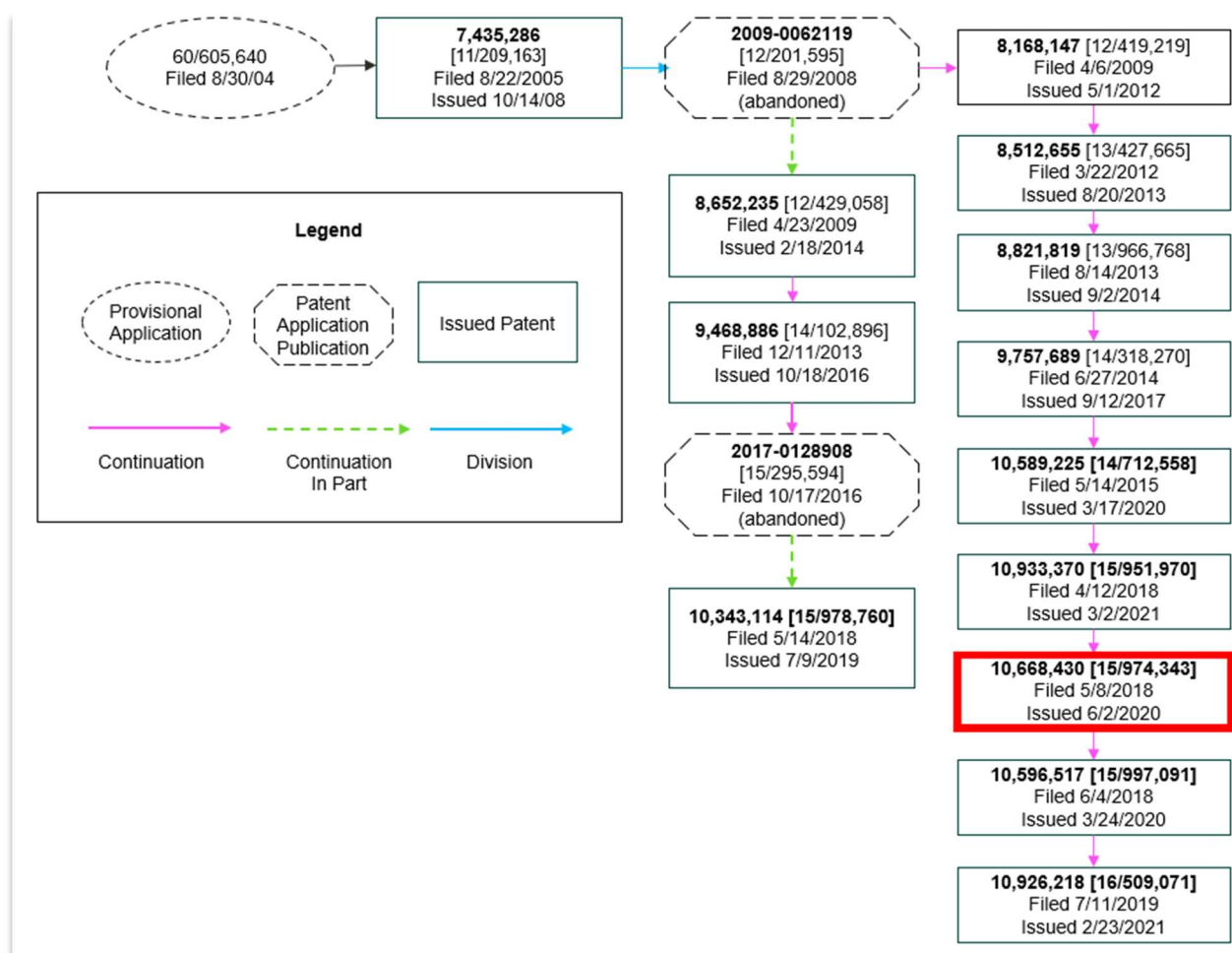
power generation plants for natural gas, coal, and/or industrial waste incineration.  
EX1002 ¶¶48-51.

**B. THE ALLEGED INVENTION OF THE '430 PATENT**

The '430 Patent relates to removing mercury from flue gas. EX1001, 1:40-46. 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, 2:2-7, 30:24-27. The Patent combines these known solutions to improve sorbent efficacy. Each independent claim includes: adding bromine-containing ingredients to the combustion chamber and/or coal before it enters the combustion chamber; and collecting mercury in the mercury-containing gas with activated-carbon sorbent. Even this combination was known in the art. EX1002 ¶¶ 152-156, 223-226.

**C. PROSECUTION HISTORY OF THE '430 PATENT**

The '430 Patent was filed May 8, 2018, as Application 15/974,343 (“’343 Application”) (EX1019), stemming through eight earlier non-provisional applications to App. No. 60/605,640 (the “Provisional”) (EX1020) filed August 30, 2004. EX1002 ¶¶157-176.



EX1004 (annotated).

Prior to April 2018, PO's patent specifications were directed to preparing a brominated activated-carbon sorbent outside mercury-containing flue gas, and then injecting the pre-brominated sorbent into mercury-containing flue gas (downstream from the combustion chamber). This is shown in Figures 1 and 3 of the '595 Application (filed 8/29/2008), annotated below:

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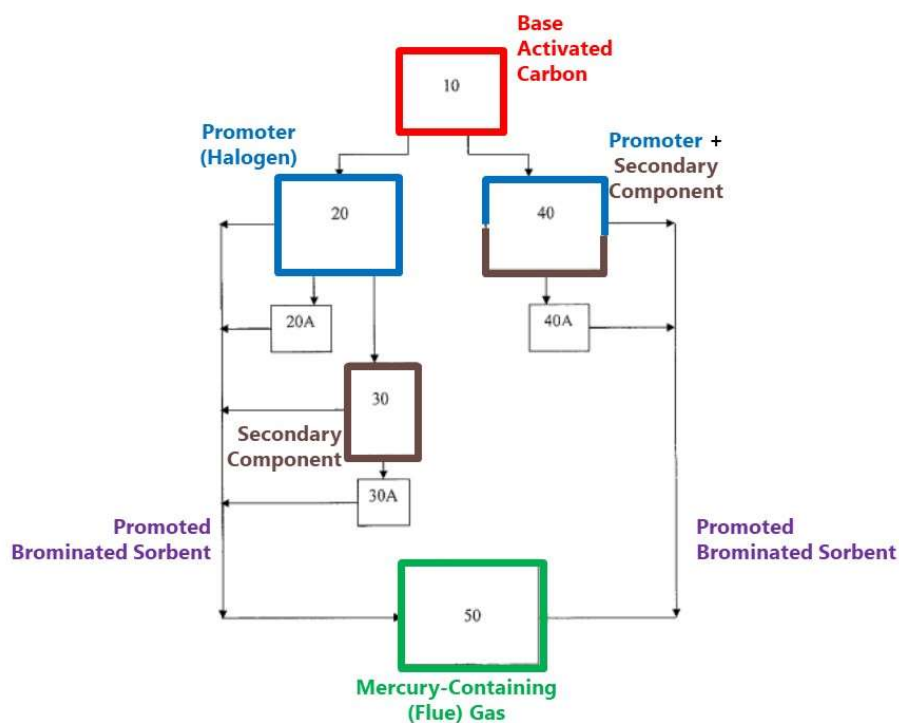
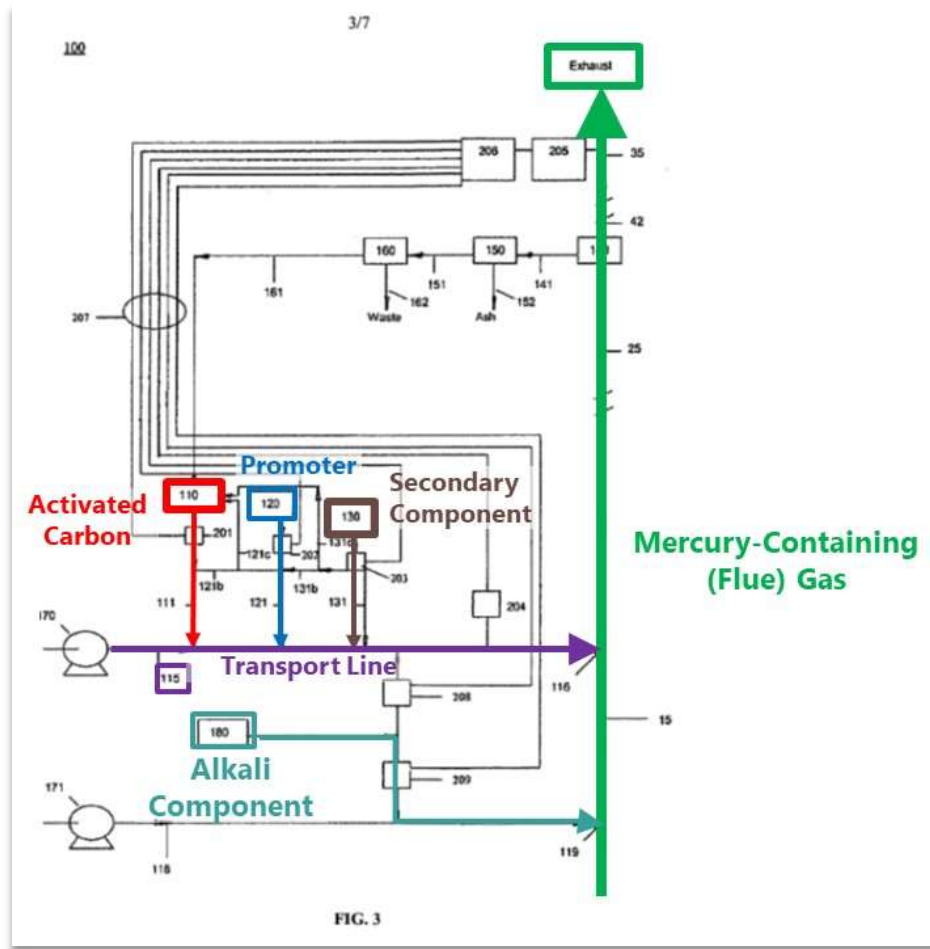


FIG. 1



EX1022, 295, 297; EX1002 ¶¶195-200. The power-generation industry, however, combined the two known components in a different way. Power-generation companies applied halogens directly to coal before combustion, so the halogens contact activated-carbon sorbent inside the mercury-containing gas. PO responded by amending its specification in April 2018 through filing the continuation '970 Application (EX1023), which added substantially more disclosure than contained in the preceding '558 Application. *See* EX1063-EX1064 (redline comparison). PO

cannot demonstrate priority back to 2004, and the '430 Patent's priority date is not before April 2018. EX1002 ¶¶159-176.

**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<sub>2</sub>, Br<sub>2</sub>), halides/halide compounds (e.g., sodium chloride), and hydrohalides (e.g., hydrogen bromide). EX1040; EX1002 ¶¶53-68 (chemistry fundamentals). It was known that mercury is metallic and generally exists in two forms: elemental (Hg<sup>0</sup>); and oxidized (Hg<sub>2</sub><sup>2+</sup> (mercurous) or Hg<sup>2+</sup> (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 ¶¶69-84 (also 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”) and fabric filters (“FF”) for particulates. EX1027, 33-1–33-7; EX1053, 1.1-6–1.1-9; EX1037; EX1045; EX1002 ¶¶85-96, 226.

### **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 from coal-fired plants. EX1039, 2-8. The timetable to update mercury-emissions standards was set for December 2003, to be finalized December 2004. EX1039, 8; EX1050; EX1054. The EPA passed the Clean Air Mercury Rule in 2005, requiring 70% mercury removal, but gave the industry advanced notice. EX1055-EX1058. State governments were also interested in regulating mercury emissions. EX1009. 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**

Even before EPA regulations, activated-carbon sorbents were used to remove mercury, and researchers were investigating improving their effectiveness. EX1060, 2-54; EX1038; EX1002 ¶¶97-115

By 1998, “[a]ctivated carbons ha[d] been the most thoroughly studied sorbent for the capture of mercury.” EX1038, 22; EX1002 ¶98. Two named inventors, Dr. Olson and Mr. Holmes, 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, 2:8-12 (known “mercury control methods” included activated carbon); EX1002 ¶¶223-225. It was known to fine-tune mercury removal by controlling sorbent-injection rate. EX1059; EX1009, 33, 73; EX1002 ¶¶114-115.

Olson admitted his research group was not the first “to conceive of adding a bromine compound to the furnace or to the flue gas.” EX1095, 145:25-146:4. By 1934, halogens were known to improve activated carbon in removing mercury. *See* EX1029, 1:33-41; *see* EX1002 ¶132. By 1970, it was shown that carbon adsorbed up to a saturation limit (adsorption equilibrium) of around 31-38% of bromine. EX1002 ¶¶109-111; EX1042, 255-262; EX1070, iii-viii, 238, 259, 391. In 1999, researchers demonstrated that flue-gas mercury formed chemical bonds with

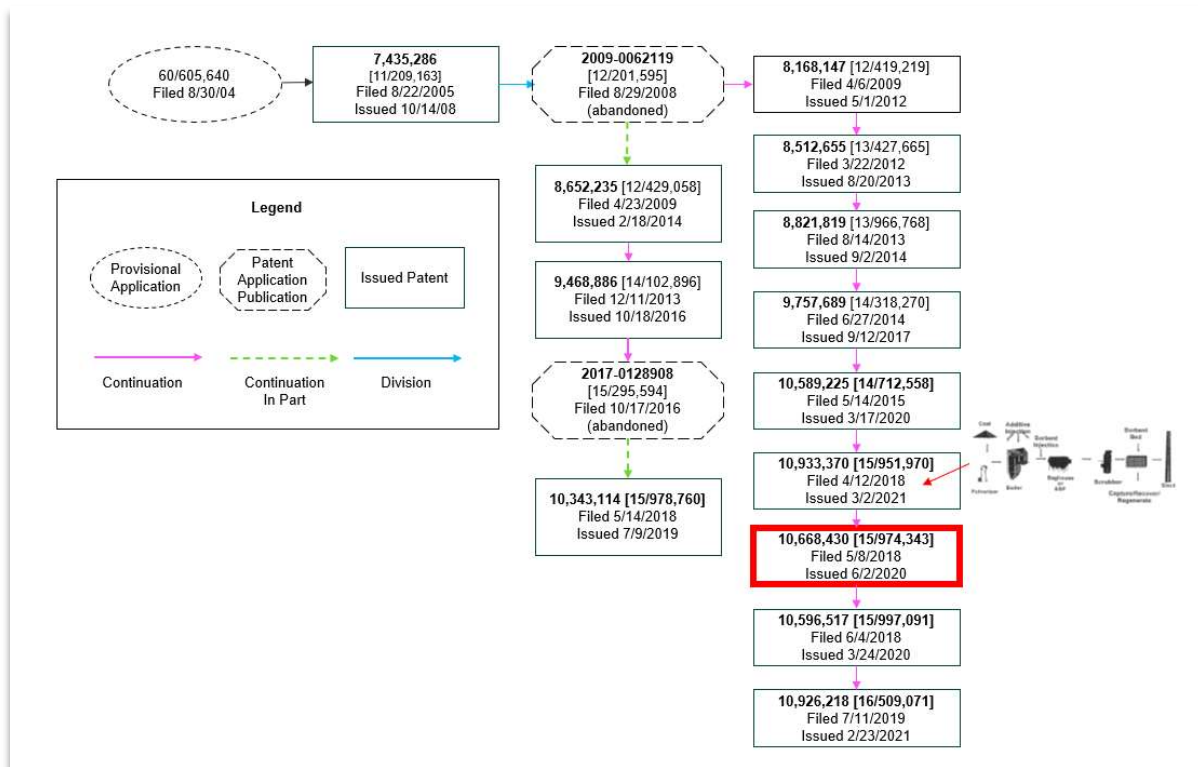
halogenated species on activated carbons. EX1043, 119; EX1041, 804, 1212-1213. By 2004, these findings were generalized to interpret capturing elemental and oxidized mercury on injected activated-carbon sorbents. EX1044, 4-5; EX1062 at 2-3 (halides “improve[d] Hg capture both by conversion of the  $\text{Hg}^0$  to the more easily removed  $\text{Hg}^{2+}$  forms and by enhancing the reactivity of  $\text{Hg}^0$  with activated carbons”). It was known that halogens, particularly bromine-containing ingredients, improved the effectiveness of activated carbon in removing mercury. EX1002 ¶¶129-151 (discussing state of the art, supported by EX1005-EX1006, EX1008, EX1012-EX1014, EX1028, EX1036, EX1046-EX1048).

**VI. THE '430 PRIORITY DATE IS NOT ENTITLED TO PRIORITY BEFORE THE ASSERTED ART**

Petitioners assert prior art dated before the May 2018 filing date of the '430 Patent, including Sjostrom/Eckberg (2005), Olson-646 (2006), and Olson-235 (2014). *See infra* §VII. Accordingly, the burden of production shifts to PO to “argue or produce evidence” that the '430 Patent is entitled to an earlier filing date. *Mueller Sys., LLC v. Rein Tech, Inc.*, IPR2020-00100, 2020 WL 2478524, at \*10 (P.T.A.B. May 12, 2020); *see PowerOasis, Inc. v. T-Mobile USA, Inc.*, 522 F.3d 1299, 1304-05 (Fed. Cir. 2008) (burden on PO to “prove entitlement to claim priority to an earlier filing date”); *Bj's Wholesale Club Holdings, Inc. v. Walmart Apollo, LLC*, No. IPR2022-01564, 2024 WL 1558422, at \*4 (P.T.A.B. Apr. 10, 2024) (same);

M.P.E.P. §201.08 (USPTO does not make findings of priority as a matter of course during prosecution). PO cannot meet this burden.

The '430 Patent ('343 Application) is the seventh continuation application in the priority chain. The specification was amended on April 12, 2018, upon filing the '970 Application.



EX1004 (annotated). The changes to the specification in the '970 Application added a figure and were extensive. EX1064 (comparison of '558 to '970 published applications).

Before April 2018, a POSITA would not have concluded Applicants were in possession of the subject matter of the issued claims of the '430 Patent. The

limitations that deprive the '430 Patent of earlier priority (collectively, “Newly-Introduced Limitations”) are directed to what species of bromine-containing ingredients are added, and where they are added:<sup>2</sup>

- “the coal comprises an additive comprising Br<sub>2</sub>, HBr, a bromide compound, or a combination thereof, wherein the additive is added to the coal before the coal enters the combustion chamber, or the combustion chamber comprises an additive comprising Br<sub>2</sub>, HBr, a bromide compound, or a combination thereof, or a combination thereof” (claims 1, 28, 29).

These Newly-Introduced Limitations do not have written-description support in the earlier applications. EX1002 ¶¶177-180.

**A. REQUIREMENTS TO DEMONSTRATE PRIORITY**

Without support in earlier-filed applications for the Newly-Introduced Limitations, PO cannot receive a priority date before April 12, 2018, when the '970 Application was filed. *Lockwood v. Am. Airlines, Inc.*, 107 F.3d 1565, 1571-72 (Fed. Cir. 1997) (“to gain the benefit of the filing date of an earlier application...each

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<sup>2</sup> The claims require adding bromine-containing ingredients to the combustion chamber, the coal upstream of the combustion chamber, or both. Each alternative must find written-description support. *See Tronzo v. Biomet, Inc.*, 156 F.3d 1154, 1158-60 (Fed. Cir. 1998) (denying priority where earlier application did not provide written-description support for the full scope of alternative shapes encompassed by the claims).

application in the [priority-chain] must comply with the written description requirement”).

PO must demonstrate that each prior application “convey[s] with reasonable clarity to those skilled in the art that, as of the filing date sought, [the inventor] was in possession *of the invention*.... Entitlement to a filing date does not extend to subject matter which is not disclosed, but would be obvious over what is expressly disclosed.” *PowerOasis*, 522 F.3d at 1306. “The question is not whether a claimed invention is an obvious variant of that which is disclosed in the specification. Rather, a prior application itself must describe an invention, and do so in sufficient detail that one skilled in the art can clearly conclude that the inventor invented the claimed invention as of the filing date sought.” *Lockwood*, 107 F.3d at 1571-72 (emphasis added). To claim priority to the Provisional, PO must demonstrate that the Provisional and all intervening applications—expressly or inherently—disclose adding halogens to coal upstream of the combustion chamber, including the claimed bromine-containing ingredients (Br<sub>2</sub>, HBr, and bromide compound).

**B. THE NEWLY-INTRODUCED LIMITATIONS IN THE ’343 APPLICATION**

The prosecution history of the ’343 Application confirms that no application before April 2018 supports the Newly-Introduced Limitations. Instead, the only passages cited to support the Newly-Introduced Limitations either: (a) do not support them at all; or (b) were first added in the April 2018 filing of the ’970 Application.

When Applicants amended the '430 Patent independent claims during prosecution to recite the Newly-Introduced Limitations, Applicants cited to ¶¶[0025], [0072], [0076]-[0086], [0090], [0200], and Figure 11 of the '343 Application for support. EX1019, 307, 538, 2273; EX1069; EX1002 ¶¶160-176.

Though ¶¶[0025], [0072], [0076]-[0086], and [0090] were present in the earlier '558 Application (filed 5/14/2015, and immediate parent to the '970 Application), they do not describe any bromine-containing species being added to the combustion chamber, coal, or elsewhere. Paragraph [0072] only discusses the surface structure of activated carbon and its interaction with halogens. Meanwhile, Paragraphs [0042] and [0054] merely describe the characteristics of a promoted sorbent (injected downstream into the mercury-containing gas and not added to coal) and a mechanism for how it reacts with mercury. Paragraphs [0076]-[0086] only refer to a halogen promoter being contacted with a base sorbent in-flight. Paragraphs [0025] and [0090] describe adjusting sorbent-injection rate according to mercury measurements. None of these paragraphs describe bromine-containing species being added to the combustion chamber, coal, or elsewhere. Figure 11 and Paragraph [0200] were not present in the '558 Application. EX1064; EX1002 ¶¶181-183.

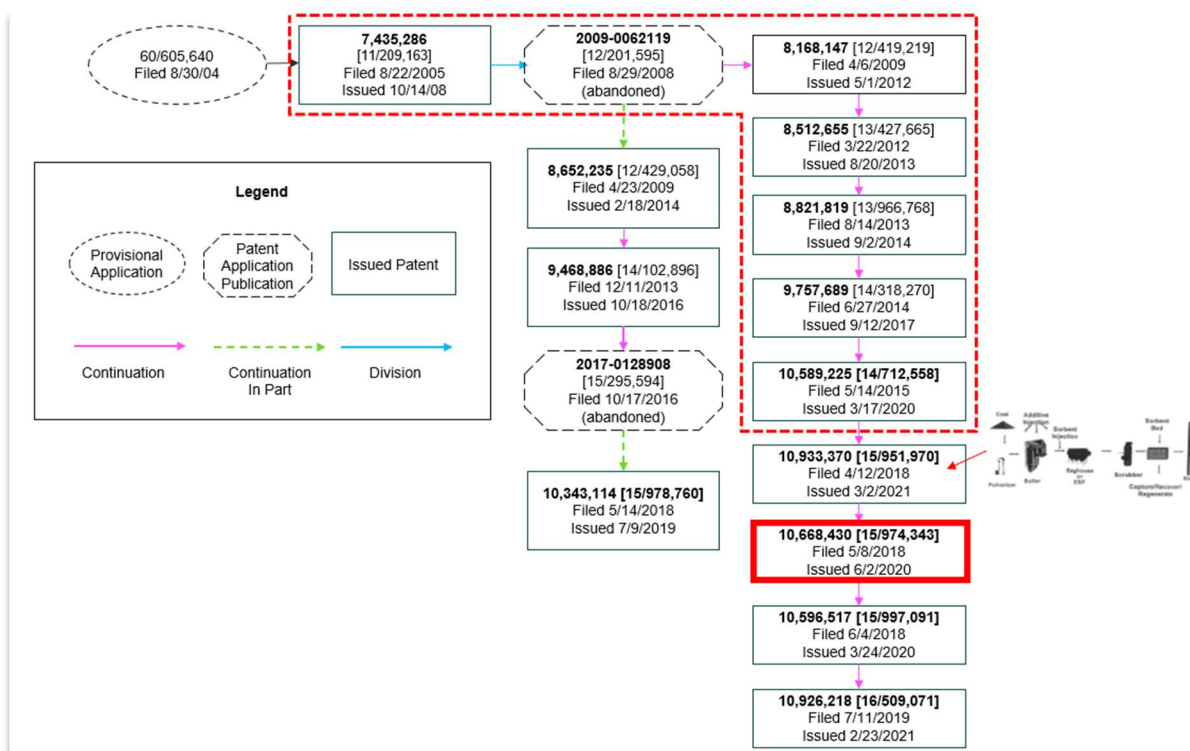
Accordingly, there was no uninterrupted disclosure of any passage supporting the Newly-Introduced Limitations before the '970 Application (filed 4/12/2018).

Thus, the passages cited during prosecution do not entitle PO to a priority date before April 2018. EX1002 ¶¶181-184.

**C. NO SUPPORT IN PARENT APPLICATIONS FOR NEWLY-INTRODUCED LIMITATIONS**

The Newly-Introduced Limitations also are not supported by the earlier-filed “application[s] in the chain,” each of which breaks priority. *See Lockwood*, 107 F.3d at 1572.

With the exception of alterations made to a replacement-Figure 1 during prosecution of the '219 Application ('147 Patent, discussed below), the specifications (i.e., other than the claims) are substantively identical between the '558, '270, '768, '665, '219, '595, and '163 Applications (shown below) (collectively, “Pre-2018 Applications”).



