Trials@uspto.gov
571-272-7822

Paper 17
Date: December 2, 2020

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

NRG ENERGY, INC. and
TALEN ENERGY CORPORATION
Petitioner,

v.

MIDWEST ENERGY EMISSIONS CORP.,
Patent Owner.

IPR2020-00928
Patent 8,168,147 B2

Before ZHENYU YANG, CHRISTOPHER M. KAISER, and AVELYN M. ROSS, *Administrative Patent Judges*.

ROSS, *Administrative Patent Judge*.

DECISION
Granting Institution of *Inter Partes* Review
35 U.S.C. § 314, 37 C.F.R. § 42.4

I. INTRODUCTION

NRG Energy, Inc., Talen Energy Corporation, and Vistra Corp. (formerly known as Vistra Energy Corp.), filed a Petition (Paper 3, "Pet.") requesting *inter partes* review of claims 18 and 19 of U.S. Patent No. 8,168,147 B2 (Ex. 1001, "the '147 patent"). Pet. 1. Subsequently, Vistra Corp and Midwest Energy Emissions Corp. ("Patent Owner") filed a Joint Motion to Terminate Vistra Corp. as a petitioner pursuant to a settlement. Paper 8. That motion was granted. Paper 11. Therefore, NRG Energy, Inc. and Talen Energy Corporation (collectively "Petitioner") remain as petitioners. *Id.* at 4. Patent Owner filed a Preliminary Response to the Petition (Paper 12, "Prelim. Resp."). Pursuant to our authorization, Petitioner filed a Reply (Paper 14, "Pet. Reply"), and Patent Owner filed a Sur-reply (Paper 15, "Sur-reply").

We have authority to determine whether to institute an *inter partes* review. 35 U.S.C. § 314 (2018); 37 C.F.R. § 42.4(a) (2019). The standard for instituting an *inter partes* review is set forth in 35 U.S.C. § 314(a), which provides that an *inter partes* review may not be instituted "unless the Director determines . . . there is a reasonable likelihood that the petitioner would prevail with respect to at least [one] of the claims challenged in the petition."

For the reasons set forth below, upon considering the Petition, Preliminary Response, and evidence of record, we determine the information presented in the Petition establishes a reasonable likelihood that Petitioner would prevail with respect to at least one of the challenged claims. Accordingly, we institute *inter partes* review.

A. Real Parties-in-Interest

Petitioner identifies the real parties-in-interest as NRG Energy, Inc. ("NRG"), Talen Energy Corporation ("Talen"), and Vistra Corp. Pet. 1. Petitioner identifies the following real parties-in-interest who are parties to the pending lawsuit identified below: Brandon Shores LLC; Talen Generation LLC; H.A. Wagner LLC; IPH, LLC; Illinois Power Resources Generating, LLC; Dynegy Midwest Generation LLC; Dynegy Miami Fort, LLC; NRG Texas Power LLC; Midwest Generation EME, LLC; and Midwest Generation, LLC. *Id.* Petitioner also identifies numerous *potential* real parties-in-interest—namely vendors and suppliers. *Id.* at 2–6.

B. Related Matters

Petitioner identifies a pending lawsuit between the parties, styled *Midwest Energy Emissions Corp. and MES Inc. v. Vistra Energy Corp*., No. 1:19-cv-01334-RGA (D. Del.), as a related proceeding in which the Patent Owner asserts the '147 patent. Pet. 6–7; *see also* Paper 6, 1 (Patent Owner's Mandatory Notices).

Petitioner filed a second petition challenging claims 1, 2, 4–6, and 9–24 of the '147 patent, applying different prior art and a different priority date. IPR2020-00926, Paper 2.[1] Additionally, Petitioner filed concurrent petitions challenging U.S. Patent No. 10,343,114 B2 ("the '114 patent"), which is also asserted by Patent Owner in the district court proceeding. *See* IPR2020-00832, Paper 3; *see also,* IPR2020-00834, Paper 3. We instituted

[1] In accordance with our Trial Practice Guide, Petitioner provides an explanation of material differences and ranking for the multiple petitions directed to each challenged patent. Paper 2, (Petitioner's Explanation Regarding the Necessity of Multiple Petitions, "Explanation").

trial on IPR2020-00832 and IPR2020-00834 on October 26, 2020. *See* IPR2020-00832, Paper 17; *see also* IPR2020-00834, Paper 18.

C. The '147 Patent

1. Specification

The '147 patent, titled "Sorbents for the Oxidation and Removal of Mercury," issued on May 1, 2012. Ex. 1001, codes (45), (54). The '147 patent is directed to methods for capturing mercury using reactive bromine-promoted carbon sorbents. *Id.* at 6:19–24.

The '147 patent explains that combusting coal generates flue gas containing mercury and other trace elements. *Id.* at 1:29–40. "The release of the mercury (and other pollutants) to the environment must be controlled by use of sorbents," e.g., activated carbon particles. *Id.* at 1:37–40, 57–62. According to the '147 patent, "[a] major problem with existing carbon injection systems is that the sorbent is initially unreactive, and only after extended exposure to the flue gas does the sorbent become effectively seasoned and provide increased reactivity with the mercury in the gas." *Id.* at 2:10–14.