The Pre-2018 Applications do not support adding any halogens to the coal or combustion chamber, let alone the particular bromine-containing ingredients claimed in the '430 Patent. This is because the Pre-2018 Applications are directed to preparing a brominated-activated carbon (purple) outside mercury-containing flue gas (green), and then injecting the pre-brominated sorbent into mercury-containing flue gas (green) downstream from the combustion chamber:

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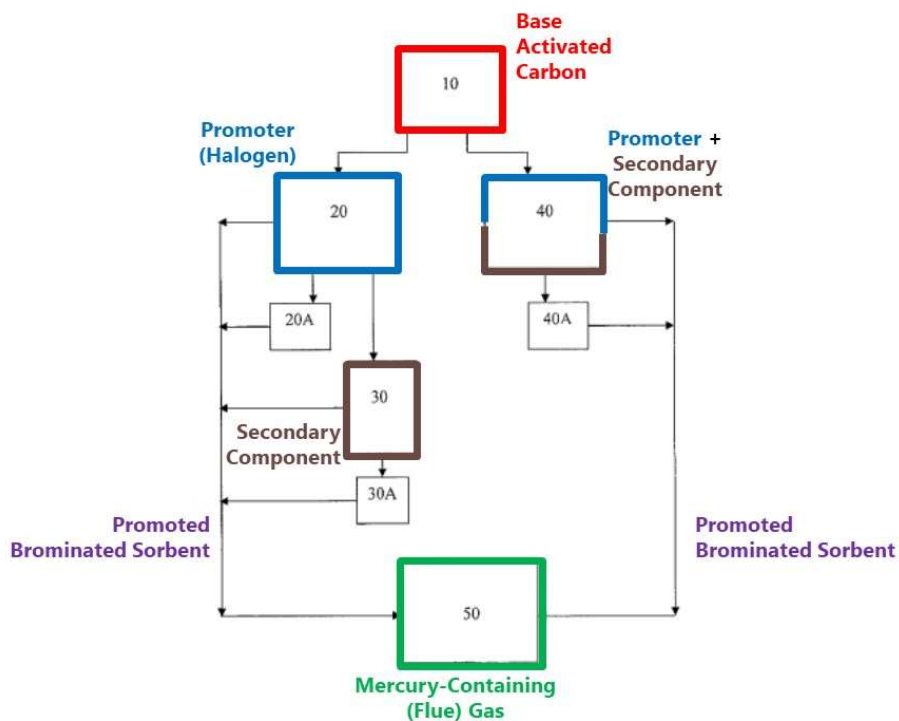
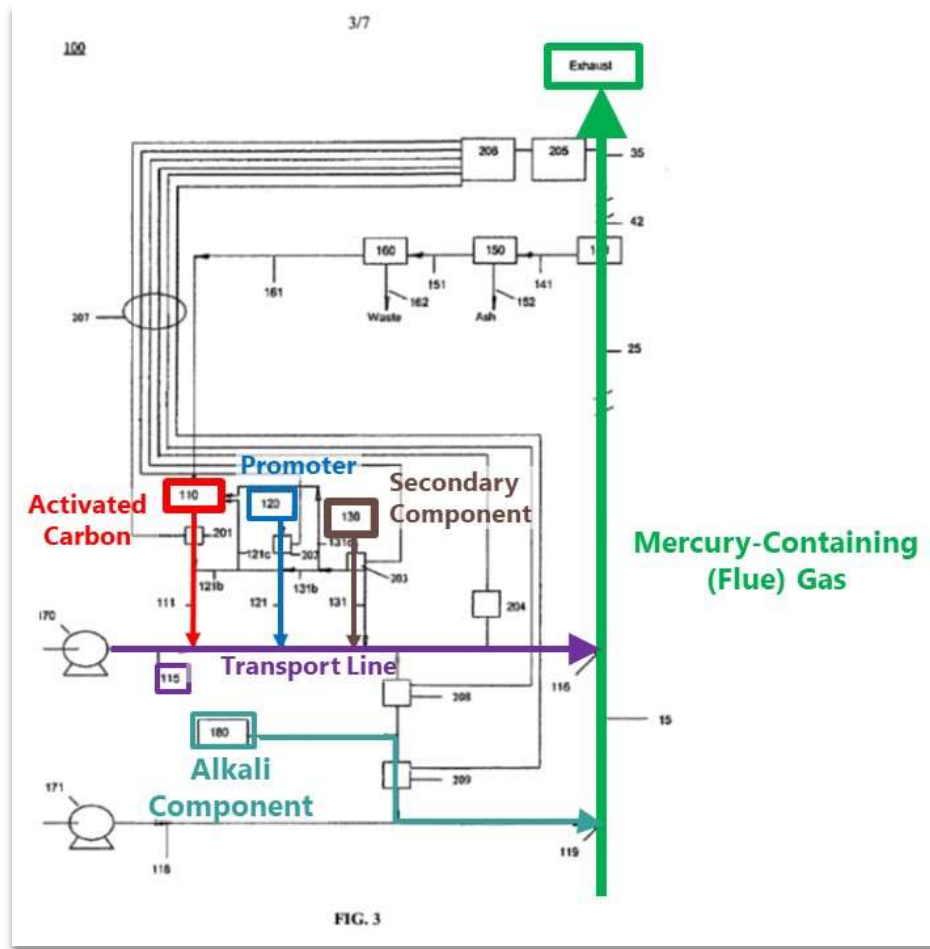


FIG. 1



EX1022, 263-264, 295-297 (annotated); EX1002 ¶¶195-200. Indeed, the named inventors and PO's expert in the Delaware Litigation were asked about the specification of the 8,168,147 Patent (12/419,219, filed in 2009), and they confirmed no examples disclosed adding bromine to coal. EX1095 (Olson), 128:20-25; EX1097 (Pavlish), 116:22-125:17; EX1093 (O'Keefe 1), 156:5-170:5.<sup>3</sup>

<sup>3</sup> This alone is sufficient to qualify Sjostrom, Eckberg, and Olson-646 as prior art, as each was published in 2005-2006.

**D. PO CANNOT RELY ON THE PROVISIONAL FOR SUPPORT**

To the extent PO alleges that the Provisional itself provides sufficient disclosure for the Newly-Introduced Limitations, this fails because PO cannot demonstrate that each of the parent applications to the '970 Application (filed 2018, upon which the '430 Patent depends for priority) includes the disclosure from the Provisional. *Lockwood*, 107 F.3d at 1572 (“Each application in the chain must describe the claimed features.”); *Droplets, Inc. v. E\*TRADE Bank*, 887 F.3d 1309, 1320 (Fed. Cir. 2018) (“[I]f any application in the priority chain fails to make the requisite disclosure of subject matter, the later-filed application is not entitled to the benefit [of a priority date] preceding the break in the priority chain.”); *accord DDR Holdings, LLC v. Priceline.com LLC*, 122 F.4th 911, 917 (Fed. Cir. 2024) (determining “skilled artisan would deem significant the [non-provisional]’s deletion of the provisional application’s” subject matter, and finding deleted matter outside scope of claims). If PO argues the Provisional was incorporated by reference into the intervening applications, that fails because: (1) the language referencing the Provisional was insufficient in the Pre-2018 Applications; (2) the Provisional is “essential material” and cannot be incorporated to provide written-description support; and (3) the Provisional and parent applications (even if they could legally be incorporated) do not fully support the '430 Patent claims.

1. **The Reference to the Provisional Is Not Clear and Is Ineffective**

To incorporate another document, “the host document must identify with detailed particularity what specific material it incorporates and clearly indicate where that material is found in the various documents.” *Callaway Golf Co. v. Acushnet Co.*, 576 F.3d 1331, 1346 (Fed. Cir. 2009). Between the Provisional and the ’430 Patent are four patents causing a break in the priority chain: 8,168,147; 8,512,655; 8,821,819; and 9,757,689. EX1004. Each of those intervening patents purports to claim priority to the Provisional “to the extent appropriate.” EX1033-1035, EX1065. PO could have incorporated and claimed priority to the entire provisional “full stop”; instead, PO claimed priority to the Provisional to a limited extent. *See Midwest Energy Emissions Corp. v. Arthur J. Gallagher*, No. 19-1334-CJB, 2023 WL 7411160, at \*3 (D. Del. Nov. 3, 2023) (holding Provisional was not properly incorporated into ’430 Patent); *Zenon Env’t., Inc. v. U.S. Filter Corp.*, 506 F.3d 1370, 1379 (Fed. Cir. 2007) (“The plain language expressly limits the incorporation to only relevant disclosures of the patents, indicating that the disclosures are not being incorporated in their entirety.”). The Board previously held that U.S. Patent No. 8,168,147 (App. No. 12/419,219) “claims priority ‘to the extent appropriate’ and fails to identify with detailed particularity the specific material incorporated and fails to clear[ly] indicate where that material is found in the various

documents.... This ambiguity creates an additional concern regarding the chain of priority for the '219 application.” *NRG Energy*, No. IPR2020-00928, 2020 WL 7074473, at \*13 (finding '147 Patent does not have priority to Provisional). The Provisional is not properly incorporated into Pre-2018 Applications, and there is a break in priority.

**2. The Provisional Cannot Be Incorporated Because It Is “Essential Material”**

The Provisional cannot be incorporated to provide written-description support for the additional reason that its disclosures would be deemed “essential material.”

**a. “Essential material” cannot be incorporated from unpublished applications**

“‘Essential material’ may be incorporated by reference, but only by way of an incorporation by reference to a U.S. patent or U.S. patent application publication. . . .” 37 C.F.R. §1.57(d) (current); 37 C.F.R. §1.57(c) (2005) (similar restriction). A provisional application is neither a “U.S. patent” nor a “U.S. patent application publication.” 35 U.S.C. §122(b)(2)(A)(iii) (2013) (“application shall not be published if that application is—a provisional application”); 35 U.S.C. §122(b)(2)(A)(iii) (2006) (similar). Thus, PO cannot incorporate by reference the Provisional into the Pre-2018 Applications, because it is: (1) “essential material” to the Newly-Introduced Limitations; (2) “essential material” to the claims of the Pre-2018 Applications and thus absent during the *Lockwood* analysis; and (3) barred from

incorporation by the close of prosecution. *See ZTE (USA), Inc. v. CyWee Grp. Ltd.*, IPR2019-00143, 2021 WL 641742, \*54 (P.T.A.B. Feb. 17, 2021) (incorporation by reference of provisional “ineffective” as to essential matter).

**b. Provisional Is “Essential” for ’430 Patent Claims**

The Provisional cannot be incorporated by reference into the intervening applications because it is essential material for the Newly-Introduced Limitations.

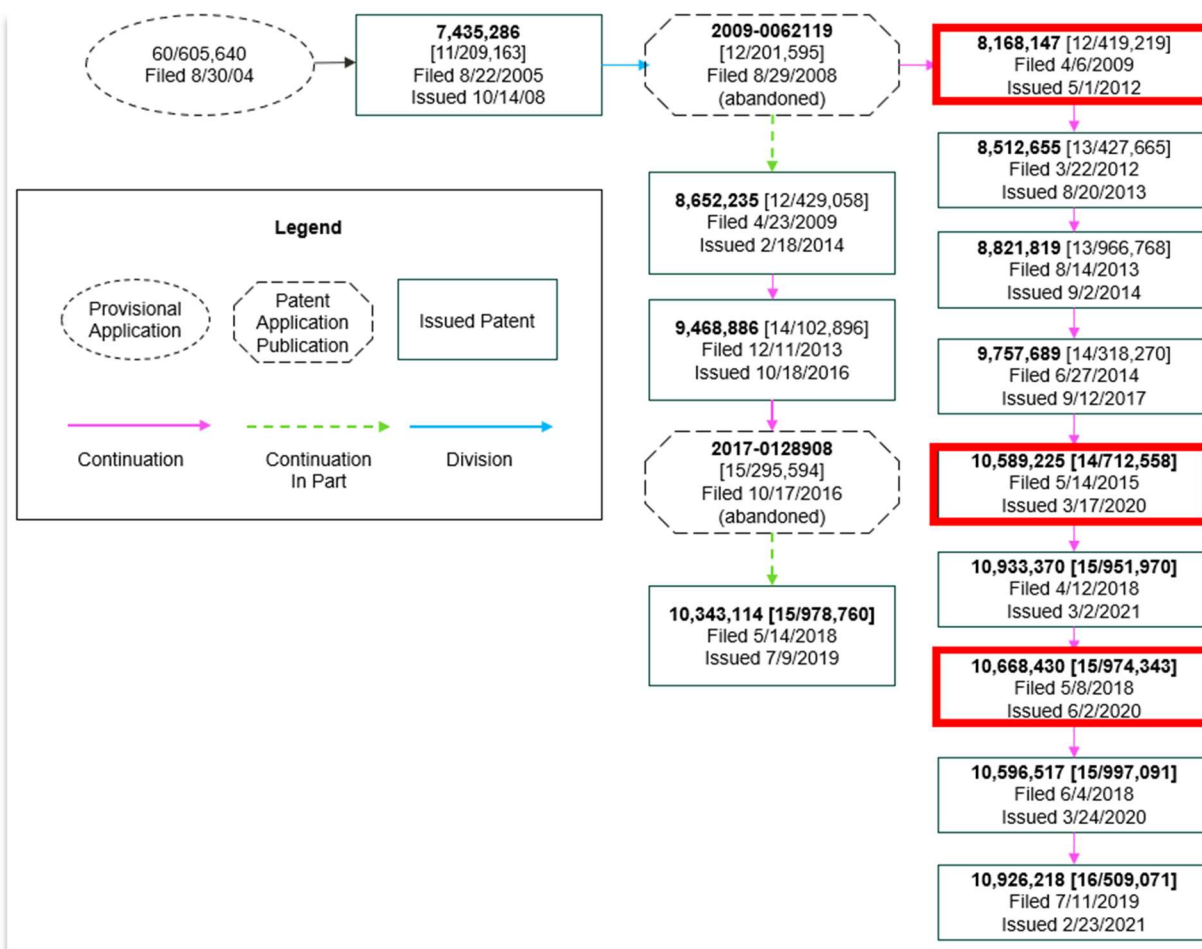
“Essential material” is material that is necessary to...[p]rovide a written description of the claimed invention,...as required by 35 U.S.C. 112(a)

37 C.F.R. §1.57(d)(1). As discussed *supra* §VI.C, the specifications of Pre-2018 Applications do not support the Newly-Introduced Limitations. Thus, the disclosure of the Provisional is “necessary” to provide written-description support for those limitations. This should not be in dispute, because PO’s testifying expert in the Delaware case admitted that Figure 2 of the Provisional and surrounding text (correlating to Figure 11 of the ’430 Patent identified by PO during prosecution to support the ’430 Patent claims) was “essential material for the patents in this case” (which included the ’430 Patent). EX1093 (O’Keefe), 237:20-241:9. The Provisional is essential material for the Newly-Introduced Limitations, and essential material cannot be incorporated by reference from provisional applications. Priority is broken. *See NRG Energy*, IPR2020-00832, Paper 17, 2020 WL 6277239, at \*12 (applying Rule 1.57(d) and holding the Provisional cannot be incorporated by reference into counterpart of ’430 Patent); IPR2020-00928, Paper 17, 2020 WL

7074473, at \*10 (applying predecessor to Rule 1.57(d) and holding the Provisional cannot be incorporated by reference into parent of '430 Patent).

**c. Provisional Is “Essential” for Claims of Parent Patents**

The Provisional is not only “essential” for the Newly-Introduced Limitations, but also “essential” to provide written-description support for claims of parent patents. *See Maquet Cardiovascular LLC v. Abiomed, Inc.*, 627 F. Supp. 3d 72, 81-82 (D. Mass. 2022) (analyzing whether material was essential to claims of intervening applications). The '430 Patent claims priority to U.S. Patent Nos. 8,168,147 ('147 Patent) and 10,589,225 ('225 Patent).



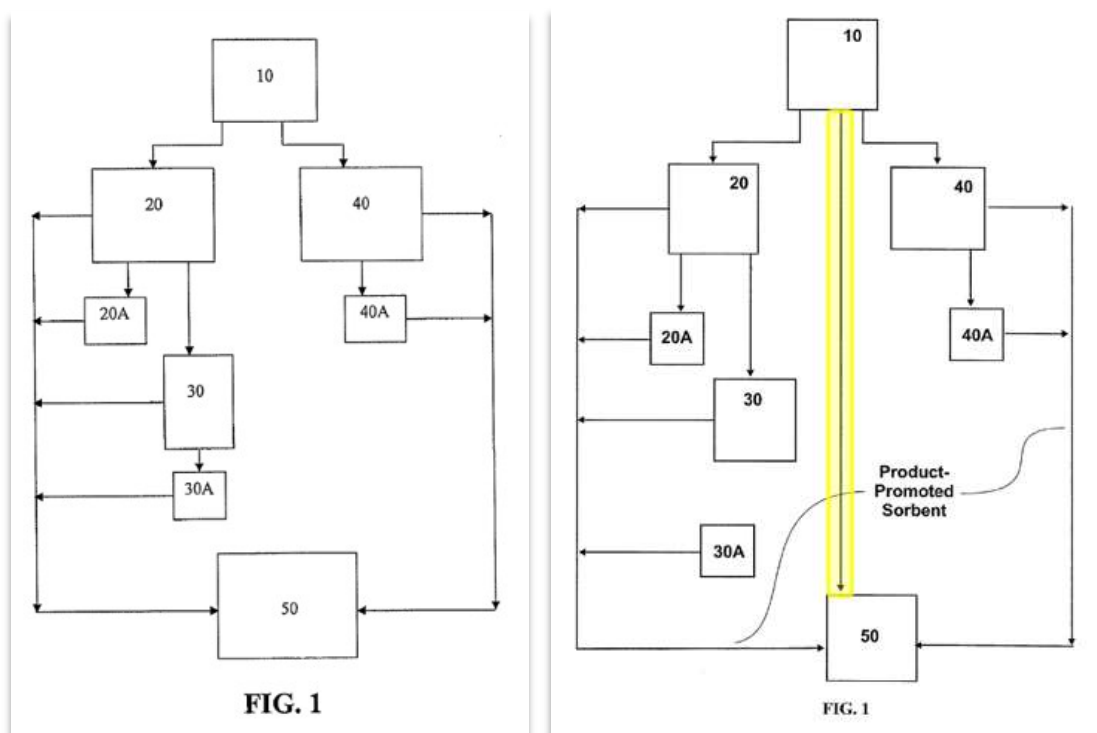
EX1004 (annotated).

#### i. '147 Patent claims 18-19

Claims 18-19 of the '147 Patent collectively require “injecting the particulate sorbent material at a sorbent material injection rate and injecting separately the bromine containing promoter into [cl. 19—a mercury containing gas that is a transport gas] whereby in-flight reaction produces the promoted brominated sorbent.” EX1065, cls. 18, 19; EX1002 ¶¶201-204. The '163 and '595 Applications (parents to the '147 Patent, and which also omit portions of the Provisional) do not

disclose the subject matter of Claims 18-19. EX1020, 5-8, 15, 260; EX1021, 236-265; EX1022, 256-284; EX1002 ¶¶205-206, 218-219. As discussed above, those applications describe treating a base activated-carbon sorbent with a bromine promoter prior to injecting the sorbent into a mercury-containing flue gas, such that: (a) the sorbent material and bromine containing promoter are not injected “separately” into the mercury-containing gas (they are injected together); and (b) an in-flight reaction between sorbent and promoter occurs prior to injection into the mercury-containing gas, not in the “gas stream [that] is a mercury-containing gas.” EX1002 ¶¶207-210; *see NRG Energy*, IPR2020-00928, 2020 WL 7074473, at \*11 (finding for ’147 Patent that “[t]here is no suggestion that bromine and the activated carbon are separately injected into mercury-containing flue gas”).

Notably, Replacement-Figure 1, as found in the issued ’147 Patent, is not the same as the version originally filed in the ’163 and ’595 Applications. EX1021, 272. On November 4, 2009, Applicants filed a replacement set of Figures 1-10 during prosecution of the ’219 Application (’147 Patent), revised Figure 1 is shown on the right (annotation in yellow) and original Figure 1 on the left:



EX1025, 541-551, 571. There is no textual support describing the direct line between block 10 (activated carbon) and block 50 (flue gas), highlighted above in yellow, and there is no support that the line added in Replacement-Figure 1 teaches adding activated carbon directly to mercury-containing (flue) gas independently and separately from the halide promoter, as recited in Claims 18-19. EX1002 ¶¶211-215.

Even if PO could rely on this improperly added line from block 10 (activated carbon) to block 50 (flue gas), it still fails to support Claims 18-19, as the specification refers to this embodiment as one where no halogen promotion occurs, such as where an alkali component is used instead of a halogen promoter. EX1065, 10:7-12, 20:60-21:16, Fig. 10; EX1002 ¶¶216-219; *see NRG Energy*, No. IPR2020-

00928, 2020 WL 7074473, at \*12 (finding that Figure 1 does not provide written-description support for '147 Patent claims 18-19). Thus, the only support for these claims (if any) would be from Figure 2 of the Provisional, making it “essential material” to the '147 Patent.

**ii. '225 Patent claims 1, 14, 16-17, 20-21, 23**

Claims 14 and 23 of the '225 Patent require “combusting coal in a combustor comprising pyrolysis char and an additive comprising HBr, a bromide compound, or a combination thereof, to form the mercury-containing gas” and “the sorbent is free of contact with a halogen or halide promoter prior to the addition of the sorbent to the mercury-containing gas,” respectively. EX1067; EX1002 ¶¶220-222.

For the same reasons discussed for the '147 Patent, the '225 Patent specification discloses that any contact between the activated-carbon sorbent and the bromine-containing promoter occurs before the sorbent enters the mercury-containing gas, and the sorbent is not “free of contact with a halogen or halide promoter prior to the addition of the sorbent to the mercury-containing gas.” EX1002 ¶221. Thus, any support for Claim 23 of the '225 Patent would be from the Provisional, making it “essential material” to the '225 Patent.

Regarding claim 14, there is no disclosure in the Pre-2018 Applications of adding HBr, a bromide compound, or any bromine-containing ingredients in the combustion chamber (i.e., “combustor” recited in claim 14 of the '225 Patent).

There is no disclosure in the Pre-2018 Applications of HBr being present in the combustion chamber, because any bromine-containing promoter in the specification is introduced downstream of the combustion chamber. *Supra* §VI.C; EX1002 ¶222. In fact, this limitation in Claim 14, as well as other '225 Patent claims (e.g., 16, 17, 20, 21) that recite adding bromine-containing ingredients (e.g., HBr, a bromide compound) to the coal and/or combustion chamber, was not present in the originally filed application for the '225 Patent. *Compare* EX1067, cls. 14, 16, 17, 20, 21 with EX1068, 41. Such limitations were introduced for the first time during prosecution upon the Applicants' filing of a June 13, 2018, Supplement Amendment presenting twenty-one new claims. EX1068, 1637-1651. The as-filed '225 Patent application (as well as the preceding Pre-2018 Applications) does not disclose adding the claimed bromine-containing species to the coal and/or combustion chamber. EX1002 ¶222.

Regarding Claim 1 of the '225 Patent, there is no disclosure in the Pre-2018 Applications of “combusting a mixture comprising coal, pyrolysis char, and an additive comprising HBr, a bromide compound, or a combination thereof, to form the mercury-containing gas.” EX1067, cl.1. The only disclosure of adding bromine-containing ingredients in the specification and the Pre-2018 Applications involves additions downstream of the combustion process. Notably, the Pre-2018 applications (e.g., '163 and '595 Applications) omit the series of numbered

“outline[s] of examples of the invention”; example number 1E in the Provisional referring to an “additional substance” is not carried over to the Pre-2018 Applications or ’225 Patent). Nor is Figure 2 of the Provisional. Thus, any support for these limitations, and Claims 1, 14, 16-17, and 20-21 of the ’225 Patent, would be from the Provisional, making it “essential material” to the ’225 Patent. EX1002 ¶¶221-222.

**d. Cannot physically incorporate after close of prosecution**

Incorporation by reference under 37 C.F.R. §1.57 is allowed to “safeguard against the omission of a portion of a prior application for which priority is claimed.” M.P.E.P. §608.01(p)(I)(2)(B). This safeguard contemplates a specific scenario: a patentee files a child application that omits material from a parent application, but learns during prosecution of the child that the omitted material is needed for written-description support. “The inclusion of such an incorporation by reference statement in the later-filed application will permit applicant to include subject matter from the prior application into the later-filed application without the subject being considered new matter.” M.P.E.P. §608.01(p)(I)(2)(B). Because a provisional cannot be incorporated by reference under 37 C.F.R. §1.57(d), there are limits to when M.P.E.P. §608.01(p)(I)(2)(B) can be used to add omitted material from a provisional:

[1] The “inadvertently omitted portion of the specification or drawing(s) is completely contained in the prior-filed [parent] application;” and

[2] “The application must be amended to include the inadvertently omitted portion of the specification or drawing(s)...in no case later than the close of prosecution” of the child application.

37 C.F.R. §1.57(b) (quoted in M.P.E.P. §608.01(p)(I)); *see* M.P.E.P. §217 (analyzing 37 C.F.R. §1.57(b)). The ’430 Patent and its parents fail both requirements. As explained below, the scope of the ’430 Patent claims is not “completely contained” in the Provisional. Second, the April 2018 physical incorporation into the ’970 Application was too late: the ’430 Patent is the ninth non-provisional from the Provisional (EX1004); the Pre-2018 Applications (’558, ’270, ’768, ’665, ’219, ’595, and ’163 Applications) were either abandoned or issued, but were never “amended to include the inadvertently omitted portion of the [Provisional before] the close of prosecution.” 37 C.F.R. §1.57(b); *see* M.P.E.P. §217(III) (Example 3) (when application #2 and application #3 in priority chain omit material from application #1, omitted material cannot be added in application #3 after close of prosecution of application #2).

### **3. Provisional Does Not Support the ’430 Patent Claims**

Even if the Provisional could be legally considered, it does not support the Newly-Introduced Limitations. There would still be no written-description support

for the Newly-Introduced Limitations prior to the '970 Application's April 12, 2018, filing date.

**a. Additive Comprising Br<sub>2</sub> or Bromide Compounds  
or Combinations of Br<sub>2</sub> and HBr with Bromide  
Compounds**

The Provisional fails to disclose adding to coal or combustion chamber each of the bromine-containing ingredients recited in the Newly-Introduced Limitations, such as Br<sub>2</sub> and “bromide compounds.” Example 1E of the Provisional, reciting that the “additional substance is hydrohalide (HI, HBr, HCl), etc., 1%B-10% of bromine,” is not sufficient. EX1020, 6; EX1002 ¶¶191-194.

There is no disclosure that this “additional substance” is the “additive” supplied “before the boiler,” discussed below. EX1020, 6. And even if the “additional substance” is added before the boiler, the Provisional discloses at most that this additional substance is hydrogen bromide (HBr). During prosecution of the '430 Patent, PO distinguished “hydrogen bromide” from other bromine-containing ingredients, such as those in the Newly-Introduced Limitations. EX1019, 426-428; EX1002 ¶192.

As declared by named inventor, Mr. Pavlish: “Br<sub>2</sub> is not HBr and does not include HBr.” EX1019, 428. Thus, disclosure of HBr does not disclose Br<sub>2</sub> (as recited in “the coal comprises an additive comprising Br<sub>2</sub>” or “the combustion

chamber comprises an additive comprising Br<sub>2</sub>”) of Claims 1 and 28-29. EX1002 ¶193.

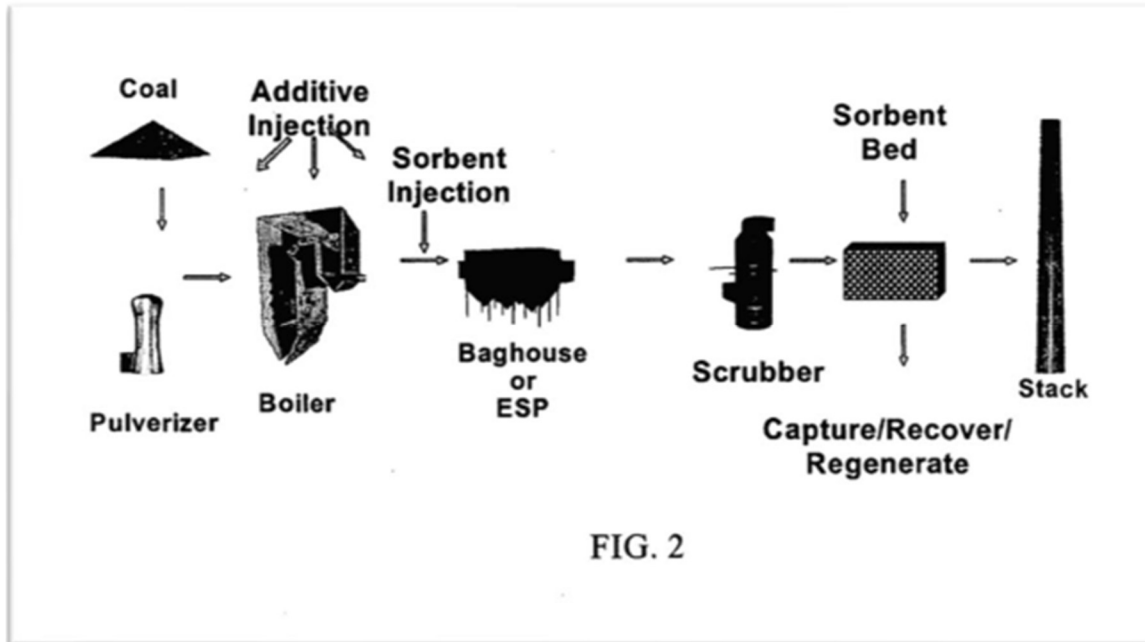
A disclosure of one species (HBr) in the Provisional does not support the full breadth of the entire class of added “bromide compound[s].” *See Ariad Pharms., Inc. v. Eli Lilly & Co.*, 598 F.3d 1336, 1350 (Fed. Cir. 2010) (disclosure of a type does not provide sufficient written-description support for a claimed class). There are nearly infinite forms of bromide compounds, because a “bromide compound” may be any “chemical compound containing a bromide ion or ligand.” EX1019, 425; EX1002 ¶194.

Thus, a POSITA would not have understood the Provisional’s disclosure of one species, HBr, to demonstrate the inventors were in possession of adding the broad class of any “bromide compound” or molecular bromine (Br<sub>2</sub>) to the combustion chamber or to the coal. EX1002 ¶¶191-194. The Newly-Introduced Limitations are not supported by the Provisional.

**b. “The Coal Comprises” Added Bromine Species**

Even if the “additive” includes the bromine-containing ingredients of the Newly-Introduced Limitations, the Provisional does not expressly or inherently disclose “the coal comprises [the bromine-containing ingredients in the Newly-Introduced Limitations] added to the coal before the coal enters the combustion chamber,” as required by the ’430 Patent claims. Figure 2 of the Provisional,

reproduced below, labels “Additive Injection” with three arrows vaguely pointing in the direction of the boiler of a coal-fired plant.

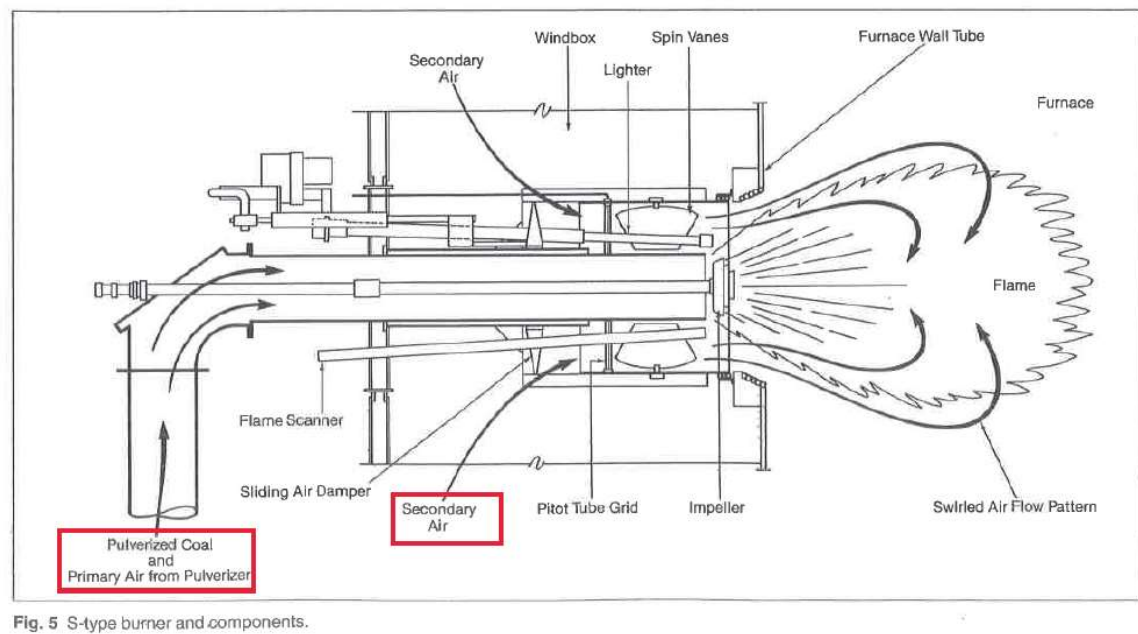


#### DESCRIPTION OF EXEMPLARY EMBODIMENTS

FIG. 2 is a block diagram illustrating the use of the invention in a coal fueled facility. Of course, the invention can also be used in any other desired type of facility. FIG. 2 shows a boiler for burning pulverized coal. The facility utilizes various devices to clean the exhaust of the boiler. In this example, a baghouse or ESP is used to collect particulates in the exhaust. A scrubber and sorbent bed are also used to remove undesired constituents from the flue gas stream, before being fed to the stack. In the example shown, the sorbent is injected into the flue gas after the boiler. The additive can be injected where desired (e.g., before, after, or within the boiler).

EX1020, 15, 16; *see* EX1001, Fig. 11; EX1020, 7. However, this figure and the “before...the boiler” language neither expressly nor inherently discloses supplying the claimed bromine-containing ingredients (e.g., Br<sub>2</sub> or any bromide compound). EX1002 ¶¶185-190.

The “before the boiler” language (or anything else in the Provisional) does not expressly or inherently disclose any bromine-containing species supplied “to the coal,” as opposed to elsewhere upstream of the boiler. *See Lockwood*, 107 F.3d at 1572 (obviousness is not enough for written-description support). There are numerous systems in a coal plant “before...the boiler” that could deliver halogens, but do not interface with the coal. Exemplary systems include secondary-air systems, low-NO<sub>x</sub> overfire air systems, or even specialized additive-injection systems separate from the coal.



EX1027, 13-3 to 13-5 (annotated). In the example above, the “Secondary Air” stream is before the boiler, but it uses a separate pipe from the one that delivers “Pulverized Coal.” EX1002 ¶189. To the extent PO argues it “would be obvious over what is expressly disclosed” to add bromine to coal upstream of the combustion

chamber, that is not the standard for a priority-date analysis. *Lockwood*, 107 F.3d at 1571-72. The Provisional fails to expressly or inherently disclose the Newly-Introduced Limitations. EX1002 ¶¶185-190.

\* \* \*

Under any legal theory, parent applications to the '430 Patent fail to provide written-description support for the Newly-Introduced Limitations before April 2018, thereby limiting the '430 Patent claims to a priority date after Sjostrom, Eckberg, Olson-646, and Olson-235.

## **VII. THE ASSERTED REFERENCES**

Petitioner asserts four prior-art references in this petition:

| <b>References</b>                                   | <b>Prior-Art Status</b>                                                                                                                |
|-----------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|
| <b>Sjostrom</b> , EX1010<br><b>Eckberg</b> , EX1011 | §§102(a)-102(b) (pre-AIA)<br>§102(a)(1) (post-AIA)<br><br>Presented January 26, 2005, at EUEC,<br>publicly accessible by February 2005 |
| <b>Olson-646</b> , EX1012<br>US2006/0048646         | §§102(a)-102(b) (pre-AIA)<br>§102(a)(1) (post-AIA)<br><br>Published: March 9, 2006                                                     |
| <b>Olson-235</b> , EX1018<br>US8,652,235            | §102(a)(1) (post-AIA)<br><br>Issued: February 18, 2014                                                                                 |

**A. SJOSTROM AND ECKBERG**

The Board previously found in IPR2020-00832 that Sjostrom and Eckberg qualify as printed publications and found in IPR2020-00928 that Sjostrom qualified as a printed publication (Eckberg was not raised in that petition). EX1026, 51; *NRG Energy*, IPR2020-00928, 2020 WL 7074473, at \*18.

Sjostrom and Eckberg were presented January 25, 2005, at the Electric Utilities Environment Conference (“2005 EUEC”) in Arizona, and mailed to conference attendees (including Dr. Niksa) by February 2005.

A conference paper 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). The Sjostrom and Eckberg presentations, delivered at EUEC on January 25, 2005, and mailed on CD to conference participants within weeks, meet the *GoPro* standard.

Dr. Niksa personally attended 2005 EUEC (and numerous other years), including delivering presentations. EX1030, 3, 32, 114.

**Wednesday, 1/26/2005**

**A7 Mercury - Measurement & Modeling . . . . . Wednesday; 7:30-9:30am**

Chairs: Raj Singhvi – US EPA/ERTBI

Constance Senior – Reaction Engineering International

- a. **A Multipathway Health Risk Assessment Model for Mercury Emissions**  
– Khanh Tran - AMI Environmental
- b. **Geographic Variation of Mercury Content, and Mercury Emissions Predicted for Existing Technologies, by U.S. County of Coal Origin.**  
– Jeffrey C. Quick - Utah Geological Survey
- c. **Measurement and Control of Mercury Emissions in Utility Boilers**  
– Constance Senior and Bradley Adams - Reaction Engineering International
- d. **The Impact of Wet FGD Scrubbing On Hg Emissions From Coal-Fired Power Stations**  
– Stephen Niksa - Niksa Energy Associates; Naoki Fujiwara - Coal Research Laboratory

EX1030, 7. The EUEC served as a direct link from vendors of technologies and services for mercury-emissions control and engineers and technical staff at utilities implementing those controls. EX1002 ¶¶125, 268-273.

Sjostrom and Eckberg were presented consecutively on “1/25/2005” in the “Mercury-Control” session:

**Tuesday, 1/25/2005**

**A3 Mercury - Control . . . . . Tuesday; 7:30-9:30am**

Chairs: George Offen – EPRI

Ram Srivastava – SAIC/NETL

**b. Full-Scale Evaluations of Mercury Control Technologies with PRB Coals**  
*Sharon Sjostrom, Travis Starns, Jerry Amrhein, and Jean Bustard – ADA ES, Inc.; Wayne Penrod and Corey Lineville – Sunflower Electric Power Corporation; Rich Phillips and Tom Hart – Ameren; Andrew O’Palko – U.S. DOE-NETL; Ramsay Chang, Ph.D. – EPRI*

**c. Mercury Control Evaluation of Halogen Injection into a Texas Lignite-Fired Boiler**  
*Craig Eckberg, John Hudspeth, Mike Meyers and Jim Russell – Texas Genco; Katherine Dombrowski and Carl Richardson – URS Corporation; Ramsay Chang – EPRI*

EX1030, 23. Based on personal participation, Dr. Niksa declares that over 800 people attended the 2005 EUEC. This figure is confirmed by an attendee list sent to

all attendees, including Dr. Niksa, shortly after the conference.<sup>4</sup> EX1030, 106-18; EX1002 ¶¶274-276.

The 2005 EUEC included four presentation tracks, with Sjostrom and Eckberg presented in “Track A-Air Quality” during the “Mercury-Control Session.” EX1030, 2, 3. Hundreds of people attended the Track A presentations. These attendees included POSITAs in the mercury-control industry, such as engineers, regulatory-compliance specialists, and project managers from utilities. EX1002 ¶¶125, 276-279.

The CD mailed to each recipient included the conference program containing a navigable index of PDF copies of all presentations given at the conference, including Sjostrom and Eckberg. EX1030. EX1010 (Sjostrom) and EX1011 (Eckberg) are the versions contained on the CD that Dr. Niksa received in February 2005. EX1030-EX1031; EX1002 ¶¶277-278.

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<sup>4</sup> The public accessibility of Sjostrom and Eckberg are further supported by the 3/3/2005 Internet Archive copy of the EUEC website, <https://web.archive.org/web/20050303090129/http://www.euec.com/>. EX1061 (“200503”); EX1091 (explaining date stamps of Internet Archive); EX1099, 5 (sponsoring EX1061). The 2005 EUEC had “over 956 participants” and “EUEC Conference Proceedings [were] mailed out the week of February 21st.” EX1061.

**B. OLSON-646 AND OLSON-235**

Olson-646 and Olson-235 are publications of counterparts to the '430 Patent. They were published and issued, respectively, more than one year before the April 2018 priority date of the Challenged Claims, and thus qualify as prior art. EX1002 ¶¶290-291, 296-297.

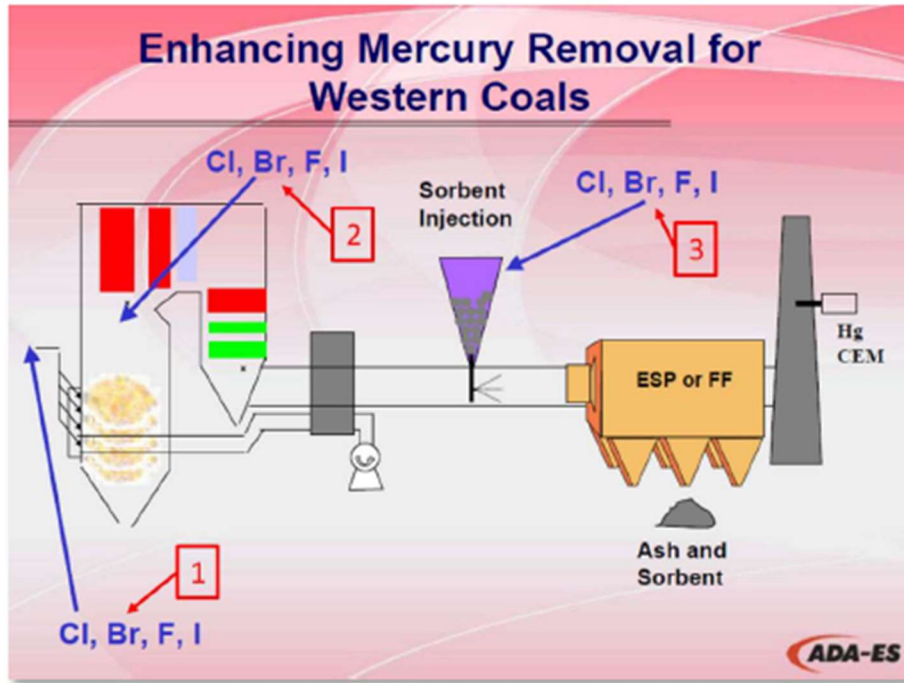
**VIII. GROUND 1-2: OBVIOUSNESS OF THE CHALLENGED CLAIMS**

Ground 1 asserts obviousness of Claims 1-4 and 6-29 over Sjostrom in view of Eckberg. Ground 2 asserts obviousness of Claims 1-4 and 6-29 over Sjostrom in view of Olson-646. EX1002 ¶¶13, 592, 673.

Grounds 1 and 2 rely largely on common disclosure of Sjostrom, with certain claim limitations disclosed by Eckberg (Ground 1) and by Olson-646 (Ground 2). The subsections below discuss the reasons a POSITA would have combined Sjostrom with each secondary reference, followed by disclosures of the specific combinations.

**A. OVERVIEW OF EX1010 (“SJOSTROM”) [GROUND 1-2]**

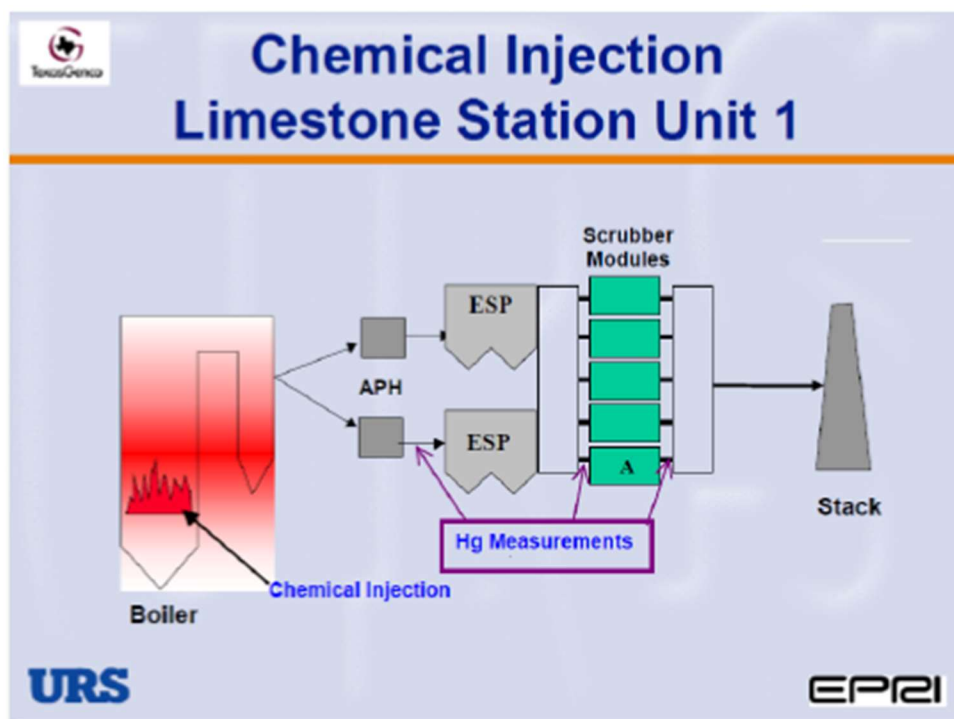
Sjostrom’s title is “Full Scale Evaluations of Mercury Control Technologies with PRB [Powder River Basin] Coals.” EX1010, 1. Sjostrom identifies multiple power plants that used “activated carbon injection to improve mercury control” and identifies the ACI equipment used. EX1010, 10-11. In addition to “Sorbent Injection,” Sjostrom teaches adding halogens (“Cl, Br, F, I”) in three locations:



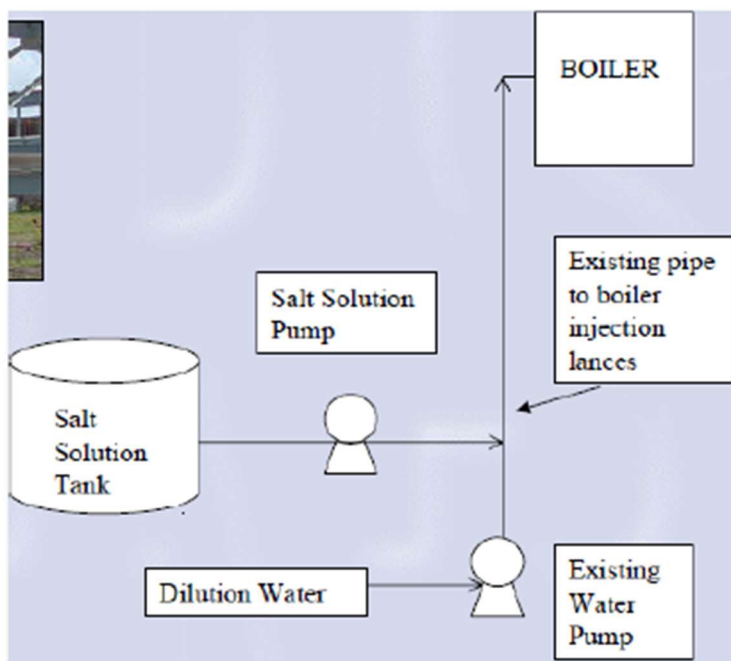
EX1010, 4 (annotations in red). Sjostrom mentions “coal additives” and, as shown at Location 1, teaches adding bromine (Br) to pulverized coal entering the boiler. Sjostrom also teaches adding bromine directly into the combustion chamber at Location 2. Finally, Sjostrom teaches adding bromine to sorbent then added to the flue gas at Location 3. EX1010, 4, 23, 25; EX1002 ¶¶280-286; EX1094 (O’Keefe 2) at 246:21-247:6, 249:6-252:9 (describing Locations 1-3 of Sjostrom).

**B. OVERVIEW OF EX1011 (“ECKBERG”) [GROUND 1]**

Eckberg is entitled “Mercury Control Evaluation of Halogen Injection into a Texas Lignite-Fired Boiler.” EX1011, 1. Eckberg describes “Chemical Injection” of halogens into coal-fired boilers to remove mercury:



EX1011, 5. Eckberg details equipment used for halogen addition:

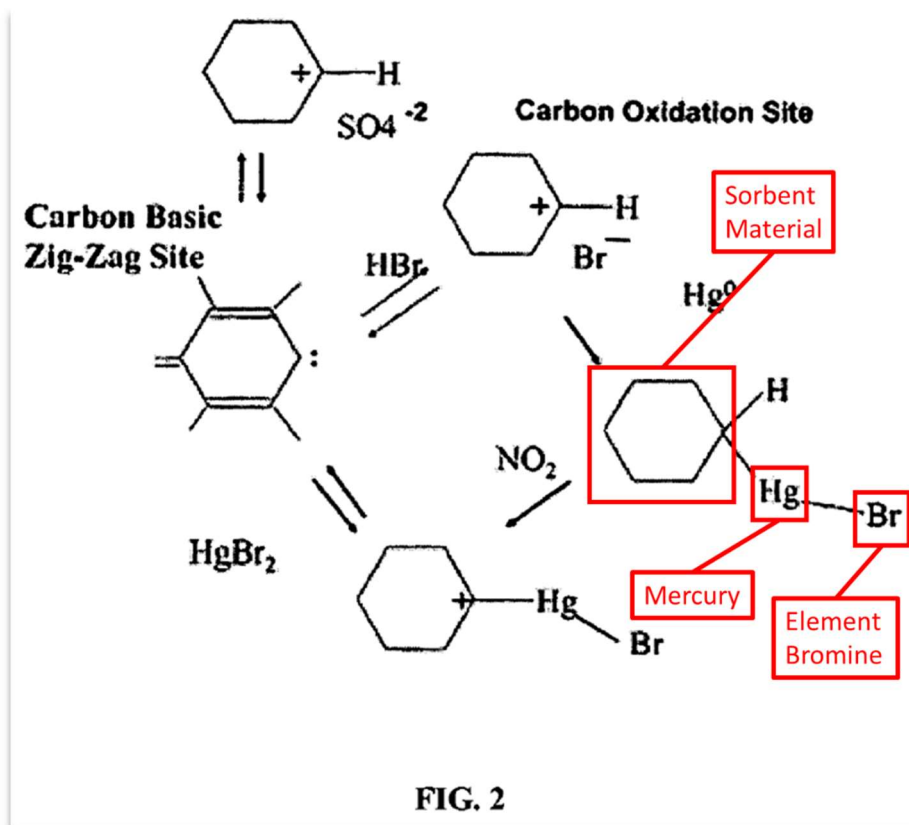


EX1011, 8. The “salt solution” was either “ $\text{CaCl}_2$  (25 wt%)” or calcium bromide, “ $\text{CaBr}_2$  (52 wt%).” EX1011, 9. Eckberg teaches the ratio of bromine to coal, feed

rate of aqueous-salt solution, and ultimate bromine concentration in flue gas.  
EX1011, 9; EX1002 ¶¶287-289.