The '147 patent discloses that the "present invention 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, at very short contact times of seconds or less." *Id.* at 6:19–24. To prepare bromine-carbon sorbents, the '147 patent describes methods for chemically combining molecular bromine with activated carbon. *Id.* at 11:45–49. Specifically, the '147 patent describes an "in-flight" method of producing a bromine-promoted carbon sorbent by

> contacting the vapors of any combination of halogens and optionally a second component, in-flight, with very fine carbon particles. The particles may be dispersed in a stream of transport air (or other gas), which also conveys the halogen/halide promoted carbon sorbent particles to the flue gas duct, or other contaminated gas stream, from which mercury is to then be removed.

Id. at 12:44–53.

The '147 patent depicts a schematic flow diagram for a mercury control system including bromine-promoted carbon sorbents in Figure 3, reproduced below:

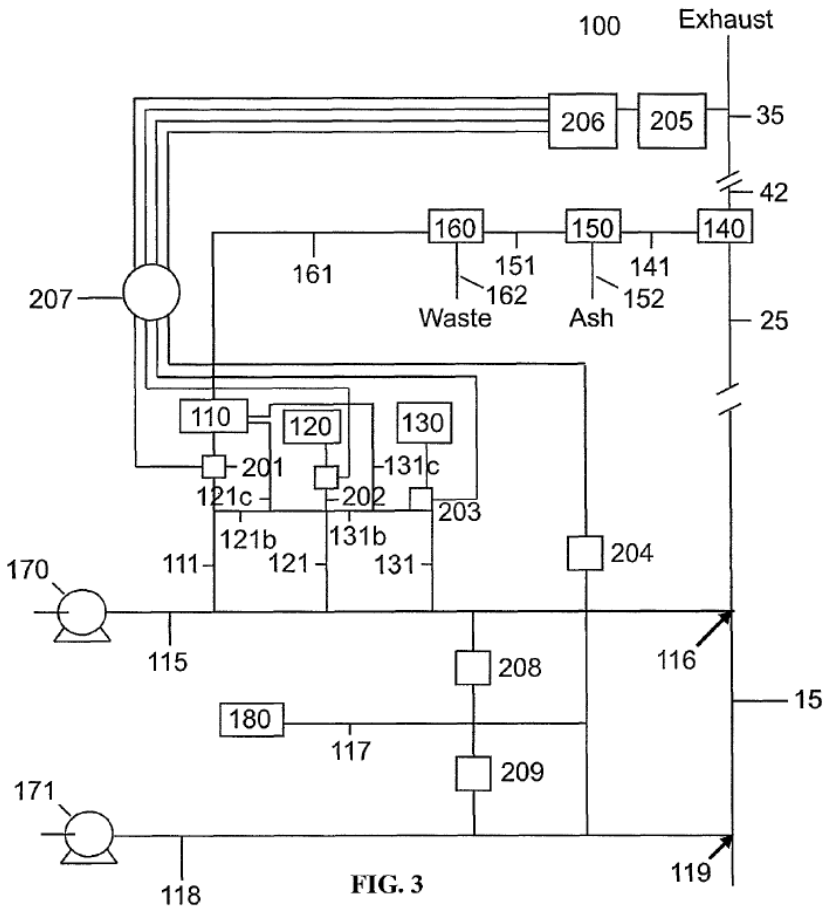


FIG. 3

Figure 3 "schematically illustrates preparation of promoted carbon sorbents and processes for flue gas mercury reduction in flue gases and/or product gases from a gasification system . . . including in-flight preparation of

promoted carbon sorbent." *Id.* at 5:47–51. Figure 3 depicts base activated carbon reservoir 110, halogen/halide promoter reservoir 120, optional secondary component reservoir 130, and corresponding flow control devices 201–203. *Id.* at 8:21–30. Transport line 115 carries material discharged from reservoirs 110, 120, and 130 in a transport gas, which injects the materials into contaminated flue gas stream 15 via injection point 116. *Id.* at 8:33–42. Particulate separator 140 collects and separates solid materials, including sorbent stream 151, which may be passed to sorbent regenerator 160 to yield regenerated sorbent stream 161. *Id.* at 8:61–9:10.

Figure 3 illustrates several preferred methods for preparing bromine-promoted carbon sorbents. *Id.* at 9:43–64. For example, the '147 patent first describes an in-flight preparation by discharging the halogen/halide "via line 121 directly into transport line 115, within which it contacts and reacts with the base activated carbon prior to injection point 116." *Id.* at 9:51–56. In a second embodiment, "the halogen/halide may be combined via line 121*b* with base activated carbon prior to entering transport line 115." *Id.* at 9:56–57. As a third alternate method, Figure 3 of the '147 patent describes introducing halogen/halide via line 121*c* into activated carbon reservoir 110 and reacting the compounds in reservoir 110. *Id.* at 9:58–64.

2. Illustrative Claims

Petitioner challenges dependent claims 18 and 19, which depend from claims 1 and 17. Claims 1, 17, 18 and 19 are reproduced below.

> 1. A method for separating mercury from a mercury containing gas comprising:
>
> (a) promoting at least a portion of a particulate sorbent material comprising activated carbon by chemically reacting the sorbent material with a bromine containing promoter to form a promoted brominated sorbent, wherein the bromine containing

promoter is in gaseous form, vapor form, or non-aqueous liquid form, and wherein the activated carbon contains graphene sheets having carbene species edge sites which react with the bromine containing promoter to form a carbocation paired with a bromide anion in the promoted brominated sorbent for oxidation of the mercury;

(b) chemically reacting elemental mercury in the mercury containing gas with the promoted brominated sorbent to form a mercury/sorbent chemical composition; and

(c) separating particulates from the mercury containing gas, the particulates including ash and the mercury/sorbent chemical composition.