C. OVERVIEW OF EX1012 (“OLSON-646”) [GROUND 2]

Olson-646 describes a proposed reaction mechanism between bromine, activated carbon, and mercury:



EX1012, Fig. 2 (annotated). Olson-646 explains “hydrogen bromide [HBr] reacts with the unsaturated structure of the activated carbon.” EX1012 ¶[0054]. “Molecular bromine or a bromine compound reacts to form a similar structure, with a positive carbon that is active for oxidizing the mercury with subsequent capture by the sorbent.” EX1012 ¶[0054]. Olson-646 provides typical process conditions

involved when reacting activated carbon with a bromine-containing reagent. EX1002 ¶¶292-295.

**D. ANALOGOUS ART**

Sjostrom, Eckberg, and Olson-646 are analogous art to the '430 Patent, as they are in the same field of endeavor and reasonably pertinent to the problems being faced by the '430 Patent inventors. 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, 1:40-44. The specific problem faced by the inventors of the Challenged Patent was needing “more economical and effective mercury removal technology.” EX1001, 2:35-36; EX1002 ¶¶280, 287, 292.

The field of endeavor of Sjostrom is “Mercury Control Technologies,” and the problem faced was a need to “enhanc[e] mercury removal for western coals.” EX1010, 1, 4. The field of endeavor of Eckberg is “Mercury Control Evaluation of

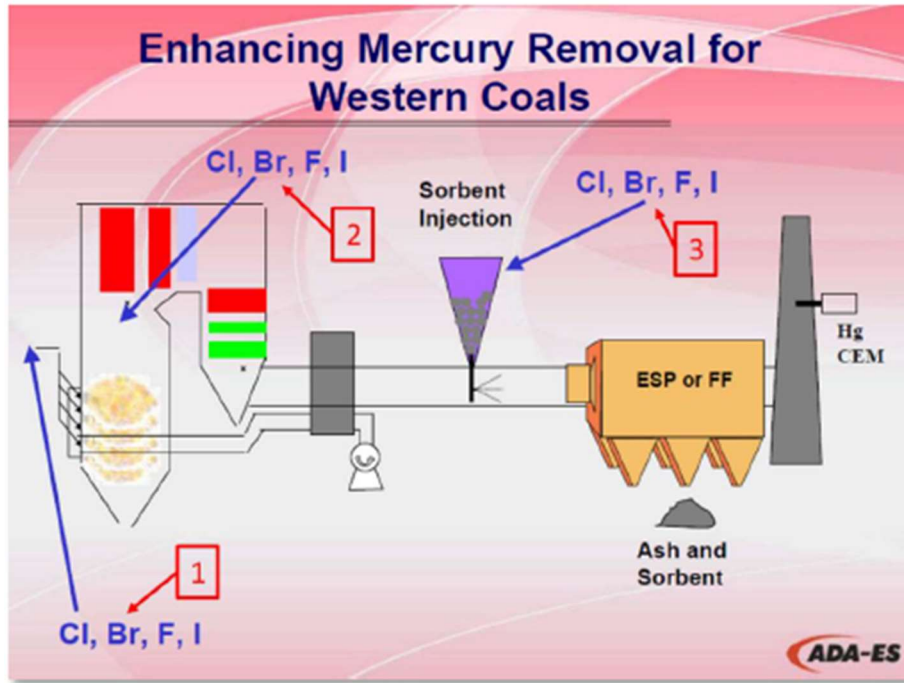
Halogen Injection into a Texas Lignite-Fired Boiler,” and the problem faced was a need to “enhance mercury removal.” EX1011, 1, 3; EX1002 ¶¶280, 287.<sup>5</sup>

**E. OVERVIEW OF THE COMBINATIONS AND REASONS TO COMBINE**

A POSITA would have been motivated to combine Sjostrom with Eckberg (Ground 1) and Sjostrom with Olson-646 (Ground 2), with reasonable expectation of success, because the references are directed towards the same goal (removing mercury from coal-combustion flue gases) and are directed to using known techniques to improve similar devices. Sjostrom describes adding halogens (including Br) and injecting activated-carbon sorbent (“Sorbent Injection”) to remove mercury in coal-fired flue gas. EX1002 ¶¶593, 674.

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<sup>5</sup> Olson-646 (EX1012) and Olson-235 (EX1018) are from the same family as the ’430 Patent, have the same field of endeavor, and are analogous art. EX1002 ¶¶292, 298-300.



EX1010, 4 (annotations in red). The “Br” is used at any/all of three locations. EX1002 ¶¶593, 596, 599, 675. To the extent Sjostrom does not identify the specific chemical containing the “Br” or what quantity to use, the secondary references, Eckberg (Ground 1) and Olson-646 (Ground 2), provide those implementation details and supplement the teachings of Sjostrom. Each combination represents application of a known technique (halogen/halide promotion) to a known device (activated-carbon sorbent) ready for improvement to yield predictable results (increased mercury removal). EX1002 ¶¶593-602, 674-681.

### 1. Ground 1

Eckberg describes a similar system as Sjostrom, including injecting halogens into coal-fired boilers for mercury removal. EX1011, 5, 8. Supplementing the

teachings of Sjostrom, Eckberg discloses which “Br” to use (calcium bromide,  $\text{CaBr}_2$ ) and how much to add. EX1011, 3, 5, 9, 14-15; EX1002 ¶¶594, 596-597.

Further motivation to combine exists because both references were presented consecutively in the same room during the “A3” session at 2005 EUEC.

| Tuesday 01/25/2005 |                                                                           |                                                                                           |                                                                        |
|--------------------|---------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|------------------------------------------------------------------------|
| 7:30 - 9:30        | <b>A3: Mercury - Control</b><br>Offen, Sjostrom, Eckberg, Landreth, Smith | <b>B3: Corporate Strategies</b><br>Wintergreen, Nelson, Tanzer, Drexler, Diamant, Jenkins | <b>C3: NSR</b><br>Harrison, Byers, Hiser, Hoefs, Poffenberger, Traylor |

| Tuesday, 1/25/2005                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| <b>A3 Mercury - Control . . . . . Tuesday; 7:30-9:30am</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |  |
| Chairs: George Offen – EPRI<br>Ram Srivastava – NETL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |  |
| <p><b>a. Mercury Control for Coal-fired Power Plants - An Update of Technology Options</b><br/>– George Offen, Ramsay Chang, Paul Chu and Richard Rhudy - EPRI</p> <p><b>b. Full-Scale Evaluations of Mercury Control Technologies with PRB Coals</b><br/>– Sharon Sjostrom, Travis Starns, Jerry Amrhein, and Jean Bustard - ADA ES, Inc.; Wayne Penrod and Corey Lineville - Sunflower Electric Power Corporation; Rich Phillips and Tom Hart - Ameren; Andrew O'Palko - U.S. DOE-NETL; Ramsay Chang, Ph.D. - EPRI</p> <p><b>c. Mercury Control Evaluation of Halogen Injection into a Texas Lignite-Fired Boiler</b><br/>– Craig Eckberg, John Hudspeth, Mike Meyers and Jim Russell - Texas Genco; Katherine Dombrowski and Carl Richardson - URS Corporation; Ramsay Chang - EPRI</p> |  |

EX1030, 23, 30. Both presentations shared an author (Ramsay Chang) and partner (EPRI). *Id.* A POSITA attending the conference, or reading the materials after receiving the CD, would have understood the two presentations had related, interoperable teachings. EX1002 ¶¶595.

A POSITA would have been motivated to apply the teachings of Eckberg to Sjostrom, because it would have been a simple substitution of one known element (“Br” in Sjostrom) for another known element ( $\text{CaBr}_2$  in Eckberg) to obtain predictable results of more than 70% mercury removal. EX1010, 4; EX1011, 9;

EX1002 ¶¶602. Both references use the same technique (Br addition) to remove mercury from the same types of coal. EX1010, 3-8; EX1011, 2, 6, 9. Both references include similar surrounding equipment (e.g., ESPs and other particulate control devices) to remove the mercury. EX1010, 4; EX1011, 5. In combining Sjostrom with Eckberg, no modifications would be needed to the overall process, equipment, operating conditions, or activated-carbon sorbent used in Sjostrom. EX1002 ¶¶598-603.

## **2. Ground 2**

A POSITA would have looked to Olson-646 to provide certain implementation details regarding the system disclosed in Sjostrom, such as the bromine-containing “Br” to use, the ratios of halogen to activated-carbon sorbent, and other downstream processes. Sjostrom identifies where to inject halogens (e.g., coal, combustion chamber, and/or downstream) and describes the need for powdered activated carbon (PAC). Likewise, Olson-646 describes where to inject PAC and what kind of bromine-containing halogens react with PAC. EX1002 ¶¶674-677.

Sjostrom discloses suitable rates for activated-carbon sorbent injection. EX1010, 10, 11, 16. Sjostrom adds halogens (e.g., “Cl, Br, F, I”) in multiple locations (including those claimed in the ’430 Patent) to increase the effectiveness of activated carbon at removing mercury. EX1010, 4, 16. To the extent Sjostrom does not expressly state which “Br” compounds to use, or their injection rate, Olson-

646 teaches that “the halogen/halide promoter is in gaseous or vapor form” and it comprises “gaseous HBr or Br<sub>2</sub>.” EX1012 ¶[0066]. A POSITA would have been motivated, with reasonable expectation of success, to add HBr or Br<sub>2</sub> into the combustion chamber of Sjostrom (e.g., Location 2), because it would have been a simple substitution of one known element (“Br” in Sjostrom) for another known element (Br<sub>2</sub> or HBr of Olson-646) to improve a known device (activated-carbon sorbent in Sjostrom and Olson-646) and obtain predictable results (e.g., more than 70% mercury removal). A POSITA would also look to Olson-646 to select an appropriate “Br” (e.g., at Location 1 of Sjostrom) that would yield HBr or Br<sub>2</sub> in the mercury-containing gas. EX1012 ¶[0054]. Such selection would have been obvious as a matter of routine implementation. A POSITA would have been motivated to add a bromide compound to the coal, because when it is heated in the furnace, it would react to form the gas-phase promoters called for by Olson-646. EX1002 ¶¶674-677; EX1095 (Olson Dep.), 98:23-100:3, 231:3-9.

Sjostrom teaches removing 70 wt% or more of mercury from the mercury-containing flue gas using halogen-treated activated carbons (KNX+FGD). EX1010, 16. Likewise, Olson-646 discloses “reducing mercury in flue gas comprising providing a sorbent, injecting the sorbent into a mercury-containing flue gas stream, [and] collecting greater than 70 wt-% of the mercury in the flue gas on the sorbent to produce a cleaned flue gas.” EX1012 ¶[0022]. Sjostrom and Olson-

646 use the same commercial activated carbon—Norit Darco FGD sorbent. EX1010, 15, 16; EX1012 ¶¶[0035]-[0040]. A POSITA would have been additionally motivated to combine because Olson-646 describes the chemicals and associated reactions theorized to take place in the system of Sjostrom. EX1010, 16; EX1012 ¶¶[0033], [0073]; EX1002 ¶¶678-680.

The implementation details provided in Olson-646 are simply proposed workable ranges (e.g., bromine:sorbent ratios), which were conventional and known in the art, and would have been selected, or at least tried, as part of routine process optimization by a POSITA applying the teachings of Sjostrom. EX1002 ¶681; *In re Applied Materials, Inc.*, 692 F.3d 1289, 1297-98 (Fed. Cir. 2012).

**F. DISCLOSURE AND TEACHINGS OF THE COMBINATIONS**

**1. Independent Claim 1**

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

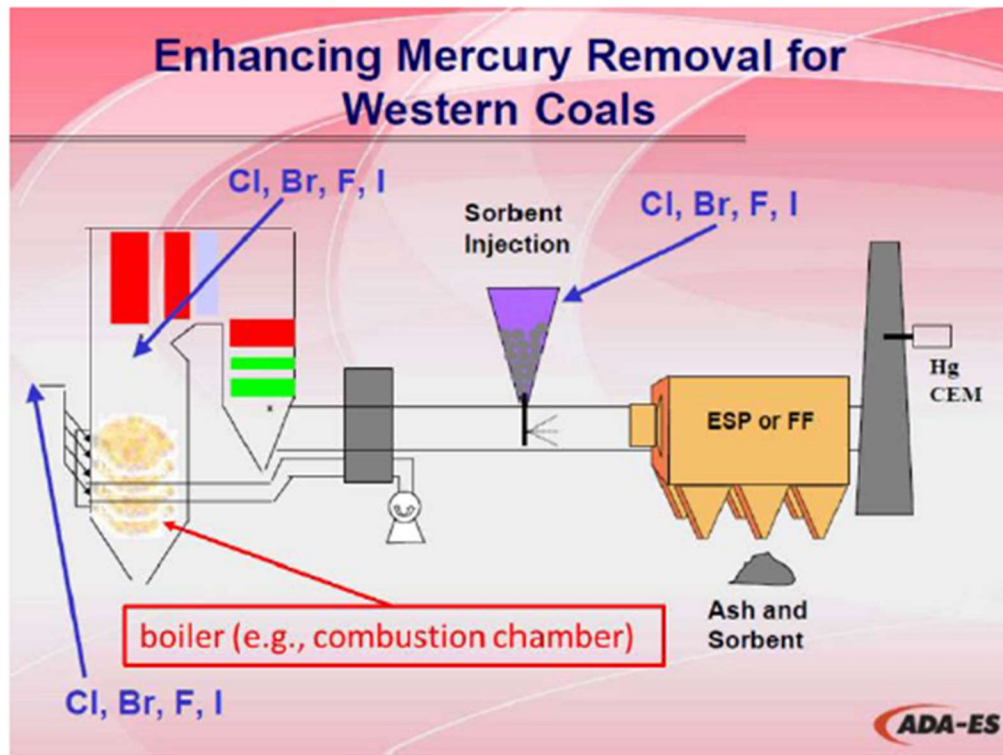
**i. Grounds 1-2**

Sjostrom discloses the preamble: “Full Scale Evaluations of Mercury Control Technologies with PRB Coals.” EX1010, 1. Sjostrom quantifies mercury separation from a mercury-containing gas through graphing “Hg Removal (%)” and “Hg Removal Efficiency (%)” EX1010, 8, 15-17, 20-21; EX1002 ¶¶604, 682-683.

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

**i. Grounds 1-2**

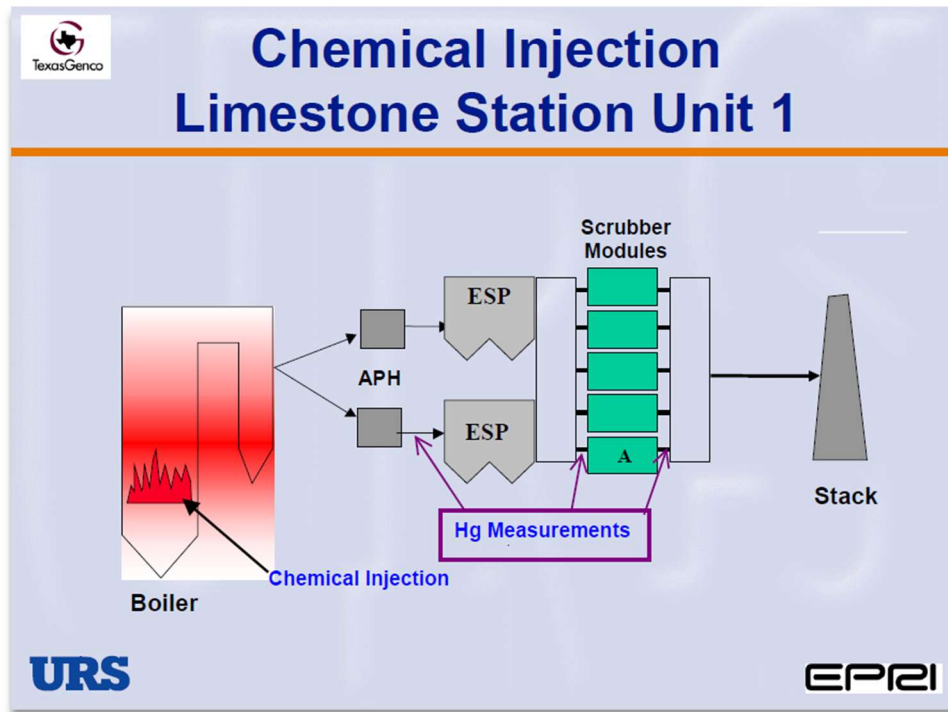
Sjostrom combusts coal in a coal-fired boiler, also referred to as a coal-fired furnace (e.g., combustion chamber):



EX1010, 4. The red annotations point to a well-known representation of a coal-fired boiler/furnace (combustion chamber). Sjostrom combusts PRB (Powder River Basin) coal to generate mercury in the flue gas. EX1010, 3, 12, 18; EX1002 ¶605.

**ii. Ground 1**

This limitation is further obvious over Eckberg. Eckberg labels the combustion chamber “boiler.”



EX1011, 5; EX1002 ¶606.

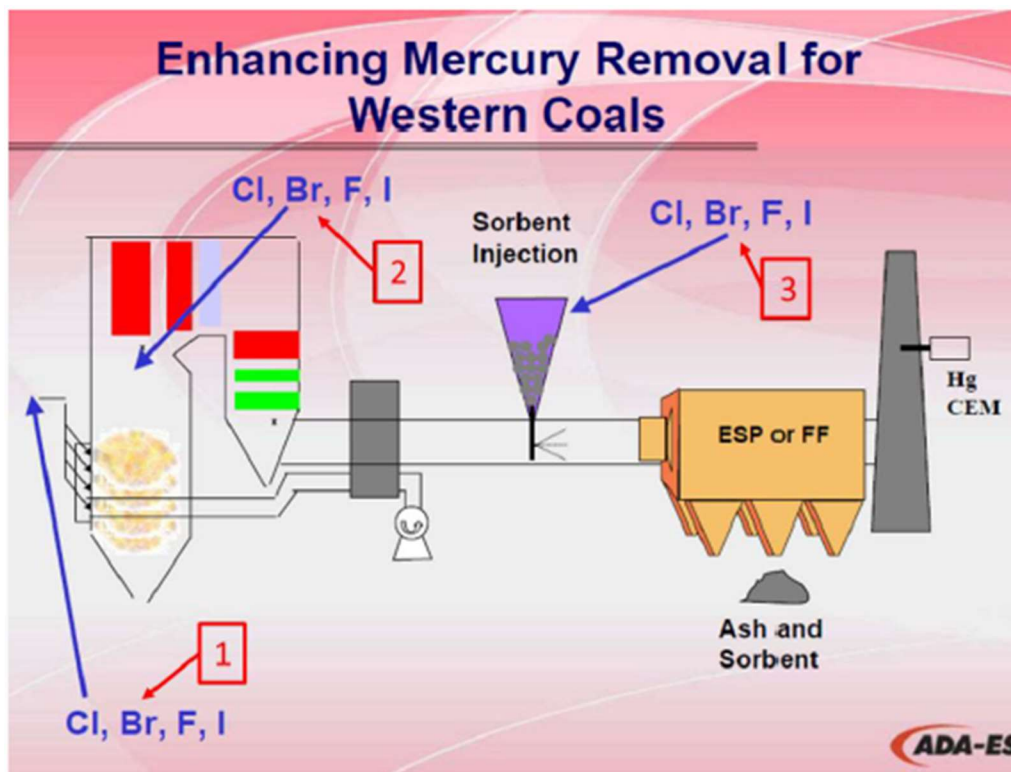
### iii. Ground 2

This limitation is obvious over Olson-646. “[C]ombustion and gasification of fossil fuel such as coal generates flue gas that contains mercury.” EX1012 ¶[0006]; EX1002 ¶684.

- c. **Element 1(b): “wherein the coal comprises an additive comprising Br<sub>2</sub>, HBr, a bromide compound, or a combination thereof, wherein the additive is added to the coal before the coal enters the combustion chamber, or the combustion chamber comprises an additive comprising Br<sub>2</sub>, HBr, a bromide compound, or a combination thereof or a combination thereof;”**

i. **Grounds 1-2**

Sjostrom renders obvious addition of the claimed bromine-containing ingredients to the coal and/or combustion chamber.



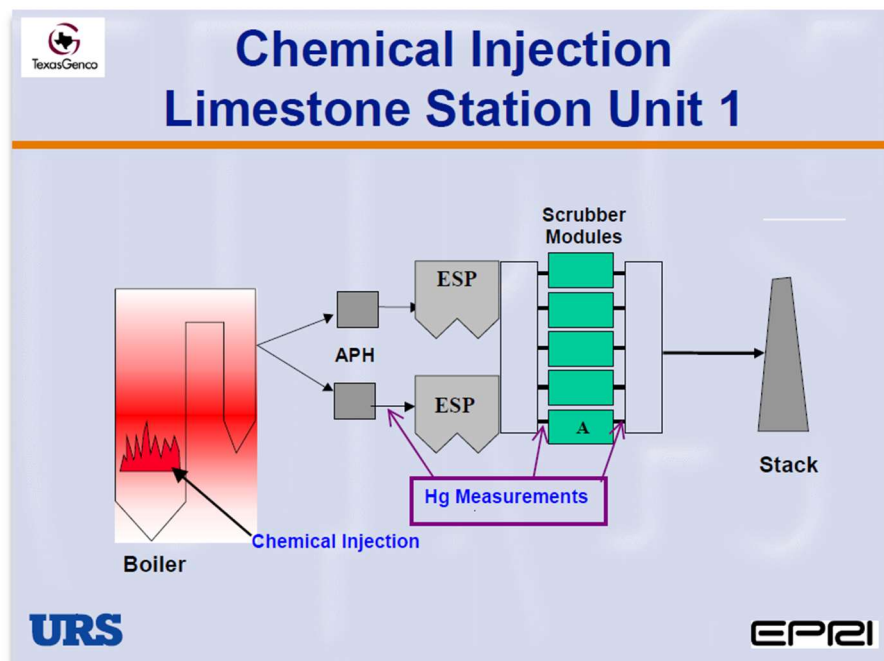
EX1010, 4 (annotations in red). Sjostrom adds “Br” to the combustion chamber at Location 2. A POSITA would understand addition of “Br” at Location 1 would be to the coal itself, because in addition to the figure, Sjostrom discloses “coal

additives.” EX1010, 23, 25; EX1094 (O’Keefe) at 246:21-247:6, 249:6-252:9 (describing Locations 1-3 of Sjostrom); EX1002 ¶¶607-608, 685.

Sjostrom does not identify which chemical to use for “Br,” but it would have been obvious to use widely available materials, including aqueous solutions of a bromide compound like  $\text{CaBr}_2$ . Sjostrom adds “KNX (Alstom Power),” a known aqueous solution of bromide salt for enhancing mercury control. EX1010, 23; EX1002 ¶609.

## ii. Ground 1

Eckberg supplements the teachings of Sjostrom, disclosing the chemical formula for the “Br” of Sjostrom. Eckberg discloses “chemical injection” to the boiler from a “salt solution tank,” an aqueous calcium bromide solution, “ $\text{CaBr}_2$  (52 wt%).” EX1011, 5, 8-9.



EX1011, 5 (“Chemical Injection”). A POSITA would have been motivated to supplement the system of Sjostrom (“Br” at Location 1) with Eckberg (aqueous  $\text{CaBr}_2$  as the “Br”), at least because calcium bromide was widely obtainable and relatively cheap. EX1002 ¶¶610-611.

### iii. Ground 2

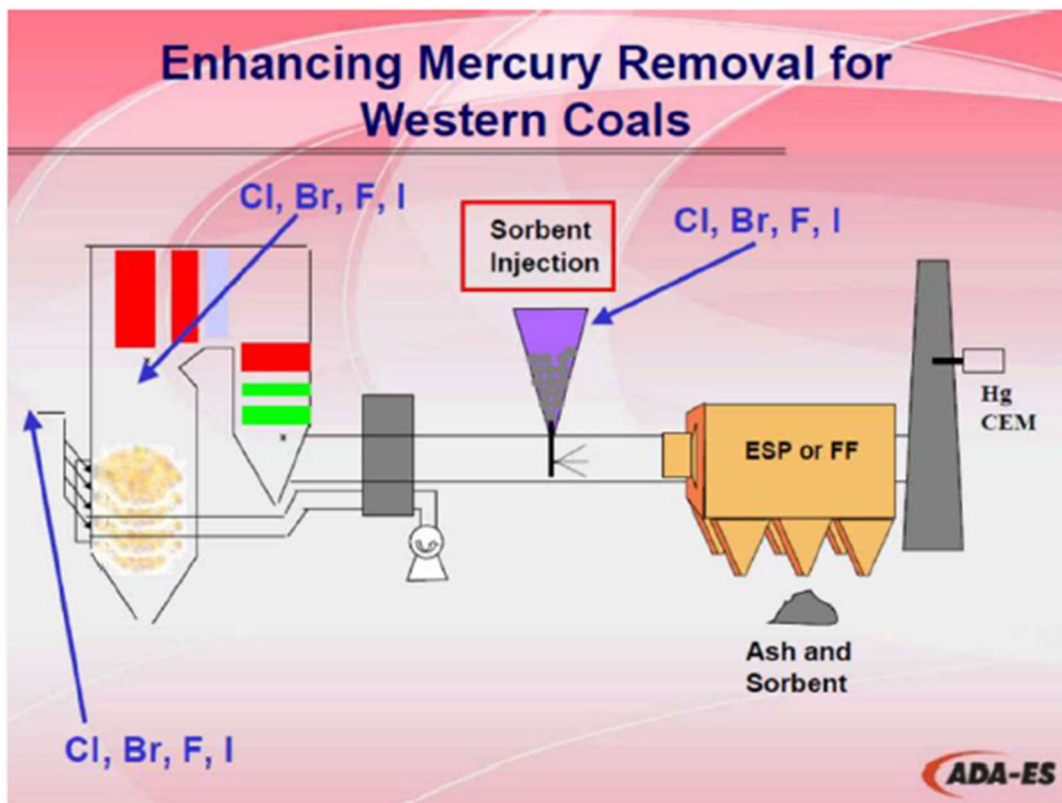
Olson-646 supplements the teachings of Sjostrom, describing “Br”-containing compounds promoting activated-carbon sorbents. Olson-646 “provides a cost-effective way to capture pollutants by utilizing exceptionally reactive halogen/halide promoted carbon sorbents using a bromide (or other halogen/halide) treatment of the carbon, that capture mercury via mercury-sorbent surface reactions.” EX1012 ¶[0043]; EX1002 ¶686.

“[T]he halogen/halide promoter” comprises “gaseous HBr or  $\text{Br}_2$ .” EX1012 ¶[0066]. A POSITA would have been motivated to add a bromide compound to the coal and/or the combustion chamber, because when heated in the furnace, it would react to form the gas-phase promoters called for by Olson-646. EX1002 ¶686; EX1095 (Olson), 98:23-100:3, 231:3-9. A POSITA would have been motivated, with reasonable expectation of success, to apply Olson-646 to the system of Sjostrom because both references teach using a conventional halogen (Br) in a conventional way (promoter) to increase the effectiveness of a conventional sorbent (activated carbon) to capture mercury. EX1002 ¶686.

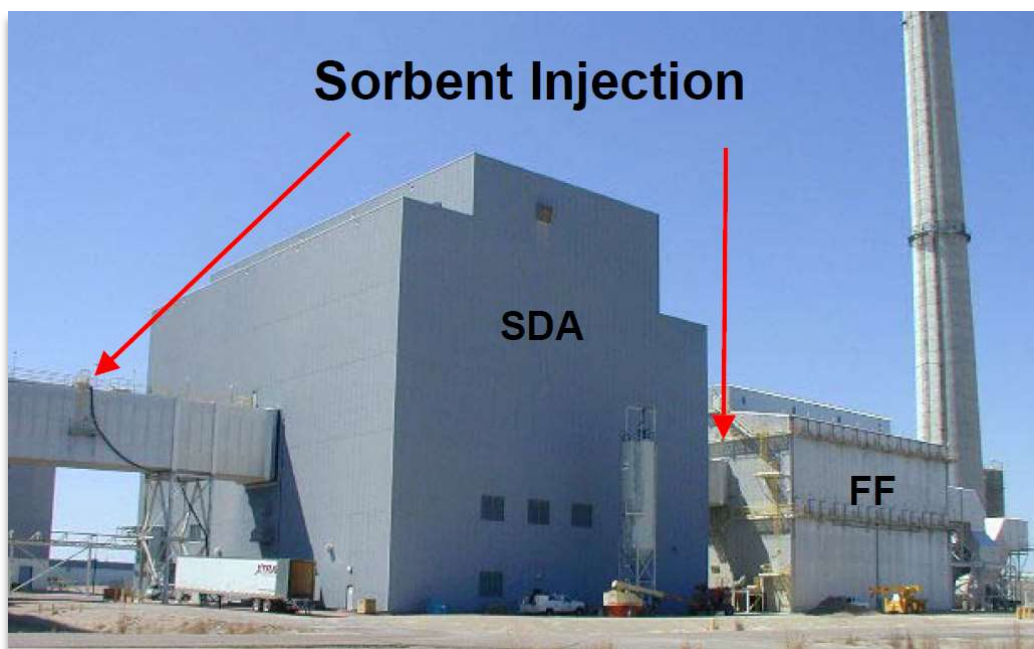
- d. Element 1(c): “injecting a sorbent comprising activated carbon into the mercury-containing gas downstream of the combustion chamber; contacting mercury in the mercury-containing gas with the sorbent; and”

i. Grounds 1-2

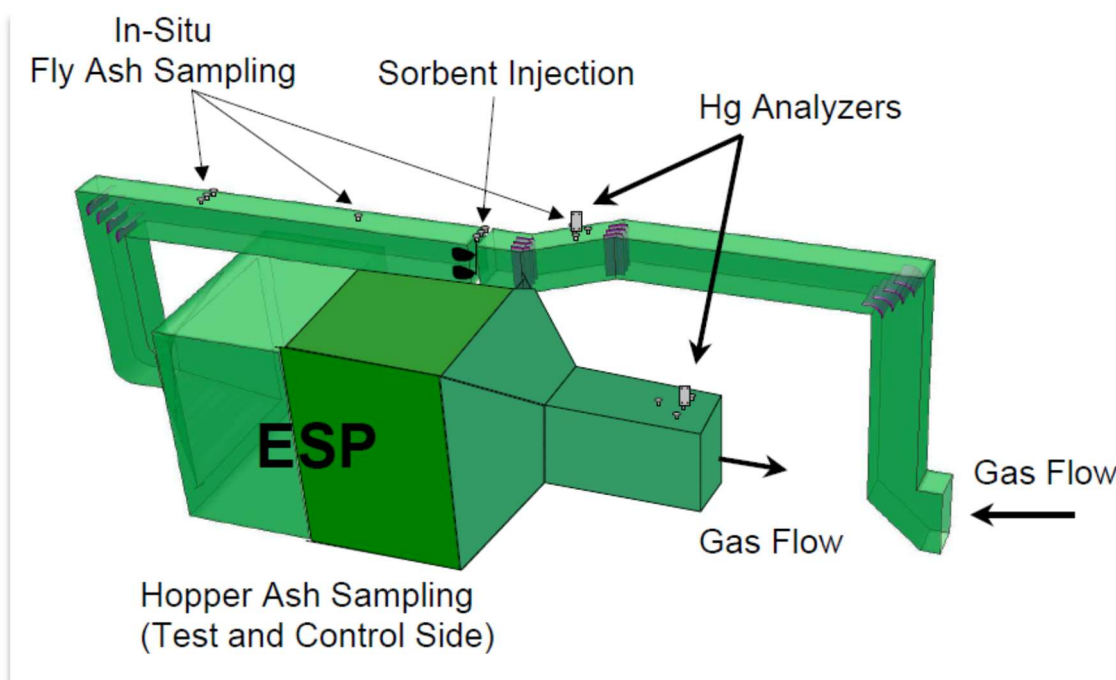
Sjostrom discloses “Sorbent Injection” downstream of the combustion chamber (e.g., boiler/furnace):



EX1010, 4 (annotations in red). Sjostrom again references “Sorbent Injection”:



EX1010, 13. The “sorbent injection” is into mercury-containing gas (“gas flow”):

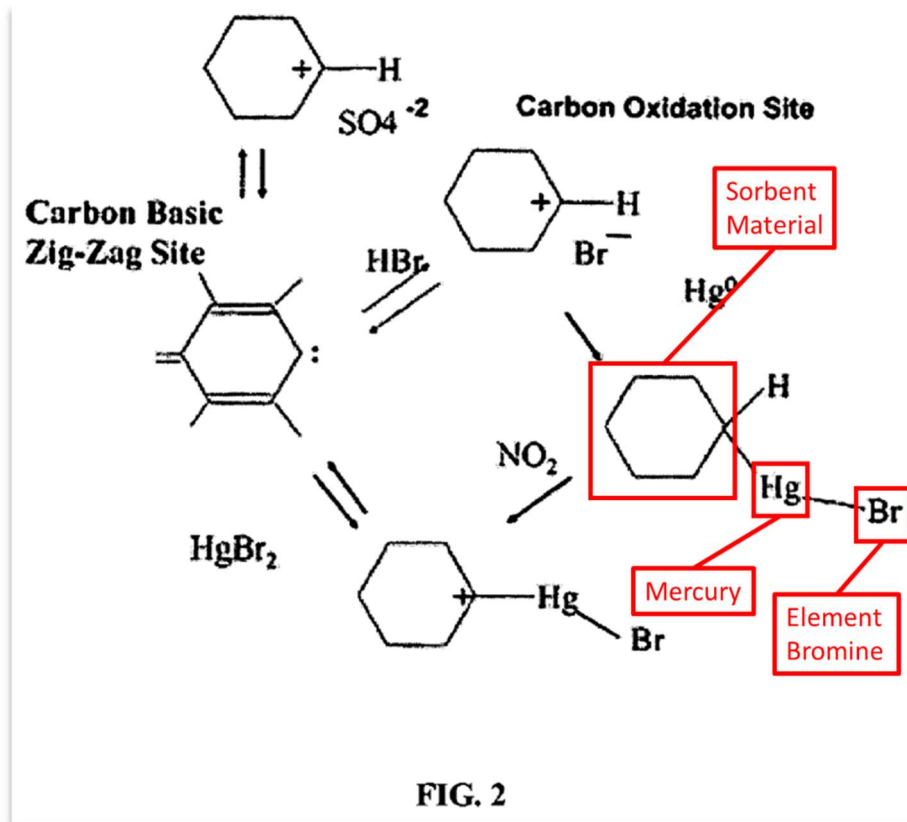


EX1010, 19; *see* EX1010, 32. The “sorbent” is “activated carbon injection to improve mercury control,” abbreviated as “ACI.” EX1010, 10-11. The specific brand of activated carbon is “DARCO FGD.” EX1010, 15-16; EX1002 ¶¶612-613.

Mercury in the flue gas is contacted with activated carbon, where it adsorbs to form a mercury-laden sorbent. Norit DARCO and other activated carbons were referred to as “sorbents,” because they “adsorb” mercury in the gas phase. It was well-known to a POSITA that in an adsorption process, adsorbate (e.g., mercury) from a fluid (e.g., flue gas) adheres to the surface of a sorbent (activated carbon). EX1002 ¶614.

## **ii. Ground 2**

This limitation is obvious over Olson-646. “A promoted activated-carbon sorbent is described that is highly effective for the removal of mercury from flue gas streams.” EX1012, Abstract. Olson-646 describes that activated carbon in the flue gas adsorbs mercury: sorbent “that capture[s] mercury via mercury-sorbent surface reactions.” EX1012 ¶[0043]. A mercury-laden sorbent is shown below:

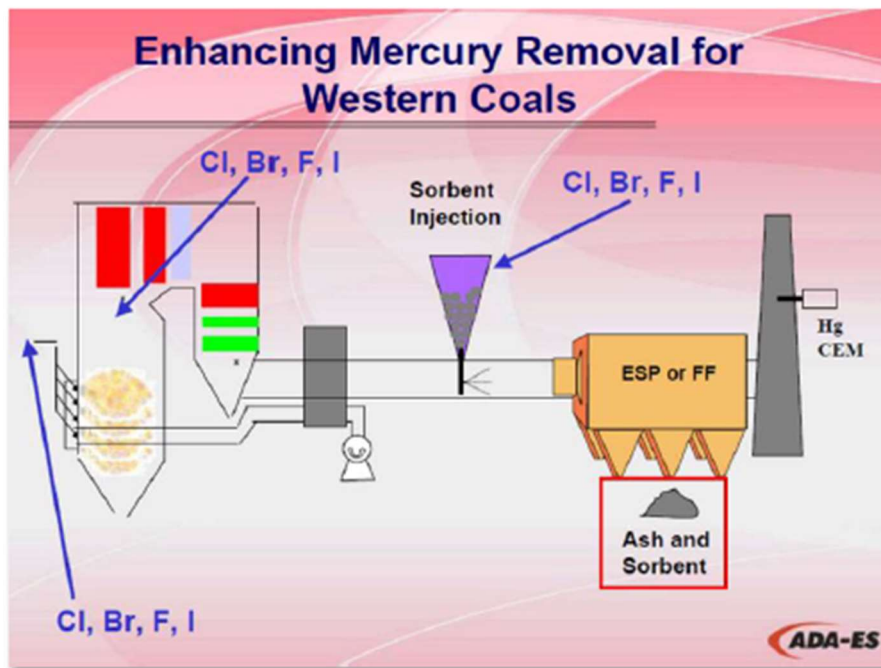


EX1012, Fig. 2 (annotated). Olson-646 describes “AC mercury binding sites,” where mercury contacts sorbent and forms a mercury-laden sorbent. EX1012 ¶¶0128]; EX1002 ¶¶687-689.

**e. Element 1(d): “separating the sorbent contacted with the mercury from the mercury-containing gas.”**

**i. Grounds 1-2**

Sjostrom discloses separating sorbent contacted with mercury (labeled, “Ash and Sorbent”) from flue gas, using an ESP or FF:



EX1010, 4 (annotations in red). ESPs and FFs were well-known particulate control devices to separate particles (e.g., sorbent contacted with mercury) from mercury-containing gas. EX1010, 4; EX1002 ¶¶86-88. As described for Element 1(c), a POSITA would have known, or at least found it obvious, that sorbent is contacted with mercury after being introduced into the mercury-containing gas, and thus the “sorbent” removed by the ESP/FF is sorbent contacted with mercury. EX1002 ¶615.

## ii. Ground 2

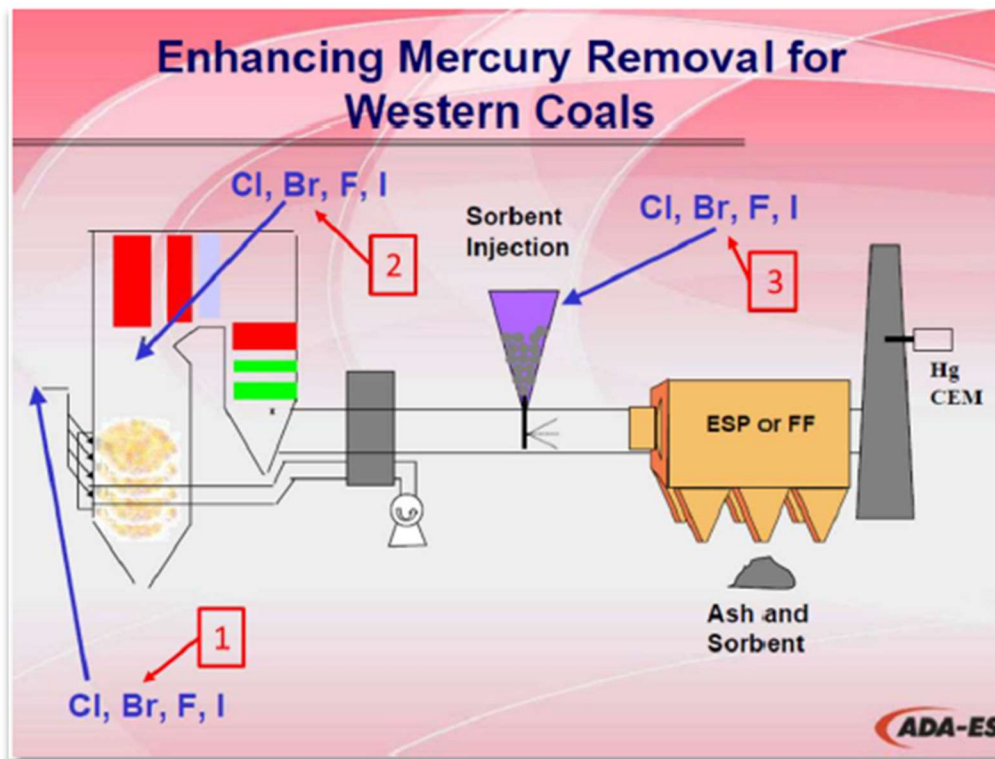
This limitation is further obvious over Olson-646, which discloses sorbent “capture[s] mercury via mercury-sorbent surface reactions.” EX1012 ¶[0043]. That mercury-laden sorbent is removed by a particulate separator (ESP or FF). EX1012 ¶[0059]; EX1002 ¶690.

2. Claims Depending from Claim 1

- a. Claims 2-3: “wherein the [cl. 2-coal; cl. 3-combustion chamber] comprises the additive comprising the  $\text{Br}_2$ ,  $\text{HBr}$ , the bromide compound, or a combination thereof, [cl. 2-wherein the additive is added to the coal before the coal enters the combustion chamber].”

i. Grounds 1-2

These claims are obvious for the reasons discussed for Element 1(b). Regarding Claim 2, Sjostrom applies bromine-containing ingredients upstream to coal at Location 1.



EX1010, 4 (annotated); EX1094 (O’Keefe), 246:21-247:6, 249:6-252:9 (describing Locations 1-3 of Sjostrom). Sjostrom also refers to Location 1 as applying “coal

additives.” EX1010, 23, 25. Regarding Claim 3, the claimed bromine-containing ingredients are present in the combustion chamber after the treated coal is fed into the chamber. Sjostrom also applies bromine-containing ingredients directly to the combustion chamber at Location 2. EX1010, 4; EX1002 ¶¶616-618, 691-694.

**b. Claims 4, 6:**

**4: “wherein the coal is combusted in the combustion chamber at a coal-combustion facility, wherein the additive comprising the Br<sub>2</sub>, HBr, bromide compound, or combination thereof, is added to the coal before the coal enters the combustion chamber, wherein the addition of the additive comprising the Br<sub>2</sub>, HBr, bromide compound, or combination thereof, to the coal is performed at the coal-combustion facility.”**

**6: “wherein the combustion chamber is an electric utility coal combustion chamber.”**

**i. Grounds 1-2**

These claims would have been obvious for the reasons discussed above for Elements 1(a)-1(b) regarding bromine-containing ingredients added to the coal. In addition, the combustion chambers of Sjostrom are located at coal-combustion facilities, such as the “Sunflower Electric Power Corporation Holcomb Station” and the “We Energies Presque Isle Power Plant.” EX1010, 3, 5, 8, 12, 29. Electric-utility plants with coal-fired combustion chambers such as these are examples of coal-combustion facilities at an electric utility. EX1002 ¶¶619-620, 695-696.

**ii. Ground 1**

These claims are further obvious over Eckberg. Eckberg combusts coal in a combustion chamber at “Texas Genco’s Limestone Electric Generating Station,” which is a coal-combustion facility that functions as an electric utility. EX1011, 4-5; EX1002 ¶¶619-620.

**c. Claim 7: “wherein the combustion chamber is a coal combustion furnace.”**

This claim is obvious for the reasons discussed for Elements 1(a)-1(b). The combustion chamber in Sjostrom is a coal-combustion furnace. This limitation is further rendered obvious by Eckberg (Ground 1) and Olson-646 (Ground 2), as each expressly references a furnace. EX1011, 4; EX1012 ¶[0113]; EX1002 ¶¶621, 697.

**d. Claim 8: “wherein the coal comprises a subbituminous coal.”**

**i. Grounds 1-2**

Sjostrom discloses this limitation, combusting “Subbituminous (PRB)” coal. EX1010, 1, 3, 20; EX1002 ¶622.

| Hg Removal with Existing Equipment |                   |                            |
|------------------------------------|-------------------|----------------------------|
| ICR Data                           |                   |                            |
| <u>Controls</u>                    | <u>Bituminous</u> | <u>Subbituminous (PRB)</u> |
| CSESP                              | 46%               | 16%                        |
| FF                                 | 83%               | 72%                        |
| SDA + FF                           | 98%               | 25%                        |

**ii. Ground 1**

This limitation is further obvious over Eckberg. Eckberg uses “PRB coals” (Powder River Basin). EX1011, 2, 6. As recognized by Sjostrom, PRB is a subbituminous coal. EX1002 ¶622.

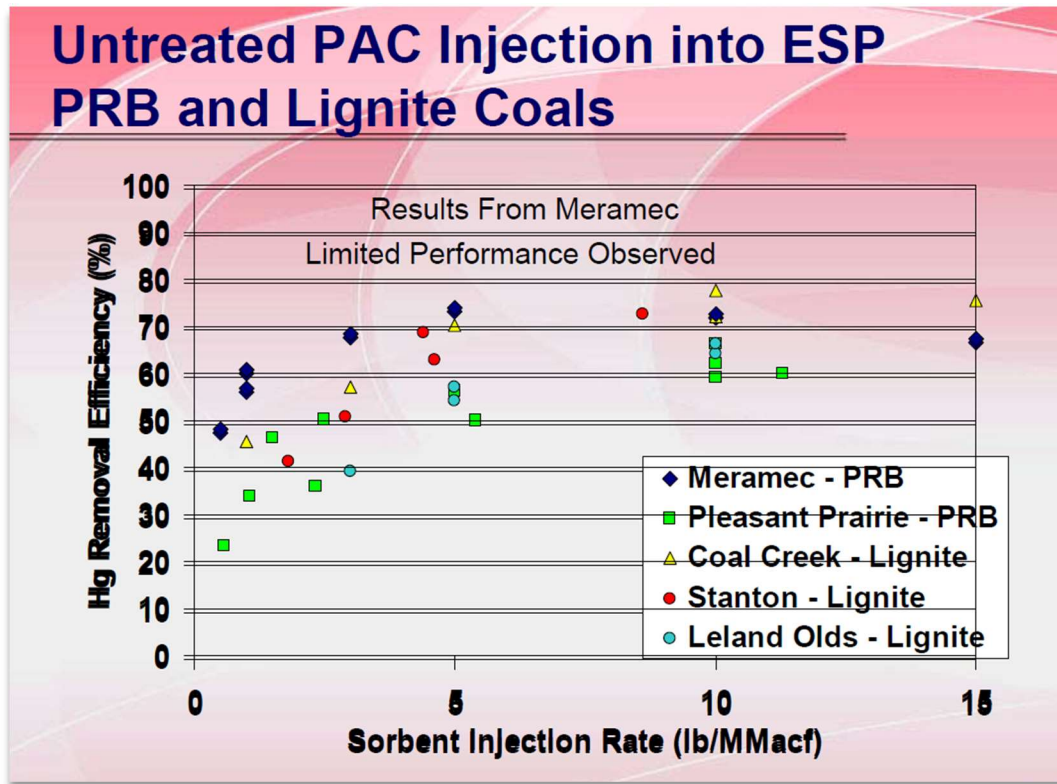
**iii. Ground 2**

This limitation is further obvious over Olson-646. Olson-646 discloses “firing a subbituminous coal[.]” EX1012, ¶[0106]; EX1002 ¶698.

**e. Claim 9: “wherein the coal comprises a lignite coal.”**

**i. Grounds 1-2**

Sjostrom discloses this limitation, describing combusting “lignite” coal. EX1010, 20, 31, 32; EX1002 ¶623.



**ii. Ground 1**

This limitation would be further obvious over Eckberg. Eckberg uses “lignite” coal. EX1011, 1, 2, 3, 6; EX1002 ¶623.

**iii. Ground 2**

This limitation would be further obvious over Olson-646. Olson-646 discloses “firing a Texas lignite to evaluate mercury control.” EX1012 ¶¶[0124], [0127]; EX1002 ¶699.