Ex. 1001, 23:34–52.

17. A method according to claim 1, further comprising

injecting the particulate sorbent material at a sorbent material injection rate and

injecting separately the bromine containing promoter into a gas stream whereby in-flight reaction produces the promoted brominated sorbent,

wherein 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 sorbent material.

Id. at 24:34–41.

18. A method according to claim 17, wherein the gas stream is a mercury containing gas.

Id. at 24:42–43.

19. A method according to claim 18, wherein the gas stream is a transport gas.

Id. at 24:44–45.

D. Prior Art and Asserted Grounds

Petitioner asserts that claims 18 and 19 would have been unpatentable on the following grounds:

Claim(s) Challenged	Statutory Basis	Reference(s)/Basis
18, 19	§ 103	Lissianski-Presentation,[2] Olson[3]
18, 19	§ 103	Sjostrom,[4] Olson

Petitioner also relies on declaration testimony of Stephen Niksa, Ph.D. (Ex. 1003, "the Niksa Declaration").

II. ANALYSIS

A. Legal Standards

"In an [*inter partes* review], the petitioner has the burden from the onset to show with particularity why the patent it challenges is unpatentable." *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016) (citing 35 U.S.C. § 312(a)(3) (requiring *inter partes* review petitions to identify "with particularity . . . the evidence that supports the grounds for the challenge to each claim")). This burden of persuasion never shifts to Patent Owner. *See Dynamic Drinkware, LLC v. Nat'l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015) (discussing the burden of proof in *inter partes* review).

[2] V. Lissianski, *Integrated Approach to Multi-Pollutant Control*, 9th Electric Utilities Environmental Conference (January 2006) (Exhibit 1011, "Lissianski-Presentation").
[3] Olson et al., US 2006/0048646 A1, published March 9, 2006 (Exhibit 1014, "Olson").
[4] S. Sjostrom, *Full Scale Evaluations of Mercury Control Technologies with PRB Coals*, Electric Utilities Environmental Conference (January 2005) (Exhibit 1010, "Sjostrom").

A claim is unpatentable under 35 U.S.C. § 103(a) if "the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains." *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations including: (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and (4) objective evidence of nonobviousness.[5] *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

To show obviousness, it is not enough to merely show that the prior art includes separate references covering each separate limitation in a challenged claim. *Unigene Labs., Inc. v. Apotex, Inc.*, 655 F.3d 1352, 1360 (Fed. Cir. 2011). "This is so because inventions in most, if not all, instances rely upon building blocks long since uncovered, and claimed discoveries almost of necessity will be combinations of what, in some sense, is already known." *KSR*, 550 U.S. at 418–419.

On the other hand, an obviousness analysis "need not seek out precise teachings directed to the specific subject matter of the challenged claim, for a court can take account of the inferences and creative steps that a person of ordinary skill in the art would employ." *KSR*, 550 U.S. at 418; *accord In re Translogic Tech., Inc.*, 504 F.3d 1249, 1259 (Fed. Cir. 2007). However, Petitioner cannot satisfy its burden of proving obviousness by employing "mere conclusory statements." *In re Magnum Oil Tools Int'l, Ltd.*, 829 F.3d

[5] The parties have not asserted or otherwise directed our attention to any objective evidence of non-obviousness.

1364, 1380 (Fed. Cir. 2016). Instead, Petitioner must articulate a reason why a person of ordinary skill in the art would have combined or modified the prior art references. *In re NuVasive, Inc.*, 842 F.3d 1376, 1382 (Fed. Cir. 2016); *see also Metalcraft of Mayville, Inc. v. The Toro Co.*, 848 F.3d 1358, 1366 (Fed. Cir. 2017) ("In determining whether there would have been a motivation to combine prior art references to arrive at the claimed invention, it is insufficient to simply conclude the combination would have been obvious without identifying any reason why a person of skill in the art would have made the combination."); *Belden Inc. v. Berk-Tek LLC*, 805 F.3d 1064, 1073 (Fed. Cir. 2015) ("[O]bviousness concerns whether a skilled artisan not only *could have made* but *would have been motivated to make* the combinations or modifications of prior art to arrive at the claimed invention.") (citing *InTouch Techs., Inc. v. VGO Commc'ns, Inc.*, 751 F.3d 1327, 1352 (Fed. Cir. 2014)).

At this preliminary stage, we determine whether the information presented shows a reasonable likelihood that Petitioner would prevail in establishing that at least one of the challenged claims would have been obvious over the proposed prior art.

We analyze the challenges presented in the Petition in accordance with the above-stated principles.

B. Level of Ordinary Skill in the Art

We review the grounds of unpatentability in view of the understanding of a person of ordinary skill in the art at the time of invention. *Graham*, 383 U.S. at 17. Petitioner contends that

> [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 with implementing pollution control in power generation plants for natural gas, coal, and/or industrial waste incineration.

Pet. 11 (citing Ex. 1003 ¶¶ 63–66).