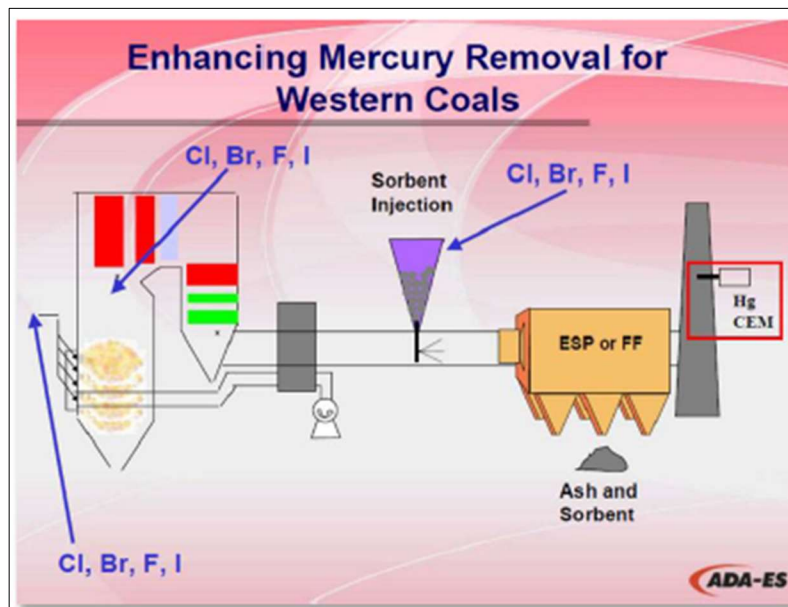
**f. Claims 10-11:**

**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  $\text{Br}_2$ ,  $\text{HBr}$ , the bromide compound, or a combination thereof, added to the coal or the combustion chamber, or a combination thereof”**

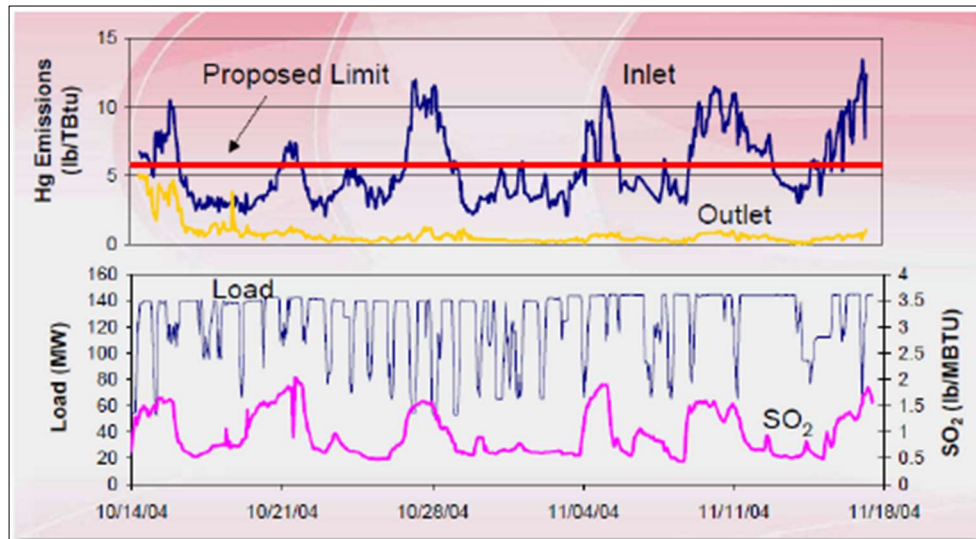
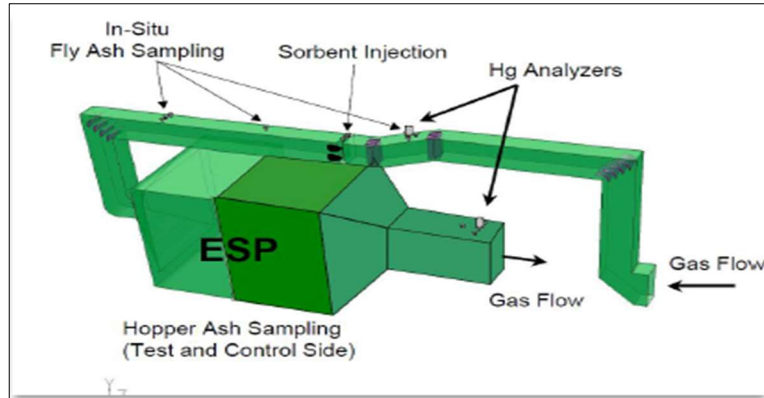
**11: “the measuring of the mercury content comprises continuous measurement.”**

**i. Grounds 1-2**

Sjostrom discloses an “Hg CEM” (mercury continuous emissions monitor) to measure mercury content of the mercury-containing gas:

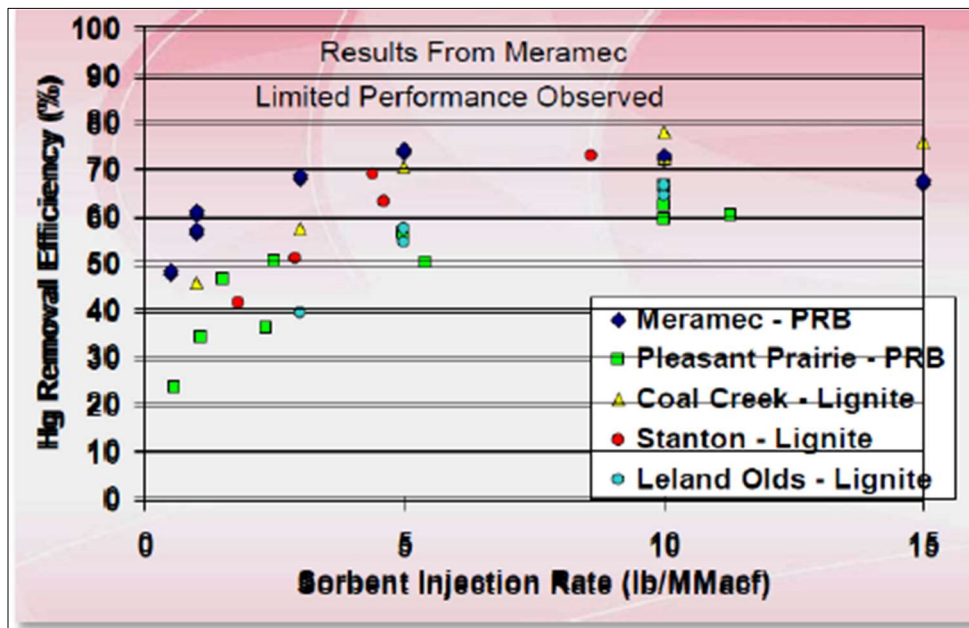
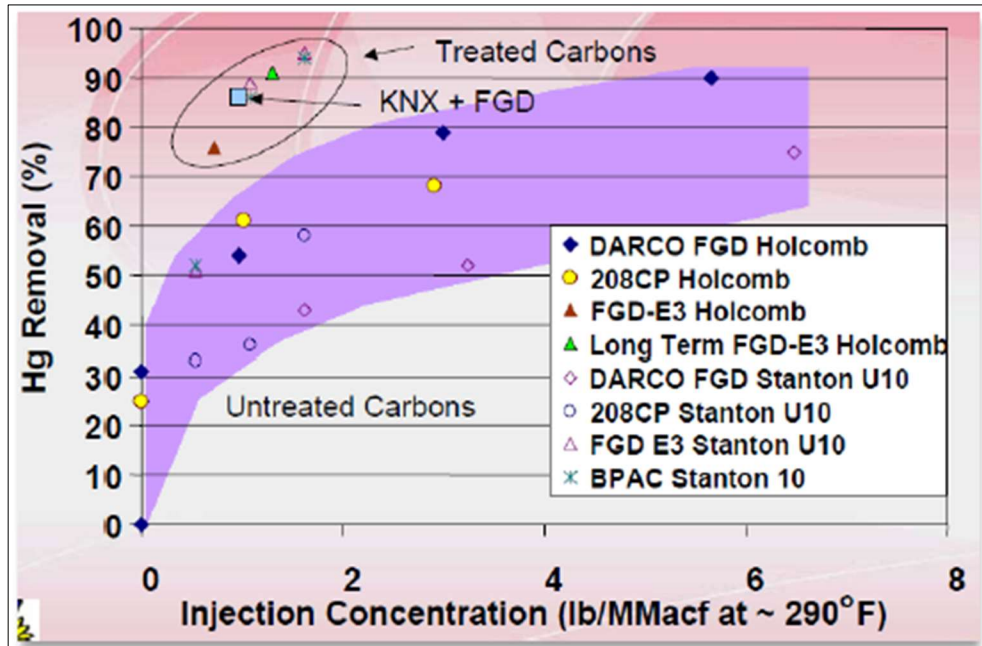


EX1010, 4 (annotations in red). Mercury content is measured at the ESP inlet and outlet (labeled “Hg Analyzers”):



EX1010, 19, 22 (red line in original); EX1002 ¶624.

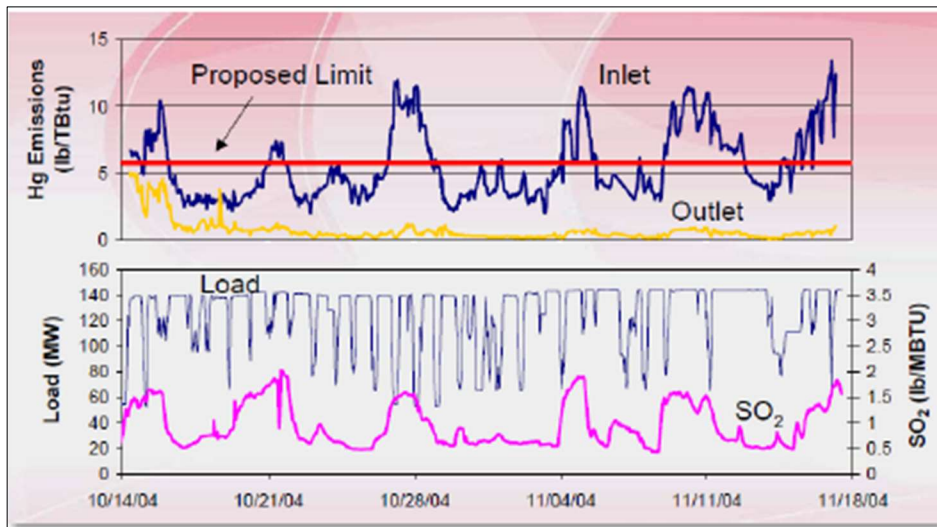
Sjostrom includes charts showing mercury-removal percentages, plotted against ACI rates:



EX1010, 16, 20. These graphs teach how sorbent-injection rate (X-Axis) affects Hg-removal percentage (Y-axis). It would have been obvious to a POSITA to modify the sorbent-injection rate (independent variable) in response to the measured mercury content (dependent variable) to target a specific mercury-removal

percentage, particularly since the mercury is measured continuously in Sjostrom with the CEM. Because activated-carbon sorbent was expensive, a POSITA would have been motivated to use Sjostrom's charts as a guide to control sorbent-injection rate, avoiding injecting unneeded sorbent while reaching desired mercury-removal levels. EX1002 ¶¶625-627.

Sjostrom also includes a chart showing a "Proposed Limit" (red line) on Hg emissions:



EX1010, 22. A POSITA would have been motivated to modify sorbent-injection rate to stay within this "Proposed Limit" while minimizing the amount of activated carbon injected. EX1002 ¶¶624-626.

## ii. Ground 2

These claims are further obvious over Olson-646, which discloses a "Continuous Emission Monitor" ("CEM") and recites "monitoring the mercury

content of the clean flue gas...and using the monitored mercury content...to control the rate of injection of the sorbent.” EX1012 ¶¶[0022], [0060]. Feedback signals and control algorithms are further discussed. EX1012 ¶¶[0056], [0060]-[0061]; EX1002 ¶¶700-704.

A POSITA would have had a reasonable expectation of success in applying the control algorithms of Olson-646, such as modifying sorbent-injection rate in response to mercury measurements, because Sjostrom and Olson-646 use conventional equipment and materials to implement well-known control methods to achieve the same goal (e.g., mercury removal from flue gas). The hardware in Olson-646 involves CEMs (as in Sjostrom), mass-flow controllers, and basic feedback logic, which would have been well-known to a POSITA and were routinely used in the power-generation industry. A POSITA would not have needed to remove anything from the system of Sjostrom. They merely would have had to apply the teachings of Olson-646 to fill in the missing details (e.g., flow controllers and valves) to implement the desired control system. EX1002 ¶¶703-704.

- g. Claim 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 Br<sub>2</sub>, HBr, the bromide compound, or a combination thereof, added to the coal or the combustion chamber, or a combination thereof.”**

Claim 12 is obvious for the reasons discussed for Claims 10-11. EX1002

¶¶628, 705.

- h. Claim 13: “wherein the mercury-containing gas comprises about 1 g to about 30 g of the element bromine per 100 g of the sorbent.”**

This claim is obvious over Sjostrom and Eckberg (Ground 1) and Sjostrom and Olson-646 (Ground 2).

**i. Grounds 1-2**

Claim 13 is merely an attempt to claim a workable range for a conventional halogen (bromine) used in a conventional way (halogens oxidize mercury and promote activated carbon) with a conventional sorbent (activated carbon). Nothing in the '430 Patent 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; EX1002 ¶¶629. PO’s expert in the Delaware Litigation stated that, for Claim 13 and Claim 17, the claimed ratio

would “necessarily” be present. EX1092, 153, 158 (’114 Patent cl. 29, cross-citing the “necessarily present” language of claim 4), 175-176 (’430 cl. 13, 17).

**ii. Ground 2**

Olson-646 includes repeated discussion of this ratio of halogen/halide promoter to sorbent: “the promoter is added at from about 1 to about 30 grams per 100 grams of activated carbon.” EX1012 ¶¶[0023], [0027]; *see* cls. 3, 17, 37, 47; EX1002 ¶¶706-708.

**i. Claim 14: “wherein the sorbent contacted with the mercury comprises the element bromine and mercury.”**

**i. Grounds 1-2**

As discussed for Element 1(c), at least some promoted sorbent (comprising bromine and sorbent) would have formed as a reaction between the sorbent and bromine. A POSITA would have known that the sorbent would also contact and adsorb mercury in the flue gas. Upon adsorption, the mercury would adhere to activated carbon, forming a mercury/sorbent composition. A POSITA would have

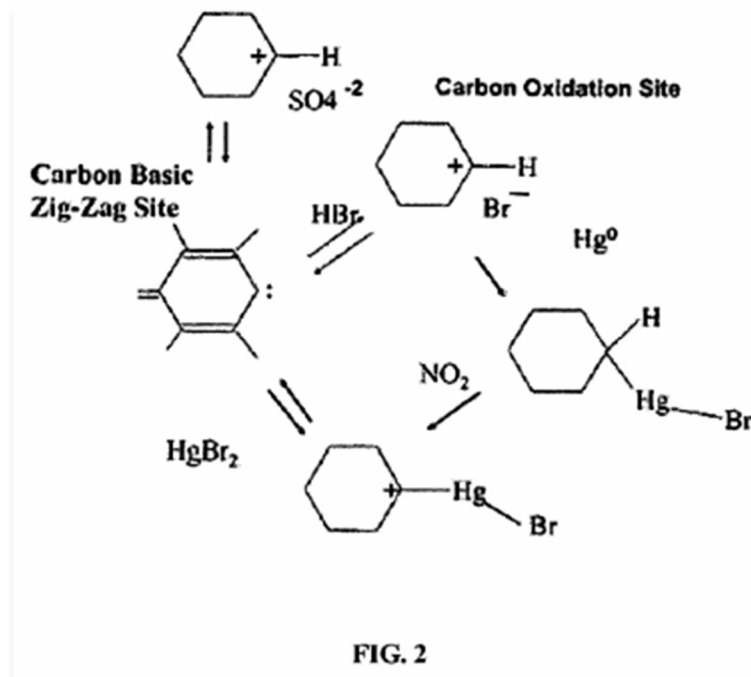
understood that the sorbent then comprises mercury and the element bromine.<sup>6</sup>

EX1002 ¶¶630-634.

## ii. Ground 2

Claim 14 is further obvious over Olson-646. As discussed for Element 1(c),

Figure 2 of Olson-646 identifies a bromine/sorbent/mercury composition.

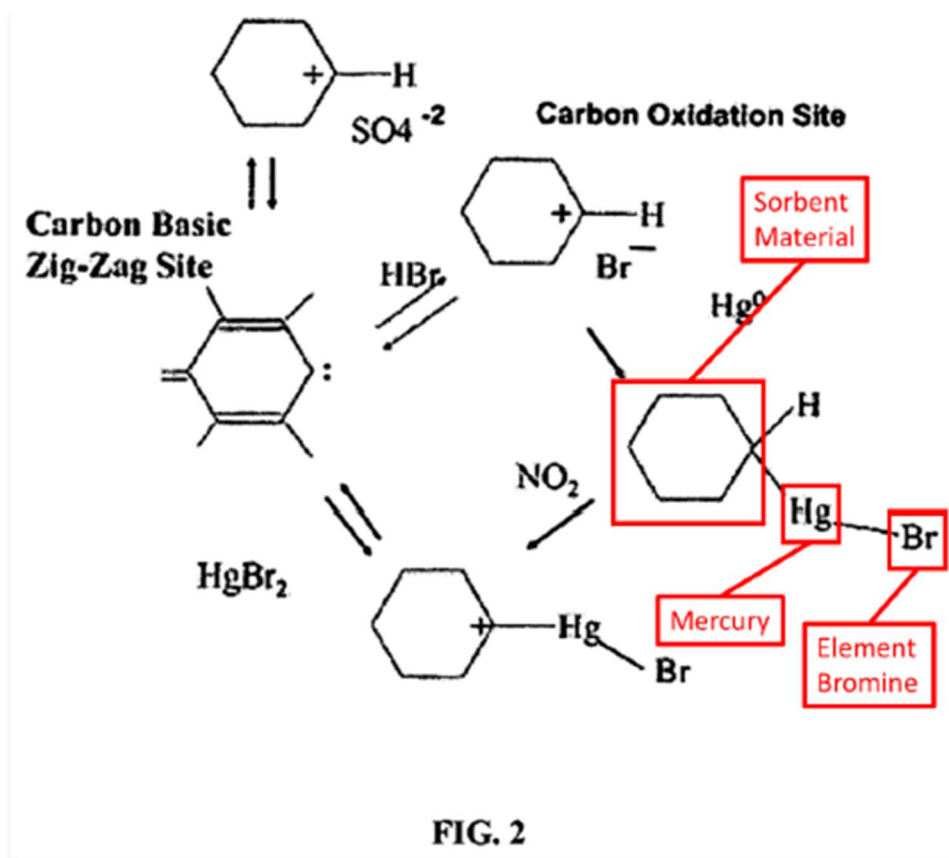


<sup>6</sup> To the extent PO narrowly construes the claim to require the sorbent first contact bromine before contacting mercury, such a read would be unsupported.

Nevertheless, the claim would still be obvious for the reasons discussed *infra*

Claim 20.

EX1012 ¶[0054], Fig. 2. At combustion temperatures found within the boiler, Br injected at Locations 1 and/or 2 of Sjostrom vaporizes and further reacts to form HBr. Olson-646 explains “hydrogen bromide reacts with the unsaturated structure of the activated carbon.” EX1012 ¶[0054]. “Molecular bromine or a bromine compound reacts to form a similar structure.” *Id.* Figure 2 of Olson-646, annotated below, shows the composition includes activated-carbon sorbent, the element bromine, and mercury.

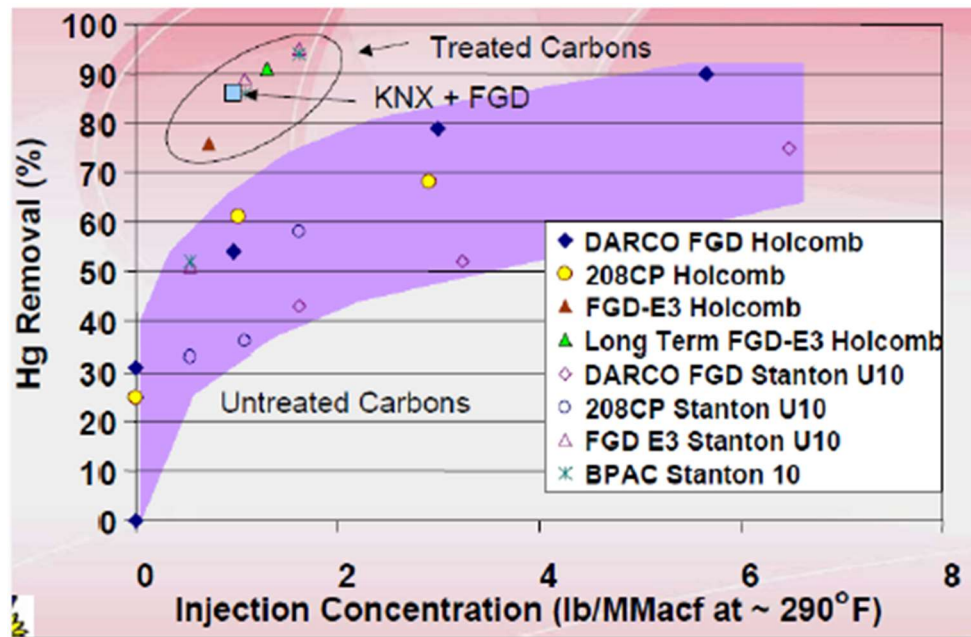


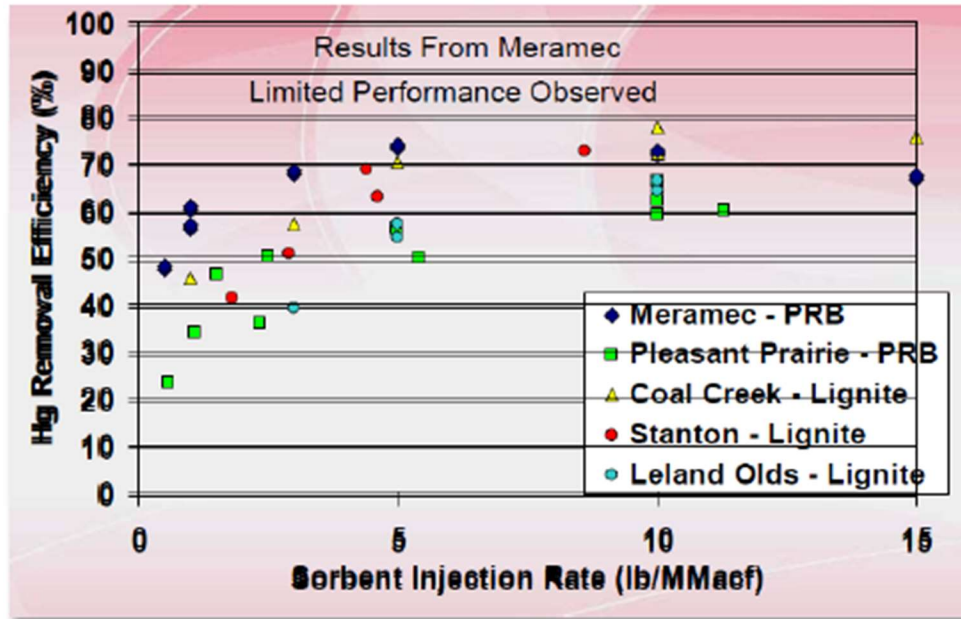
EX1012, Fig. 2 (annotations in red); EX1002 ¶¶709-711.

- j. Claims 15-16: “comprising removing greater than 70 wt % of the mercury in the mercury-containing gas [cl. 16-with the sorbent].”

i. Grounds 1-2

Regarding Claim 15, Sjostrom includes charts showing greater than 90 wt% mercury removal (Y-axis):





EX1010, 16, 20; EX1002 ¶635.

Claim 16 would have been obvious over Sjostrom. In the plant setup of Sjostrom, there is only dry emission-control equipment (e.g., ESP or FF). EX1010, 4. Plants with dry emission-control systems depend on sorbent for mercury removal. It would have been obvious that mercury removal on sorbents alone would meet or exceed 70%, as Sjostrom accomplishes 90% mercury-removal rate. As described *supra* §V.D.3, regulatory authorities had put the industry on notice that 70% mercury removal would be required. Through routine process optimization and experimentation, a POSITA would have adjusted the sorbent-injection rate to meet and exceed (e.g., safety margin) the required 70% removal of mercury. EX1002 ¶¶636-638.

**i. Ground 2**

Olson-646 states the claim language near-verbatim, including: “collecting greater than 70 wt-% of the mercury in the flue gas on the sorbent,” which meets Claims 15-16. EX1012 ¶[0022], cl. 30. EX1002 ¶¶712-714.

**k. Claim 17: “wherein the sorbent in the mercury-containing gas comprises about 1 g to about 30 g of the added Br<sub>2</sub>, HBr, the bromide compound, or a combination thereof, per 100 g of the sorbent.”**

**i. Grounds 1-2**

Claim 17 is obvious for the reasons discussed for Claim 13. PO’s expert treats Claim 17 the same as Claim 13, including arguing the claimed ratios are “necessarily” present. EX1092 (O’Keefe), 153 (’114 Patent cl. 4, ratio is “necessarily present”), 158 (’114 Patent cl. 29, cross-citing the “necessarily present” language of claim 4), 175-176 (’430 cl. 13, 17); EX1002 ¶¶639-642.

**ii. Ground 1**

A POSITA would have understood that the calcium bromide (CaBr<sub>2</sub>) of Eckberg is a bromide compound that, when combusted, forms HBr in the mercury-containing gas.

TexasGenco

## Effect of $\text{CaBr}_2$ Tests

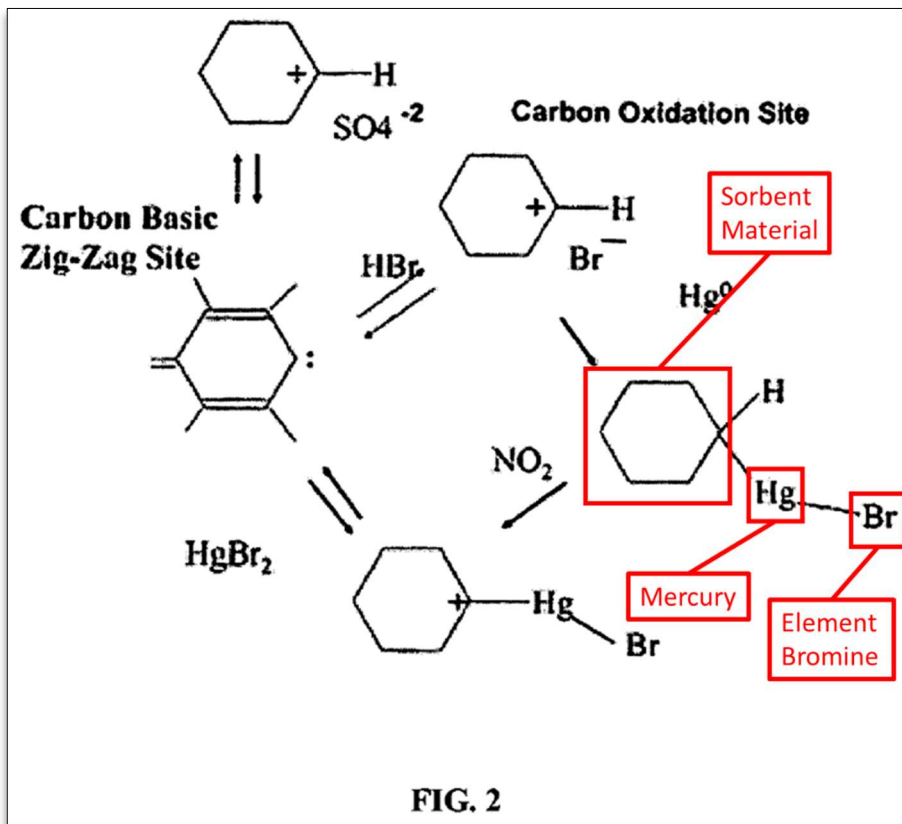
- **Limited, three-hour test of calcium bromide**
- **Injected 0.09 wt% as Br in coal**
  - **48 ppm HBr in flue gas**

EX1011, 9, 14. Lead inventor Dr. Olson admitted that, when bromides are added to coal “and activated carbon is injected downstream of the furnace,” then there would be “in-flight promotion.” EX1095, 231:3-9; *see* 98:23-100:3. Thus, it would have been obvious for the sorbent in the mercury-containing gas to be bound with HBr, including in the claimed ratio. EX1002 ¶641.

### iii. Ground 2

This limitation would be further obvious over Olson-646. Olson-646 includes repeated discussion of this ratio of the halogen or halide promoter (e.g.,  $\text{Br}_2$ , HBr) to the sorbent in the mercury-containing gas. For example, Olson-646 discloses that, in certain embodiments, “the sorbent comprises from about 1 to about 30 grams promoter per 100 grams of base activated carbon.” EX1012 ¶¶[0014], [0018], cls. 3, 17. Olson-646 then provides examples of “the halogen/halide promoter” comprising “gaseous HBr or  $\text{Br}_2$ .” EX1012 ¶[0066], cl. 13. A POSITA would have understood that, at combustion temperatures found within the boiler, any gaseous HBr or  $\text{Br}_2$  added at Locations 1 and/or 2 of Sjostrom, as discussed above for

Element 1(b), would have remained in the vapor phase as it works its way through the combustion chamber. EX1036, 4-53, 5-65; EX1002 ¶715. The “hydrogen bromide reacts with the unsaturated structure of the activated carbon.” EX1012 ¶[0054]. This is shown below:



EX1012, Fig. 2 (annotated); *see* EX1012 ¶[0054] (“[m]olecular bromine or a bromine compound reacts to form a similar structure”). Thus, under the chemical proposed by Olson-646, the sorbent in the mercury-containing gas comprises about 1g to about 30g of  $\text{Br}_2$  or  $\text{HBr}$  per 100g of the sorbent. As described above for Claim 1, a POSITA would have been motivated, with a reasonable chance of success, to

apply the teachings of Olson-646 (i.e., injection of HBr or Br<sub>2</sub>) to Sjostrom's system.  
EX1002 ¶715.

**I. Claim 18: “wherein the Br<sub>2</sub>, HBr, or the bromide compound is contacted with the sorbent in vapor form, gaseous form, liquid form, or in an organic solvent.”**

**i. Grounds 1-2**

As described for Element 1(b), a POSITA would have found it obvious that the “Br” of Sjostrom would have included a bromide compound (e.g., CaBr<sub>2</sub>). At combustion temperatures, the aqueous-salt solution vaporizes and leaves the boiler as vapor-phase HBr. A POSITA would have known vapor-phase HBr would remain in gaseous form when contacting the injected sorbent in the mercury-containing flue gas. The boiling point of Br<sub>2</sub> is 58.8°C and HBr is -66.38°C, each well below the temperature of the mercury-containing flue gas. EX1036, 4-53, 4-65; EX1002 ¶¶643-646; EX1092, 154 ('114 Patent cl. 7), 170 (same analysis for '517 cl. 7), 176 (same analysis for '430).

**ii. Ground 1**

Eckberg teaches “chemical injection,” specifically “CaBr<sub>2</sub> (52 wt%),” to the boiler. EX1011, 5, 9. Eckberg also confirms that, when calcium bromide (CaBr<sub>2</sub>) is combusted, vapor-phase HBr is formed:

TexasGenco

## Effect of $\text{CaBr}_2$ Tests

- Limited, three-hour test of calcium bromide
- Injected 0.09 wt% as Br in coal
  - 48 ppm HBr in flue gas

EX1011, 14; EX1002 ¶¶645-646.

### iii. Ground 2

Olson-646 also teaches “the halogen/halide promoter is in gaseous or vapor form” that comprises “gaseous HBr or  $\text{Br}_2$ .” EX1012 ¶[0066]. While Olson-646 does not disclose adding HBr or  $\text{Br}_2$  to coal, a POSITA would have looked to Olson-646 to identify the effectiveness of HBr and  $\text{Br}_2$  in downstream promotion of activated carbon. EX1002 ¶716.

### m. Claim 19: “wherein the activated carbon comprises powdered activated carbon, granular activated carbon, or a combination thereof.”

Sjostrom discloses use of “PAC” (Powdered Activated Carbon) sorbents. EX1010, 10, 20, 34. Sjostrom also discloses injection of “DARCO FGD,” a well-known brand of PAC. EX1010, 15, 16; EX1002 ¶¶134, 141, 647, 717.

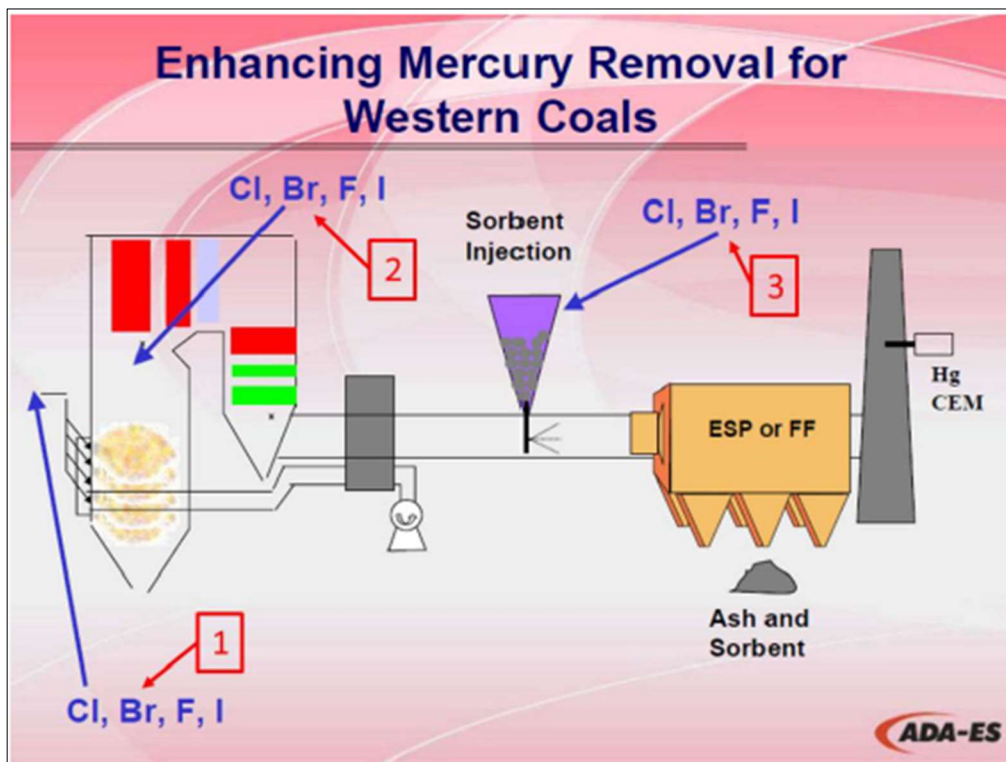
**n. Claims 20-21:**

**20: “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 the injection of the sorbent into the mercury-containing gas.”**

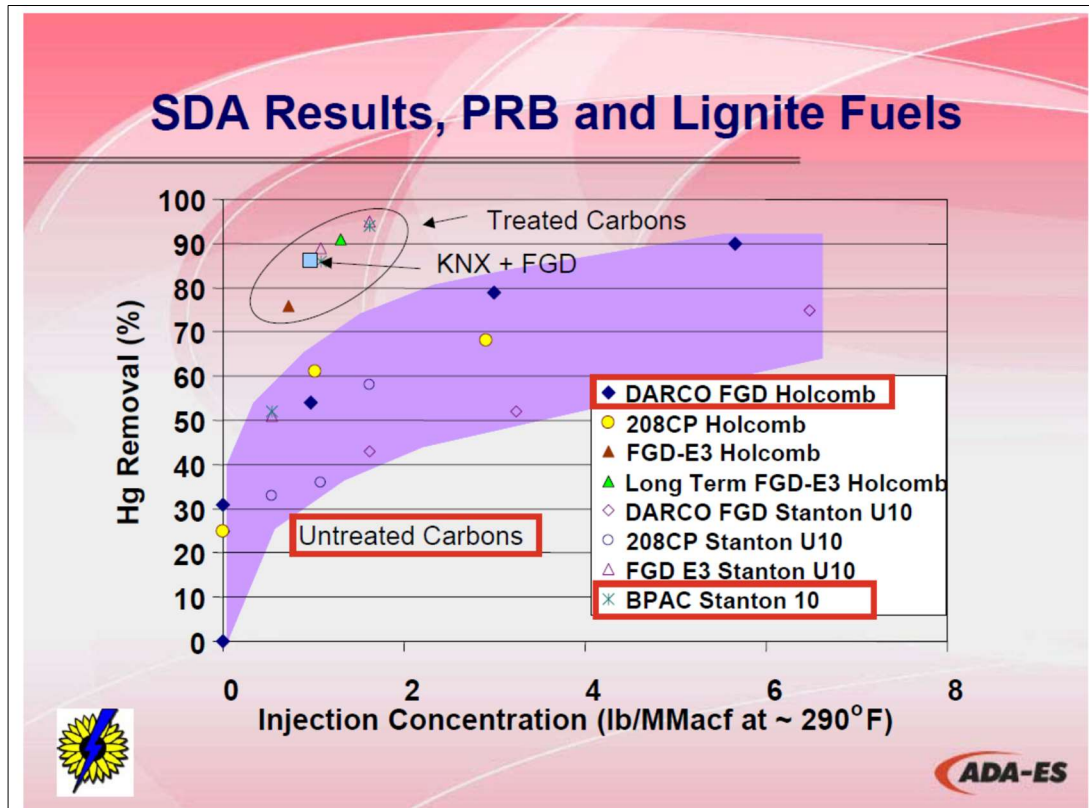
**21: “wherein the sorbent injected into the mercury-containing gas is free of contact with a halogen or halide promoter prior to injection of the sorbent into the mercury-containing gas.”**

**i. Grounds 1-2 (Claims 20-21)**

As described for Element 1(c), Sjostrom discloses activated-carbon “sorbent injection.”



EX1010, 4 (halogen injection annotated red). Sjostrom injects two types of sorbents:  
(i) “untreated carbons” (e.g., Norit “Darco FGD”); and (ii) pre-halogenated carbon, such as “BPAC” (Brominated Powdered Activated Carbon).



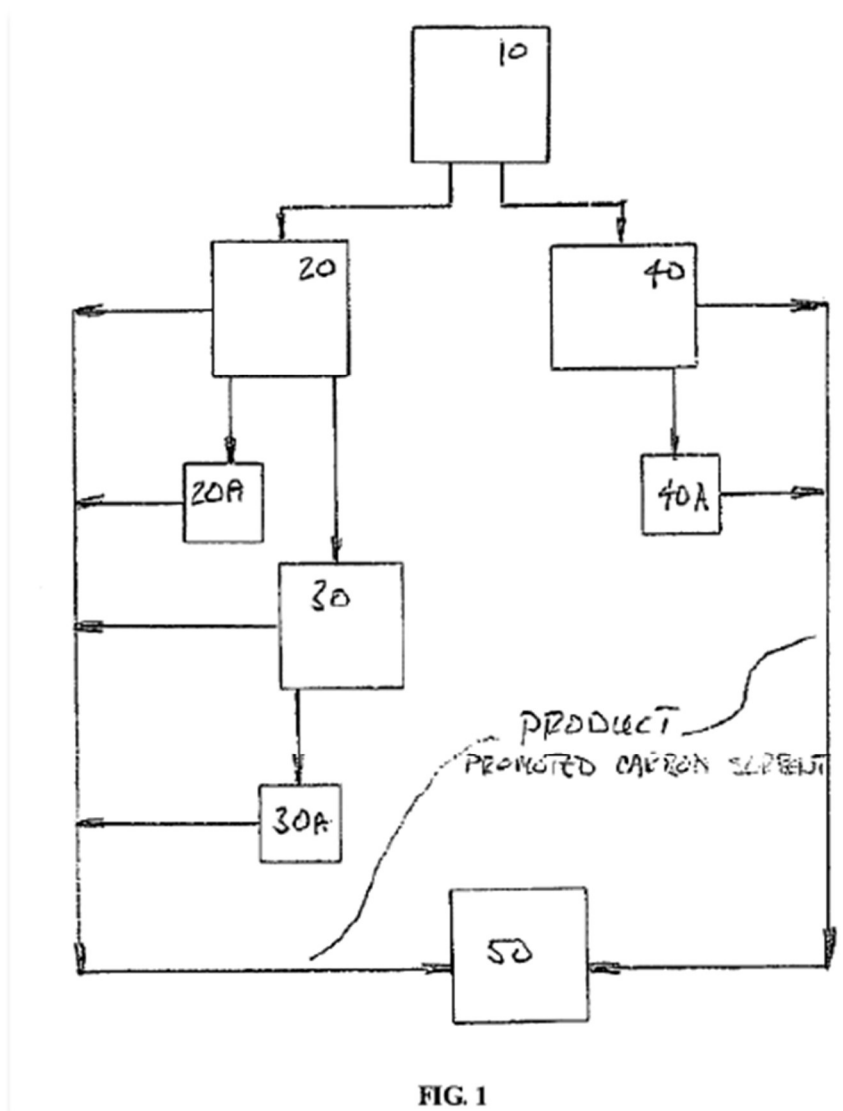
EX1010, 16 (annotated). Regarding Claim 21, a POSITA would have understood that “untreated” carbons are substantially free of halogen/halide promotion. “Darco FGD,” manufactured by Norit, was a well-known PAC brand free of halogens. EX1002 ¶¶134, 141, 650; EX1048, 1169 (chemical analysis of Norit Darco). Untreated activated carbon (e.g., Darco, solid blue diamonds) obtained 70% mercury removal. When adding KNX (aqueous solution of bromide salt at Locations 1 and/or 2) to promote the Darco FGD, the mercury-removal results are even better (point

labeled “KNX+FGD”). Accordingly, it would have been obvious to use untreated PAC (Darco FGD), which would have been cheaper than pre-brominating the activated carbon (the “BPAC” datapoint above). Given the flexibility of additional locations in Sjostrom, a POSITA would have been motivated to add “Br” at Locations 1 and/or 2 while injecting untreated activated-carbon sorbent to the flue gas downstream of the boiler (e.g., Location 3). A POSITA would have used such a configuration when cost was the driving factor in designing a mercury-removal system. Specifically, a POSITA would have understood that “Br” (Locations 1 and/or 2) and untreated carbon (Location 3) would be cheaper than using a pre-brominated activated-carbon sorbent. EX1002 ¶¶650, 721.

Regarding Claim 20, Sjostrom teaches pre-brominating (or pre-chlorinating) activated carbon at Location 3 (e.g., “BPAC”). EX1010, 4, 16. 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 total mercury emissions. EX1002 ¶¶69-71. In such situations, a POSITA would have been motivated to add, or at least try adding, “Br” at Locations 1 and/or 2 while injecting a treated activated-carbon sorbent at Location 3. A POSITA would have known this approach would increase overall mercury capture, albeit at increased cost. EX1002 ¶¶648-649.

**ii. Ground 2 (Claim 20)**

Claim 20 would have also been obvious over Olson-646. Sjostrom and Olson-646 use the same brand of commercial sorbent—Norit Darco FGD. EX1010, 15, 16; EX1012 ¶[0095]. Similar to Location 3 of Sjostrom, Olson-646 teaches first promoting a base activated carbon (item 10) with a bromine promoter (items 20, 40), and then injecting the “promoted carbon sorbent” into mercury-containing flue gas (item 50).



EX1012, Fig. 1, ¶¶[0045]-[0048]. A POSITA would have been motivated to add Br at Locations 1 and/or 2 (as taught by Sjostrom) and add pre-brominated sorbent (as taught by both Sjostrom and Olson-646). EX1002 ¶¶718-720.

**o. Claim 22: “wherein the combustion chamber comprises a boiler.”**

As described for Element 1(a), the combustion chamber in Sjostrom has a boiler. EX1002 ¶¶651, 722.

**p. Claim 23: “wherein the mercury-containing gas is a flue gas.”**

Sjostrom discloses sampling mercury content in the “Flue Gas Flow,” further demonstrating that the mercury-containing gas is a flue gas. EX1010, 19; EX1002 ¶¶652, 723.

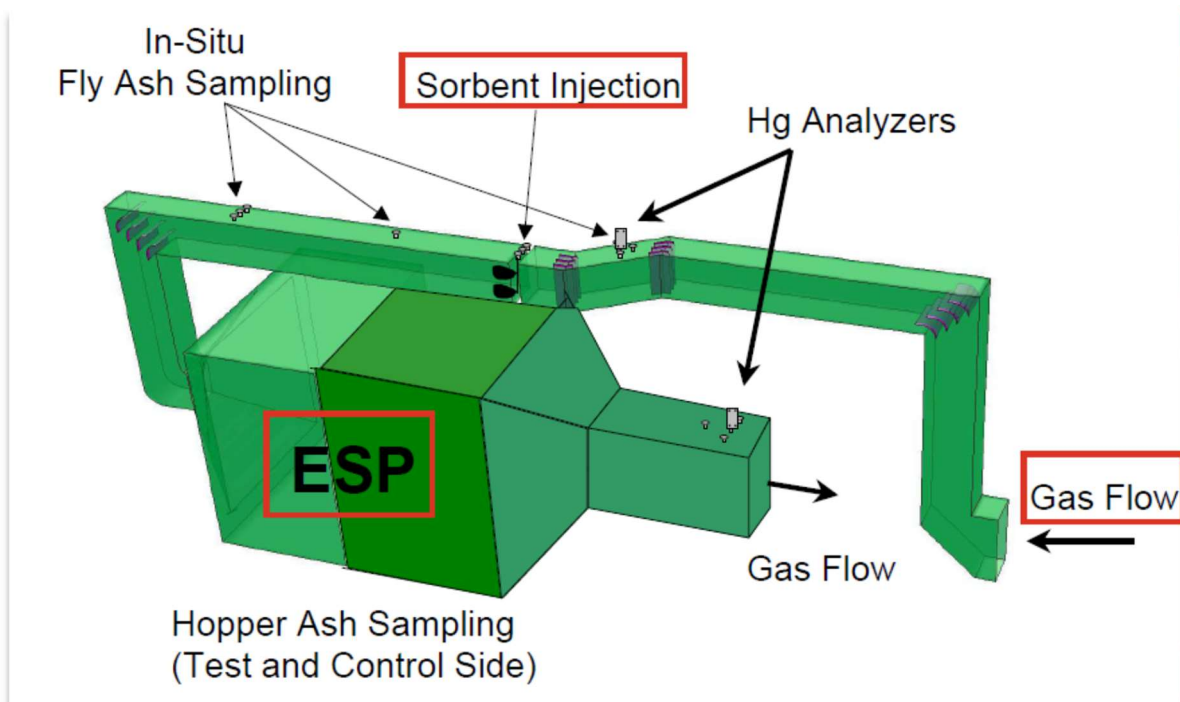
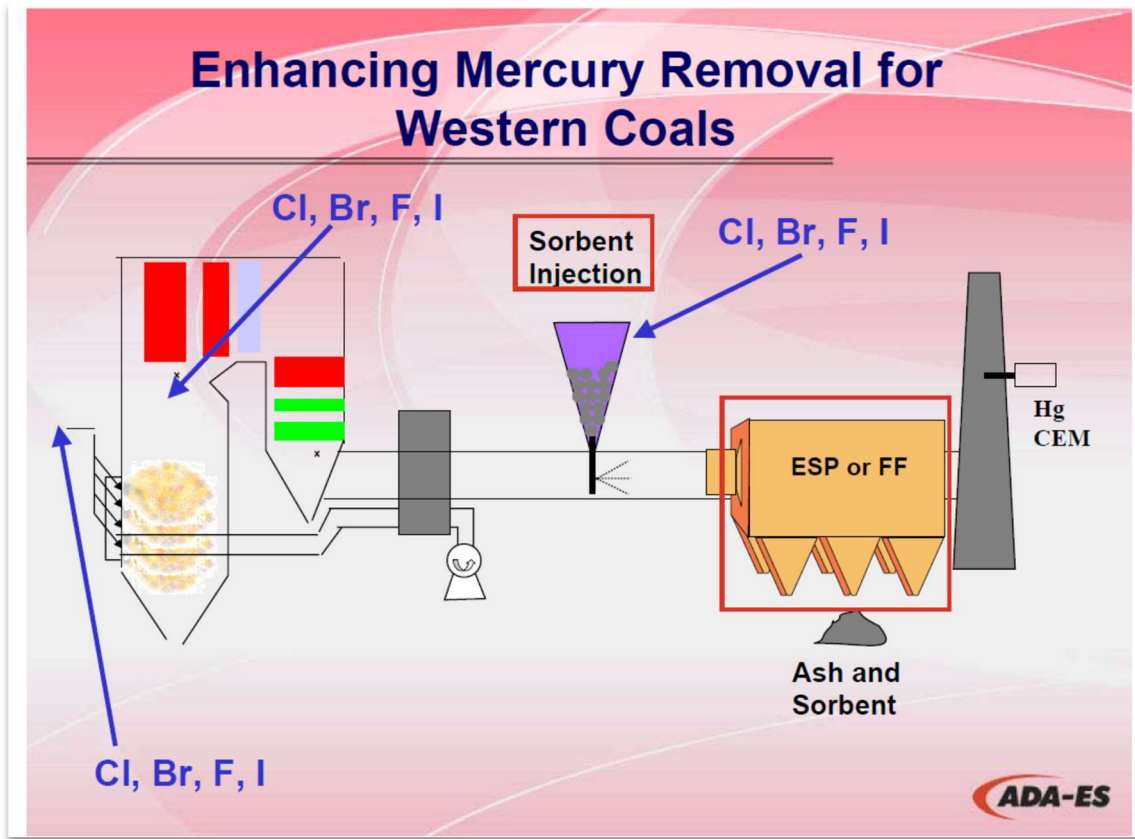
**q. Claims 24-25:**

**24: “the injection of the sorbent into the mercury-containing gas occurs upstream of a particulate separator, a scrubber, or a combination thereof.”**

**25: “the particulate separator comprises a baghouse, an electrostatic precipitator, a fabric filter, or a combination thereof.”**

**i. Grounds 1-2**

Sjostrom discloses a coal-fired power plant that includes an electrostatic precipitator (“ESP”) to remove sorbent from the mercury-containing gas.



EX1010, 4, 19 (annotated). As shown, sorbent injection occurs upstream of the ESP, which is a particulate separator. EX1002 ¶¶653-654; *see supra* §V.D.2.

**ii. Ground 2**

Claims 24-25 would further be obvious over Olson-646, which states: “[T]he mercury captured on the sorbent particles is removed from the gas stream in a bag house or electrostatic precipitator (ESP) and collected along with ash particulate.” EX1012 ¶[0007]. This instructs positioning activated-carbon sorbent upstream of the ESP, allowing the sorbent to be collected. EX1002 ¶¶724-725.

**r. Claims 26-27:**

**26: “wherein a halide sorbent enhancement additive comprises the added Br<sub>2</sub>, HBr, bromide compound, or combination thereof.”**

**27: “wherein the sorbent enhancement additive comprises the bromide compound.”**

As discussed above for Element 1(b), sorbent enhancement additives are applied to coal and/or combustion chamber. The coal and/or combustion chamber thus comprises these materials. EX1002 ¶¶655-656, 726-729.

**3. Independent Claim 28**

Claim 28 is nearly identical to Claim 1, with minor changes, as shown below:

128. A method of separating mercury from a mercury-containing ~~gas~~as, the method comprising:  
 combusting coal in a combustion chamber, to provide the mercury-containing gas, wherein the mercury-containing gas comprises a halogen or halide promoter comprising HBr, Br<sup>-</sup>, or a combination thereof, wherein  
 the coal comprises an additive comprising Br<sub>2</sub>, HBr, a bromide compound, or a combination thereof, wherein the additive is added to the coal before the coal enters the combustion chamber,  
 or the combustion chamber comprises an additive comprising Br<sub>2</sub>, HBr, a bromide compound, or a combination thereof, or a combination thereof;  
 injecting a sorbent comprising activated carbon into the mercury-containing gas downstream of the combustion chamber;  
 contacting mercury in the mercury-containing gas with the sorbent; and separating the sorbent contacted with the mercury from the mercury-containing gas.

Claim 28 is obvious for the reasons described for Claim 1. EX1002 ¶¶657-663, 730-737. The differences are discussed below.

**a. Element 28(b): “the mercury-containing gas comprises a halogen or halide promoter comprising HBr, Br<sup>-</sup>, or a combination thereof...;”**

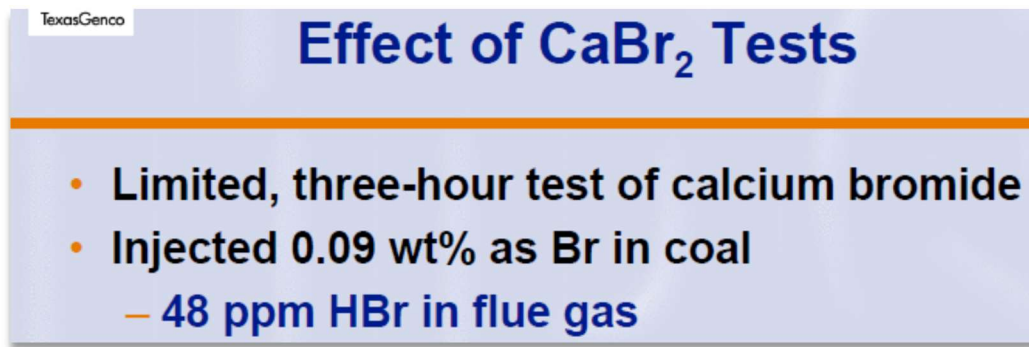
**i. Grounds 1-2**

As discussed for Element 1(b), it would have been obvious to use widely available materials, including aqueous solutions of a bromide compound, such as CaBr<sub>2</sub>, for the “Br” in Sjostrom. A POSITA would have understood that during combustion, Br injected at Locations 1 and/or 2 vaporizes and further reacts at the temperatures inside the boiler to form a halogen/halide promoter (e.g., HBr) in the vapor phase of the mercury-containing flue gas. EX1010, 4; EX1036, 4-53, 4-65; EX1002 ¶¶129-130, 660-661. Lead inventor Dr. Olson admitted that, “if calcium

bromide is added to coal and put into the furnace and activated carbon is injected downstream of the furnace,” there would be “in-flight promotion.” EX1095, 231:3-9; *see* 98:23-100:3.