Patent Owner does not identify the level of skill necessary for a person having ordinary skill in the art. *See generally* Prelim. Resp. And, neither party indicates that the outcome of any arguments made in this case would change depending on the level of ordinary skill in the art. For purposes of this Decision, and based on the record currently presented, we adopt Petitioner's definition of the level of ordinary skill in the art. Further, we find that the prior art of record reflects the level of skill in the art at the time of the invention. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001). We will make any final determination pertaining to the level of ordinary skill in the art, however, on the full trial record.

C. Claim Construction

In an *inter partes* review filed on or after November 13, 2018, we construe claims "using the same claim construction standard that would be used to construe the claim in a civil action under 35 U.S.C. 282(b), including construing the claim in accordance with the ordinary and customary meaning of such claim as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent." 37 C.F.R. § 42.100(b) (2019); *see Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc).

Petitioner does not propose any claim construction and asserts all claim terms should be accorded their plain and ordinary meaning. Pet. 19 (citing Ex. 1003 ¶ 211).

Patent Owner contends that Petitioner interprets "claim 17 in a manner that is contrary to the plain claim language. In particular, Petitioners insert the following limitation into the claim language: "injecting separately the bromine containing promoter**[, and no other material,]** into a gas stream." Prelim. Resp. 3; *see also* Sur-reply (stating that Petitioner argues "the plain meaning of the claim requires that any promoter be injected entirely on its own"). Patent Owner contends that the claimed methods include the use of additional materials beyond those specifically recited. Prelim. Resp. 3–4. Specifically, Patent Owner contends "a particulate sorbent material comprising activated carbon" may include other materials, such as pyrolysis char, and "a bromine containing promoter" may include other materials, such as an organic solvent or chloride. *See id.* (citing Ex. 1001, 2:55–60; 7:45–50).

Petitioner replies that it "did not insert 'and no other material' into the claims" and instead applies the plain language as written. Pet. Reply 2. Petitioner states that "'the gas stream' in claims 18–19 refers to 'a gas stream' of parent claim 17, and thus, claims 18–19 require 'injecting the particulate sorbent material . . . and ***injecting separately*** the bromine containing promoter ***into***' a ***mercury containing gas stream***." *Id.*

After reviewing the parties' arguments, we are not persuaded that Petitioner is attempting to insert additional language into the claim such that the relevant term would read "injecting separately the bromine containing promoter[, and no other material,] into a gas stream," as alleged by Patent Owner. And, neither party proposes an express construction for our consideration. We determine that it is not necessary, at this stage of

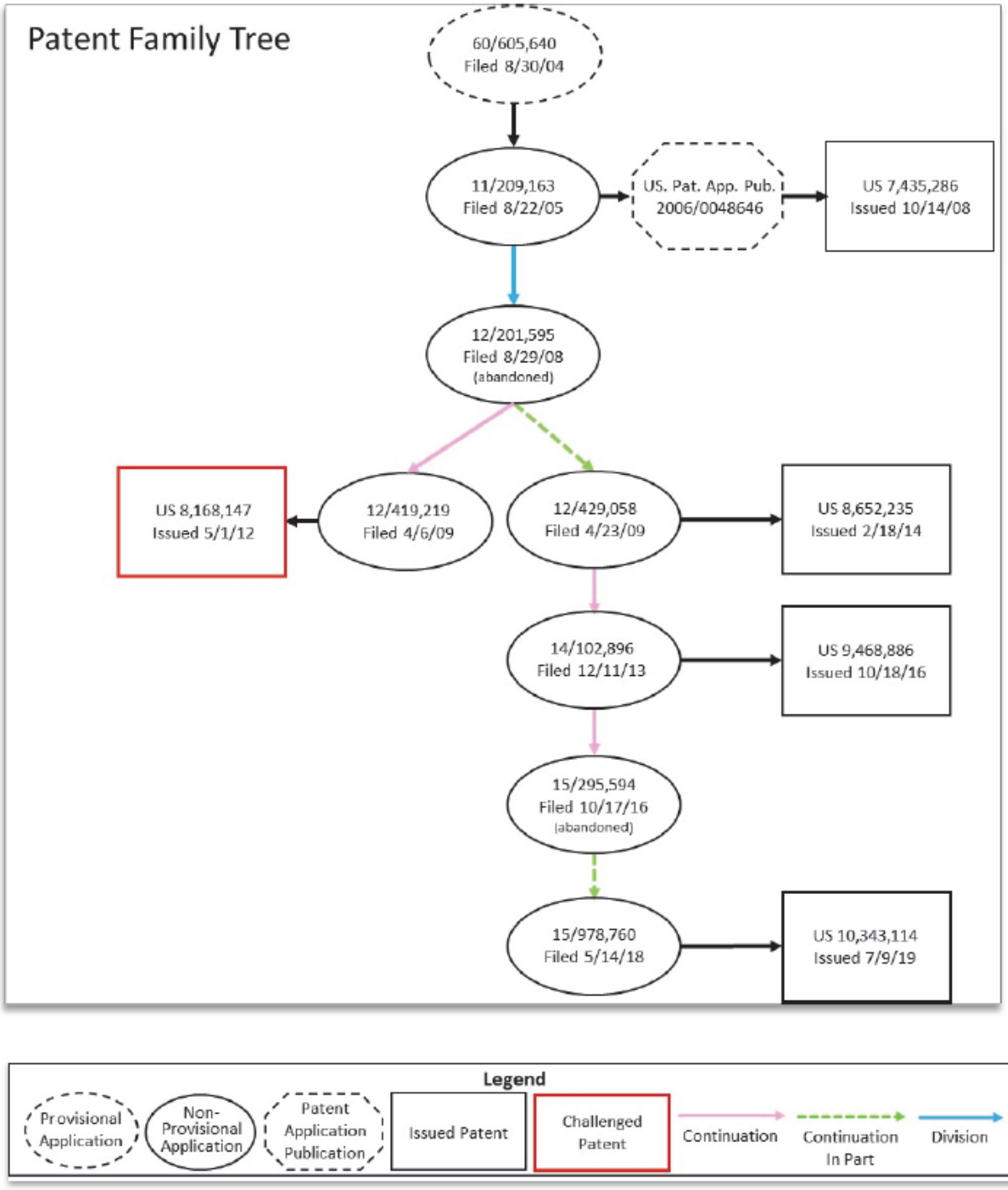
the proceeding, to provide an express construction for this term. *Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999).

We will revisit the issue based on the full record developed over the course of trial, if needed.

D. Priority for claims 18 and 19 of the '147 patent

As discussed above, the '147 patent issued from U.S. Application No. 12/419,219 ("the '219 application"), filed on April 6, 2009, which claims earliest priority through a series of non-provisional applications to U.S. Provisional Application No. 60/605,640 ("the '640 provisional"), filed August 30, 2004.

Petitioner provides the following summary of the '147 patent priority chain and family:



Ex. 1017. This summary depicts the earliest filed application at the top and shows the latest filed application at the bottom. As illustrated above, the '147 patent has the following priority chain:

- Provisional Application 60/605,640, filed August 30, 2004, ("the '640 provisional application");
- Non-provisional Application 11/209,163 ("the '163 application"), filed August 22, 2005, claiming priority to the '640 provisional application;
- Non-provisional Application 12/201,595 ("the '595 application"), filed August 29, 2008, claiming priority to the '163 application as a divisional application;
- Non-provisional Application 12/419,219 ("the '219 application"), filed on April 6, 2009, claiming priority to the '595 application as a continuation application;

Id.; Ex. 1001, code (21), (22), (60).

However, Petitioner contends that claims 18 and 19 are not supported by the '640 provisional application or the intervening non-provisional applications. Pet. 19–20. Therefore, according to Petitioner, the correct priority date for claims 18 and 19 is April 6, 2009, the filing date of the '219 application along with the preliminary amendment introducing the claims into the application. *Id.* at 20.

Patent Owner asserts that the '640 provisional application as well as the intervening '163 and '595 applications provide the requisite written description support for claims 18 and 19.[6] *See generally* Prelim. Resp. 9–19; Sur-reply 1–4. Because the '640 provisional application was filed before Lissianski-Presentation and Sjostrom were publicly accessible (January 2006 and January 2005, respectively) and before Olson-646 was published (March

[6] Patent Owner explains that "[f]or purposes of this dispute, the '595 and '163 applications contain substantively identical disclosures. For ease of reading, patent owner refers to the '163 application below." Prelim. Resp. 15. In our discussion below, we similarly refer to Exhibit 2021, i.e., the '163 application, as we discern little or no difference between the '595 and '163 applications.

2006), if claims 18 and 19 the '147 patent are entitled to the priority date of the '640 provisional application, Lissianski-Presentation, Sjostrom, and Olson-646 would not qualify as prior art. Reply 1.

We address the disclosure of the provisional and non-provisional applications, along with the parties' priority arguments below.

1. Provisional application

Petitioner argues that Patent Owner cannot rely on the '640 provisional application because the '640 provisional application fails to provide sufficient disclosure to support claims 18 and 19 and because the intervening applications "do not include the relied-upon disclosure of the Provisional, thus breaking priority." Pet. 22 (citing Ex. 1003 ¶¶ 185–186; *Lockwood v. Am. Airlines, Inc.*, 107 F.3d 1565, 1571 (Fed. Cir. 1997)). According to Petitioner, even if the disclosure in '640 provisional application were sufficient, "the intervening applications only include[] a generic statement of incorporation by reference, without identifying with particularity what specific material is being incorporated." *Id.* at 22–23. For example, the '147 patent includes the following cross-reference to related applications:

> This application is a continuation of U.S. patent application Ser. No. 12/201,595 filed on Aug. 29, 2008, which is a division of U.S. patent application Ser. No. 11/209,163, filed on Aug. 22, 2005 (now U.S. Pat. No. 7,435,286), which claims priority to the extent appropriate from provisional application 60/605,640, filed on Aug. 30, 2004. Application Ser. Nos. 12/201,595; 11/209,163; and 60/605,640 are incorporated herein by reference.