**i. Ground 1**

This limitation would also be obvious over Eckberg. Eckberg teaches that, upon combustion,  $\text{CaBr}_2$  forms HBr in the mercury-containing gas.



EX1011, 14; EX1002 ¶661.

**ii. Ground 2**

This limitation would also be obvious over Olson-646. Olson-646 discloses the “halogen/halide promoter” comprises “gaseous HBr or  $\text{Br}_2$ .” EX1012 ¶[0066]; EX1002 ¶¶733-735.

**4. Independent Claim 29**

Claim 29 is nearly identical to Claims 1 and 10, with minor changes, as shown below:

~~129~~. 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 mercury-containing gas comprises a halogen or halide promoter comprising HBr, Br<sup>-</sup>, or a combination thereof, wherein

the coal comprises an additive comprising Br<sub>2</sub>, HBr, a bromide compound, or a combination thereof, wherein the additive is added to the coal before the coal enters the combustion chamber,

or the combustion chamber comprises an additive comprising Br<sub>2</sub>, HBr, a bromide compound, 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;

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 Br<sub>2</sub>, HBr, the bromide compound, or a combination thereof, added to the coal or the combustion chamber, or a combination thereof.]

For the same reasons as Claims 1 and 10, Claim 29 is obvious. The differences are discussed below. EX1002 ¶¶664-672, 738-746.

**a. Element 29(b): “the mercury-containing gas comprises a halogen or halide promoter comprising HBr, Br<sup>-</sup>, or a combination thereof...;”**

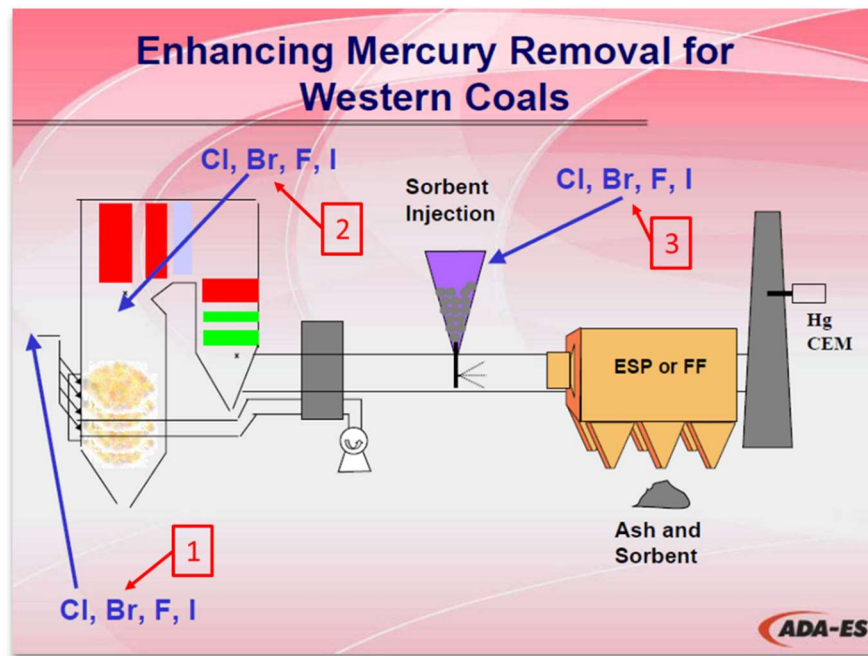
This limitation is disclosed for the same reasons as stated for Element 28(b).

EX1002 ¶667.

**b. Element 29(c): “such that the activated carbon reacts with the halogen or halide promoter in the mercury-containing gas to form a promoted sorbent;”**

**i. Grounds 1-2**

As described for Claim 14, Br added at Locations 1 and 2 of Sjostrom would contact the sorbent in the mercury-containing flue gas, at or downstream of the sorbent injection point.

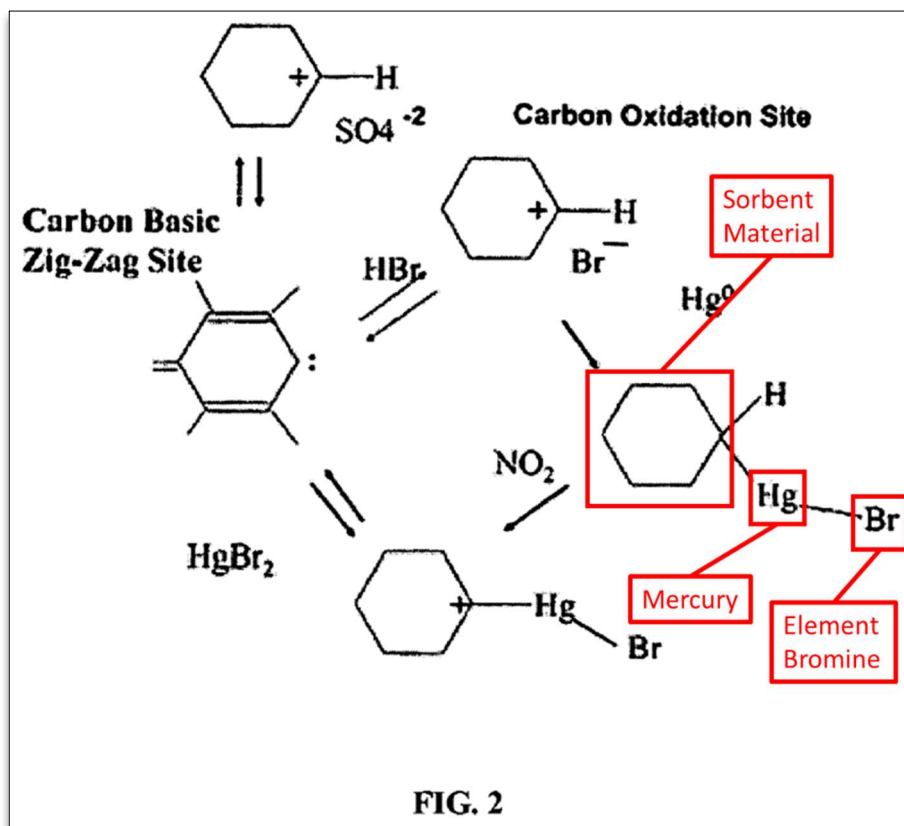


EX1010, 4. It would have been obvious that at least some Br would react with the activated-carbon sorbent, which would also react with the mercury. It was well-known in the art that halogens (including bromine) “promoted” activated-carbon sorbents because they improved mercury removal by increasing the ability of the activated carbon to bind with the mercury. *See supra* §V.D.4; EX1002 ¶¶109-111,

132-151. Lead inventor Dr. Olson admitted that, when bromides are added to coal “and activated carbon is injected downstream of the furnace,” then there would be “in-flight promotion.” EX1095 (Olson), 231:3-9; *see* 98:23-100:3. “[P]romotion” of activated carbon by halogens is a form of reaction. EX1095, 45:16-25, 174:7-14; EX1092, 156 (labeled as limitation 24e, O’Keefe explaining how bromine-containing ingredients added to coal would contact and react with sorbent), 179 (same analysis for ’430 Claim 29(c)); EX1002 ¶¶145-147, 668-670.

## **ii. Ground 2**

This limitation would also be obvious over Olson-646. As described for Element 1(b), at combustion temperatures, Br injected at Location 1 and/or 2 of Sjostrom vaporizes and reacts to form HBr in the combustion chamber, leaving as vapor-phase HBr. Olson-646 explains “hydrogen bromide [labeled ‘HBr’] *reacts* with the unsaturated structure of the activated carbon.” EX1012 ¶[0054]. This is shown below:



EX1012, Fig. 2 (annotated). “Molecular bromine or a bromine compound reacts to form a similar structure.” EX1012 ¶[0054]; EX1002 ¶¶742-743.

A POSITA would have looked to Olson-646 to further understand the relationship between the halogen, mercury, and activated carbon disclosed by Sjostrom, including how they react to form promoted sorbent. EX1002 ¶744.

### IX. GROUND 3: ANTICIPATION BY OLSON-235

Because the '430 Patent's priority date is not before April 2018, Olson-235 qualifies as a prior art anticipatory reference as of its 2014 issuance date. EX1002 ¶747.

1. **Independent Claim 1**

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

Olson-235 discloses the claim language verbatim. EX1018, 21:59-60.  
EX1002 ¶748.

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

Olson-235 discloses “a combustion chamber that produces a mercury-containing gas.” EX1018, 22:39-42. “[C]ombustion chamber 301” combusts coal to provide the mercury-containing gas. *Id.*, 17:60-18:25, Figs. 5A-5B; EX1002 ¶749.

- c. **Element 1(b): “wherein the coal comprises an additive comprising Br<sub>2</sub>, HBr, a bromide compound, or a combination thereof, wherein the additive is added to the coal before the coal enters the combustion chamber, or the combustion chamber comprises an additive comprising Br<sub>2</sub>, HBr, a bromide compound, or a combination thereof or a combination thereof;”**

Olson-235 does not disclose that coal comprises any bromine-containing chemicals added upstream of the combustion chamber, nor does it disclose all claimed Br-containing species, so it cannot provide written-description support for the '430 Patent claims. *See Tronzo*, 156 F.3d at 1158-60 (denying priority where earlier application did not provide written-description support for full scope of

alternative shapes encompassed by the claims). However, Olson-235 discloses one alternative: “halogen or halide promoter is introduced...into a combustion chamber that produces a mercury-containing gas.” EX1018, 22:39-42. *See Fresenius USA, v. Baxter Int’l*, 582 F.3d 1288, 1297-98 (Fed. Cir. 2009) (“[E]ntire element is disclosed by the prior art if one alternative in the Markush group is in the prior art”). Olson-235 refers to the “halide/halogen gas, for example, gaseous HBr or Br<sub>2</sub>.” EX1018, 15:34-35; *see* 15:60-61; EX1002 ¶750.

**d. Element 1(c): “injecting a sorbent comprising activated carbon into the mercury-containing gas downstream of the combustion chamber; contacting mercury in the mercury-containing gas with the sorbent; and”**

Olson-235 discloses the claim language near-verbatim:

- “providing a base sorbent, either by injection or in situ creation, into a mercury-containing flue gas stream”
- “carbon base sorbent may include powdered activated carbon”
- “When a promoted or a non-promoted base sorbent reacts with elemental or oxidized mercury, a mercury/sorbent chemical composition is formed.”

EX1018, 5:31-33, 10:53-55, 3:41-43; EX1002 ¶751.

**e. Element 1(d): “separating the sorbent contacted with the mercury from the mercury-containing gas.”**

Olson-235 discloses “separating particulates from the mercury containing gas to form a cleaned gas, the particulates including ash and the mercury/sorbent chemical composition.” EX1018, 22:23-25; EX1002 ¶752.

**2. Claims Depending from Claim 1**

**a. Claim 3: “The method of claim 1, wherein the combustion chamber comprises the additive comprising the Br<sub>2</sub>, HBr, the bromide compound, or a combination thereof.”**

*See supra* Element 1(b). The combustion chamber comprises HBr. EX1002 ¶753.

**b. Claim 6: “The method of claim 1, wherein the combustion chamber is an electric utility coal combustion chamber.”**

758. Olson-235 discloses that “[l]arge coal combustion facilities” include “electric utilities.” EX1018, 1:39-41, 16:11-13; EX1002 ¶754.

**c. Claim 7: “wherein the combustion chamber is a coal combustion furnace.”**

This claim is obvious for the reasons discussed for Element 1(a). Olson-235 discloses the combustion chamber can be any “chamber in which mercury containing gas is either generated or passed through” (i.e., a coal combustion furnace). EX1018, 18:17-22; EX1002 ¶755.

**d. Claims 10-11:**

**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 Br<sub>2</sub>, HBr, the bromide compound, or a combination thereof, added to the coal or the combustion chamber, or a combination thereof”**

**11: “the measuring of the mercury content comprises continuous measurement.”**

Olson-235 discloses “continuous measurement of mercury emissions as feedback to assist in control of the sorbent injection rate.” EX1018, 20:1-5; *see* 6:55-67, 7:8-20. EX1002 ¶¶756-758.

**e. Claim 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 Br<sub>2</sub>, HBr, the bromide compound, or a combination thereof, added to the coal or the combustion chamber, or a combination thereof.”**

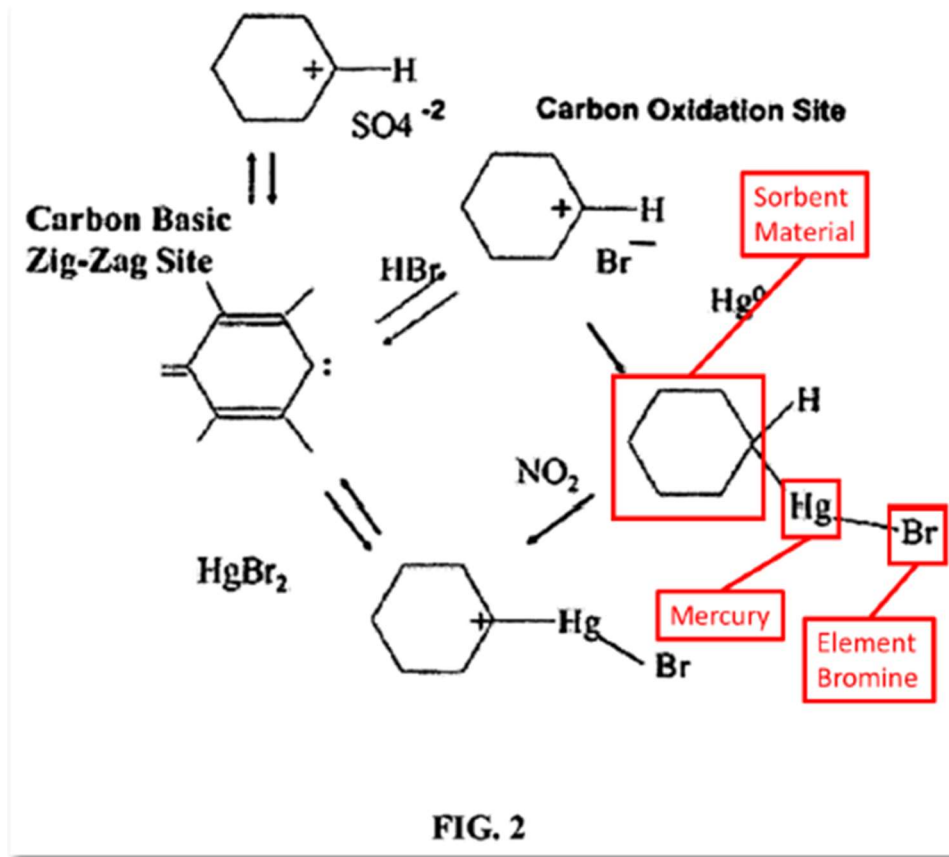
Claim 12 is obvious for the reasons discussed for Claims 10-11. EX1002 ¶759.

**f. Claim 13: “wherein the mercury-containing gas comprises about 1 g to about 30 g of the element bromine per 100 g of the sorbent.”**

Olson-235 discloses, “the promoter is reacted in the gas phase or as a vapor, wherein the promoter is added at from about 1 to about 30 grams per 100 grams of the base sorbent.” EX1018, 5:51-54. As discussed for Element 1(b), the promoter includes HBr or Br<sub>2</sub>. EX1002 ¶760.

**g. Claim 14: “wherein the sorbent contacted with the mercury comprises the element bromine and mercury.”**

The “model is presented for the reactivity of the bromine-treated carbon with mercury shown in FIG. 2.” EX1018, 16:60-62.



EX1018, Fig. 2 (annotations in red). The “sorbent,” “element bromine” (Br), and “mercury” are labeled above. EX1002 ¶761.

**h. Claims 15-16: “comprising removing greater than 70 wt % of the mercury in the mercury-containing gas [cl. 16-with the sorbent].”**

Olson-235 discloses the claim language near-verbatim: “collecting greater than 70 wt% of the mercury in the flue gas on the promoted sorbent to produce a cleaned flue gas.” EX1018, 5:33-35; EX1002 ¶762.

- i. Claim 17: “wherein the sorbent in the mercury-containing gas comprises about 1 g to about 30 g of the added Br<sub>2</sub>, HBr, the bromide compound, or a combination thereof, per 100 g of the sorbent.”**

Olson-235 discloses the claim language near-verbatim: “the promoted sorbent comprises from about 1 to about 30 grams of promoter per 100 grams of base sorbent.” EX1018, 5:52-54. As discussed for Element 1(b), the promoter includes HBr or Br<sub>2</sub>. EX1002 ¶763.

- j. Claim 18: “wherein the Br<sub>2</sub>, HBr, or the bromide compound is contacted with the sorbent in vapor form, gaseous form, liquid form, or in an organic solvent.”**

“[T]he promoter is substantially in vapor form when combined with the base sorbent.” EX1018, 4:42-43; EX1002 ¶764.

- k. Claim 19: “wherein the activated carbon comprises powdered activated carbon, granular activated carbon, or a combination thereof.”**

Olson-235 copies the claim language. EX1018, 10:53-55; EX1002 ¶765.

- l. Claim 20: “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 the injection of the sorbent into the mercury-containing gas.”**

Olson-235 discloses: “form a promoted halogenated sorbent and...chemically reacting elemental mercury in the mercury containing gas with the promoted halogenated carbon sorbent.” EX1018, 22:15-20; *see* 14:30-34; EX1002 ¶766.

**m. Claim 21: “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.”**

Olson-235 discloses injecting sorbent into mercury-containing gas that is free of contact with a halogen or halide promoter prior to injection of the sorbent into the mercury-containing gas. EX1018, 10:29-37, Figs. 1-3; EX1002 ¶767.

**n. Claim 22: “wherein the combustion chamber comprises a boiler.”**

“[C]hamber 301 is a boiler.” EX1018, 17:67-18:1; EX1002 ¶768.

**o. Claim 23: “wherein the mercury-containing gas is a flue gas.”**

“A halogen/halide-promoted sorbent is described that is highly effective for the removal of mercury from flue gas streams.” EX1018, 3:25-27; EX1002 ¶769.

**p. Claims 24-25:**

**24: “the injection of the sorbent into the mercury-containing gas occurs upstream of a particulate separator, a scrubber, or a combination thereof.”**

**25: “the particulate separator comprises a baghouse, an electrostatic precipitator, a fabric filter, or a combination thereof.”**

Olson-235 discloses these claims. “A base sorbent...is introduced at location 402 upstream of air heater 302.” EX1018, 18:33-35. “Downstream from injection point 116 and 119 [for the sorbent] is provided particulate separator 140...[which]

may comprise one or more fabric filters, [or] one or more ESPs....” *Id.*, 14:4-8; EX1002 ¶¶770-771.

**q. Claims 26-27:**

**26: “wherein a halide sorbent enhancement additive comprises the added Br<sub>2</sub>, HBr, bromide compound, or combination thereof.”**

**27: “wherein the sorbent enhancement additive comprises the bromide compound.”**

Olson-235 describes “sorbent enhancement additives” and “halogen/halide-promoted sorbents, whose activity for mercury-capture is enhanced by the addition of halogen (e.g., bromine) to the base sorbent structure.” EX1018, 3:11-16, 19:13-18. As discussed for Element 1(b), the promoter (i.e., sorbent enhancement additive) includes HBr or Br<sub>2</sub>. EX1002 ¶¶772-773.

**3. Independent Claim 28**

Claim 28 is nearly identical to Claim 1, with minor changes, as shown below:

128. 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 mercury-containing gas comprises a halogen or halide promoter comprising HBr, Br<sup>-</sup>, or a combination thereof, wherein  
the coal comprises an additive comprising Br<sub>2</sub>, HBr, a bromide compound, or a combination thereof, wherein the additive is added to the coal before the coal enters the combustion chamber,  
or the combustion chamber comprises an additive comprising Br<sub>2</sub>, HBr, a bromide compound, or a combination thereof, or a combination thereof;  
injecting a sorbent comprising activated carbon into the mercury-containing gas downstream of the combustion chamber;  
contacting mercury in the mercury-containing gas with the sorbent; and separating the sorbent contacted with the mercury from the mercury-containing gas.

Claim 28 is obvious for the reasons described for Claim 1. EX1002 ¶¶774-780. The differences are discussed below.

**a. Element 28(b): “the mercury-containing gas comprises a halogen or halide promoter comprising HBr, Br<sup>-</sup>, or a combination thereof...,”**

Olson-235 discloses the “halogen or halide promoter is introduced...into a combustion chamber that produces a mercury-containing gas.” EX1018, 22:39-42. Olson-235 refers to “halide/halogen gas, for example, gaseous HBr or Br<sub>2</sub>.” EX1018, 15:34-35; *see* 15:60-61; EX1002 ¶¶777-778.

**4. Independent Claim 29**

Claim 29 is nearly identical to Claims 1 and 10, with minor changes, as shown below:

~~129~~. 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 mercury-containing gas comprises a halogen or halide promoter comprising HBr, Br<sup>-</sup>, or a combination thereof, wherein  
the coal comprises an additive comprising Br<sub>2</sub>, HBr, a bromide compound, or a combination thereof, wherein the additive is added to the coal before the coal enters the combustion chamber,  
or the combustion chamber comprises an additive comprising Br<sub>2</sub>, HBr, a bromide compound, 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;  
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 Br<sub>2</sub>, HBr, the bromide compound, or a combination thereof, added to the coal or the combustion chamber, or a combination thereof.]

For the same reasons as Claims 1 and 10, Claim 29 is disclosed. The differences are discussed below. EX1002 ¶¶781-787

**a. Element 29(b): “wherein the mercury-containing gas comprises a halogen or halide promoter comprising HBr, Br<sup>-</sup>, or a combination thereof...;”**

This limitation is disclosed for the same reasons as stated above for Element 28(b). EX1002 ¶784.

**b. Element 29(c): “such that the activated carbon reacts with the halogen or halide promoter in the mercury-containing gas to form a promoted sorbent;”**

Olson-235 discloses “chemically reacting the carbon sorbent material...with the halogen or a halide promoter to form a promoted halogenated carbon sorbent.” EX1018, 21:65-66, 22:15-16; EX1002 ¶785.

**X. THE BOARD SHOULD NOT DISCRETIONARILY DENY INSTITUTION**

The Board should not deny institution under 35 U.S.C. §314(a), because the district-court proceeding has barely begun. Petitioner WEC is not a party to the district-court proceedings) and discovery has not opened (other than limited discovery regarding a preliminary-injunction motion). The MDL Panel consolidated the Arizona<sup>7</sup>/Missouri/Iowa actions into multidistrict litigation in the Southern District of Iowa for pretrial proceedings (Dec. 17, 2024). On January 10, 2025, the Iowa court dismissed BHE outright. The Court transferred PacifiCorp to the District of Wyoming and transferred Wisconsin Power & Light to the District of Wisconsin. Those actions were subsequently transferred back to the MDL in the Southern District of Iowa. None of the cases against Petitioners have a scheduling order, let alone trial date. For Petitioners remaining in MDL, the cases will be remanded to

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<sup>7</sup> The Arizona action since settled.

their respective district courts for trial. Trial dates are not known, and any Final Written Decision would likely conclude before trial.

The Board should not deny institution under 35 U.S.C. §325(d), because the Examiner did not consider Sjostrom (Grounds 1-2) or Eckberg (Ground 2) during prosecution. *See Becton, Dickinson & Co. v. B. Braun Melsungen AG*, IPR2017-01586, Paper 8 at 17-18 (Dec. 15, 2017) (factors (a)-(b) and (d) indicate the same art was not presented previously to the Office). The Examiner did not use any of the references (including Olson-235 and Olson-646) in a substantive rejection. *Id.* at 17-18 (factors (a)-(d)). Each reference is dated after the earliest provisional from which the '430 Patent purports to claim priority, and Examiners do not make findings of priority as a matter of course during prosecution. M.P.E.P. §201.08.

Furthermore, Sjostrom, Eckberg, and Olson-646 were previously presented to the Board in IPR2020-00832, challenging U.S. Patent No. 10,343,114, in the same family and sharing most claim limitations with the '430 Patent. The Board found in its Institution Decision that "Petitioner's arguments and evidence are sufficient to show a reasonable likelihood Petitioner would prevail in proving unpatentability of claims" and never reached a final written decision due to settlement. EX1026, 56, 61. Sjostrom and Olson-646 were also presented in IPR2020-00928 for the '147 Patent, a parent to the '430 Patent. The Board found that each qualified as prior art and granted institution. *NRG Energy*, IPR2020-00928, 2020 WL 7074473.

**XI. CONCLUSION**

Petitioners request that IPR of the '430 Patent be instituted, and the Challenged Claims be cancelled.

Respectfully submitted,

February 11, 2025

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Date

*/s/Brian Oaks*

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ATTORNEYS FOR PETITIONERS

**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 13,931 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: February 11, 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 11th day of February, 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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