Ex. 1001, 1:7–14. Petitioner contends that claiming "priority ***to the extent appropriate from***" the'640 provisional application "indicates that applicants did not intend to claim priority to and incorporate the entire Provisional

Application, but only parts of it, again without identifying the specific material to incorporate." Pet. 23. Petitioner asserts that "applicants' incorporation by reference language fails as a matter of law," and therefore, "none of the disclosure in the Provisional is properly incorporated to the applications in the priority-chain and thus cannot provide written description support for the '147 Patent claims." *Id.*

Petitioner further argues that "material incorporated by reference from the Provisional, but not disclosed in the ['147 patent] specification, cannot be considered as providing written-description support in a priority analysis because such material would be deemed 'essential material.'" *Id.* at 24. Petitioner explains that "essential material"—which includes "material that is necessary to: provide a written description of the claimed invention"—"may be incorporated by reference, but ***only*** by way of incorporation by reference to a ***U.S. patent or U.S. patent application publication***." *Id.* (quoting 37 C.F.R. § 1.57(d) (2020)). And, Petitioner asserts that because a provisional application is not published, it "is neither a 'U.S. patent' nor a 'U.S. patent application publication.'" *Id.* (citing 35 U.S.C. § 122(b)(2)(A)(iii); 35 U.S.C. § 111).

As to the substantive disclosure of the '640 provisional application, Petitioner contends that the '640 provisional application "fails to disclose Claims 18–19 because it only discloses injecting a halogen and activated carbon sorbent ***together*** into a mercury-containing gas, ***not separately*** as recited in claims 18–19." *Id.* at 25 (citing Ex. 1020, 11).[7] Petitioner contends that "[t]he halogen and activated carbon sorbent are being

[7] Petitioner cites to the pages of the provisional application, not the pages of Exhibit 1020.

combined in a transport line with a *non*-mercury-containing gas, and then injected together (not separately), into a mercury-containing gas." *Id.* (citing Ex. 1003 ¶ 203).

Petitioner discusses Figure 2 of the '640 provisional, reproduced below, in detail. *Id.* at 25–26.

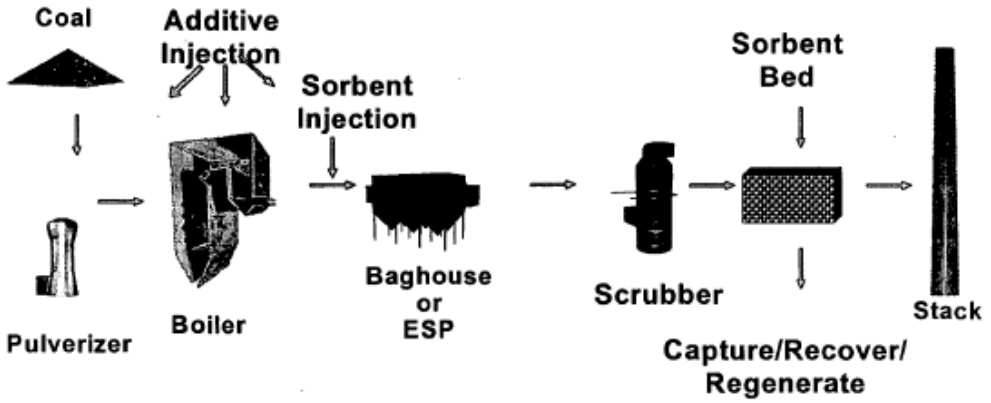


FIG. 2

Figure 2 is a block diagram illustrating a mercury control method in a coal fueled facility. Ex. 1020, 15. In relevant part, Figure 2 depicts pulverized coal introduced to a boiler and fed through a baghouse or an electrostatic precipitator ("ESP") for mercury removal. *Id.* A sorbent is injected in the transport line after the boiler and before the baghouse or ESP. *Id.* Figure 2 also shows an additive injection that may occur with the coal, in the boiler, or at the sorbent injection site. *Id.*

Petitioner first contends that Figure 2 was not included in the '147 patent. Pet. 26. Second, Petitioner contends that the "additive" of the "additive injection" is limited to "compounds of Group I or II elements," and does not include Group VII elements, e.g., bromine. *Id.* (citing Ex. 1020, 4 (Example 9)). Third, Petitioner contends that the additive injection is used to augment previously promoted activated carbon and "does not provide an

in-flight reaction promoting the sorbent with a bromine-containing promoter within the mercury containing (flue) gas stream." *Id.* at 27 (citing Ex. 1003 ¶¶ 204–205).

Patent Owner contends that the '640 provisional provides support for separately adding bromine and activated carbon sorbent to mercury-containing flue gas, thereby supporting claims 18 and 19. Prelim. Resp. 10–13. For example, with reference to the "additive" in Figure 2, Patent Owner explains the '640 provisional discloses "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)." *Id.* at 12 (citing Ex. 1020, 15–16, Fig. 2). Patent Owner contends that Figure 2 shows "the bromine-containing additive is mixed with powdered (pulverized) coal (which inherently contains mercury) and[ ]air and injected into the combustion chamber (which also contains mercury from the combusted coal). Later, activated carbon sorbent is injected into the mercury-containing flue gas to cause the promotion reaction." *Id.* As to Petitioner's arguments limiting the Figure 2 "additive injection" to Group I or II elements, Patent Owner contends that Example 9 discloses additional additives to the bromines additives of Examples 1–8. *Id.* at 14 (citing Ex. 1020, 5). Patent Owner contends that "even if the inventors had intended example 9 to redefine the word 'additive'—they did not—it would not exclude the use of bromine containing additives." *Id.* at 14–15.

Patent Owner contends that in another example, the '640 provisional application describes "combining the treatment system with the carbon injection system at the end-use site. . . . [T]he halogen is introduced to the carbon-air mixture in the transport line (or other part of the sorbent storage

and injection system).”). This gas stream is a ‘transport gas’ as required by claim 19.” *Id.* at 13 (citing Ex. 1020, 14). Patent Owner further contends that the provisional application describes “recycling and reusing the sorbent.” *Id.* (citing Ex. 1020, 5–8 (Examples 6 and 10), 13, 14). Patent Owner contends that “[b]ecause this recycled sorbent contains mercury from its use in the flue gas, this provides ‘injecting separately the bromine containing promoter into a [mercury containing] gas stream whereby in-flight reaction produces the promoted brominated sorbent’” as required by claim 18. *Id.*

Petitioner in reply stresses that “[t]he ’640 Provisional ‘only discloses injecting a halogen and activated carbon sorbent ***together*** into a mercury-containing gas, ***not separately*** as recited in claims 18–19.’” Pet. Reply 2 (quoting Pet. 25). Petitioner further contends that claims 18 and 19 additionally require that the bromine promoter be injected separately “‘***into***’ a ***mercury containing gas stream***.” *Id.* Because both separate injection of the bromine promoter and activated carbon and injection of the bromine promoter into a mercury containing gas stream are missing from the ’640 provisional application, Petitioner asserts there is no written description support for claims 18 and 19 of the ’147 patent. *Id.*

Petitioner contends that Patent Owner’s position that Figure 2 of the ’640 provisional application—which is missing from the ’163 and ’595 applications—suggests the separate addition of a bromine “additive” into a mercury containing gas stream is incorrect because “$CaBr_2$ and NaBr are salts that exist as a solid or in aqueous solution” and that “[t]he ’640 Provisional teaches that the ‘additive’ is not the ‘promoter,’ because the ‘additive’ is used to ‘augment the ***treated*** activated carbon’ (i.e., sorbent that

had been previously promoted)—by capturing pollutants 'released to the gas phase as the sorbent becomes saturated or capacity limited.'" *Id.* at 3 (citing Ex. 1020 at 7). Petitioner also disputes Patent Owner's position that in recycling regenerated sorbent, a bromine containing promoter is injected separately into a mercury containing gas because some mercury is recycled with the sorbent. Prelim. Resp. 13. Petitioner contends that "the '640 Provisional does not disclosed recycled sorbent containing mercury" because the sorbent is regenerated "so that the sorbent 'captures mercury at the same level as before.'" Pet. Reply. 4 (citing Ex. 1020, 4). Further, according to Petitioner, even if mercury remains in in the sorbent, it would be present as a "solid-phase as part of a 'stable bond' to the sorbent, and not in a 'mercury containing gas.'" *Id.* (citing Ex. 1001, claim 18; Prelim. Resp. 11).

Having considered the parties' positions and evidence, we determine that Petitioner has demonstrated a reasonable likelihood that one or more of the applications in the priority chain for the '147 patent lacks written description from the '640 provisional application to support the challenged claims.

According to *Lockwood v. American Airlines, Inc*.

> [i]n order to gain the benefit of the filing date of an earlier application under 35 U.S.C. § 120, each application in the chain leading back to the earlier application must comply with the written description requirement of 35 U.S.C. § 112. *In re Hogan*, 559 F.2d 595, 609, 194 USPQ 527, 540 (CCPA 1977).

107 F.3d at 1571. Here, Figure 2 of the '640 provisional application and its corresponding written description are entirely missing from the intervening applications. *Compare* Ex. 1020, 12, Fig. 2, *with* Ex. 1021 ¶¶ 52–53, Fig. 2. Therefore, even if the '640 provisional application was found to provide

support for challenged claims 18 and 19 of the '147 patent, at least the '163 application and the '595 application do not include that written description from the '640 provisional application. Thus, there is a break in the priority chain.

And Patent Owner's remaining arguments are insufficient to establish that the '640 provisional application in question provides the requisite written description for claims 18 and 19. With respect to Figure 2, it is unclear whether the term "additive injection" in Figure 2 includes bromine or is limited to Group I or Group II elements, as Petitioner suggests, and further, whether an in-flight reaction occurs *in* the mercury-containing gas even assuming the "additive injection" includes bromine. For example, the '640 provisional application refers to "additives" as "Ca, Na, and others" as separate from the "additional substances," including bromine. *See e.g.*, Ex. 1020, Abstract, 3–4. The '640 provisional application further states that bromine may be reacted with the activated carbon in-flight and *within* "the duct through which the carbon is transported from a reservoir *to* the flue gas duct." *Id.* at 3 (emphasis added); *see also id.* 10–11 ("the sorbent can be readily treated with any combination of bromine and the second component in-flight using vapors of the these components contacting the very fine carbon particles dispersed in air or other gas stream that *conveys the particles to the flue gas duct*." (emphasis added)). Thus, the only teaching of an in-flight reaction between bromine and activated carbon occurs in the duct work before being introduced into the mercury containing gas.

In addition to relying on Figure 2, Patent Owner also urges us to consider the regenerated and recycled sorbent as including a "mercury-containing gas." Prelim. Resp. 13. However, the '640 provisional does not

describe any mercury recycled with the regenerated sorbent unlike the later filed '163 application. *Compare* Ex. 1020, *with* Ex. 1021, 10 ("the mercury-containing sorbent particles are regenerated to remove some or substantially all of the mercury"). Rather, the '640 provisional application states that "[t]he sorbent can be regenerated by washing off contaminating components derived from flue gas that poison the spent sorbent." Ex. 1020, Abstract; *see also id.* at 11 ("the poisoning contaminants from the flue gas are removed and an inexpensive promoting agent added to restore mercury sorption activity"). The '640 provisional application continues to explain that "[a] comparison of the sorbent after subsequent regeneration with HBr indicates that it not only captures mercury at the same level as before (100% capture) but is enhanced such that its capacity is prolonged by several minutes." *Id.* at 14. Furthermore, the '640 provisional application contrasts its inventive aspects against other prior art inventions where "Hg is only partially removed from the sorbent at temperatures up to 500°C. The sorbents do not work effectively after regeneration using this technique." *Id.* at 15.

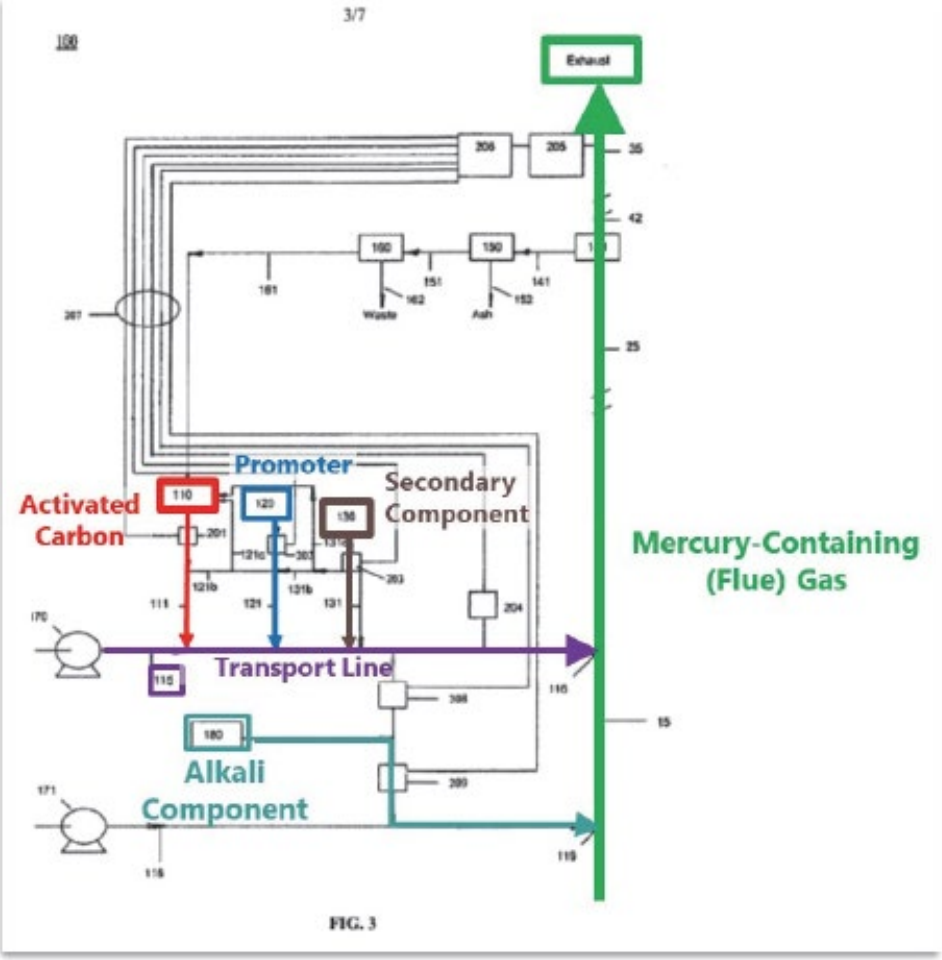
Lastly, Petitioner is correct that 37 C.F.R. § 1.57(c) (2005) permits incorporation by reference of essential material, which includes material necessary to provide a written description of the claimed invention, but it is critical to note that it limits such incorporations to U.S. patents and U.S. patent application publications. 37 C.F.R. § 1.57(c) (2005)). Patent Owner does not dispute this point. *See generally* Prelim. Resp.; Sur-reply; *cf. Ex parte Maziere,* 27 USPQ2d 1705, 1706–07 (BPAI 1993) (holding that if "essential material" is included in the application at issue, incorporation by reference in the parent application was sufficient to claim priority and to satisfy the written description requirement, but not discussing provisional

applications). Therefore, to the extent the provisional application provides support for the challenged claims, incorporation by reference of the provisional application by the '595 and '163 applications cannot cure the deficiencies discussed above.

2. Non-provisional applications

Petitioner contends that the intervening non-provisional applications, the '163 and '595 applications, do not disclose "injecting the sorbent and separately injecting the promoter into a mercury containing gas." Pet. 28 (citing Ex. 1003 ¶¶ 181–182). Petitioner contends that the non-provisional applications "describe 'in-flight' promotion only as treating the activated carbon with a bromine promoter ***before*** introduction into the mercury-containing flue gas." *Id.* at 28–29 (citing Ex. 1021 ¶ 75; Ex. 1022 ¶ 75).

Petitioner contends that annotated Figure 3 of the non-provisional applications illustrates that "in-flight promotion occurs before any injection into the mercury-containing gas," as reproduced below. *Id.* at 29–30.



According to Petitioner, annotated Figure 3 illustrates that "activated-carbon sorbent (red) and bromine-containing promoter (blue) are introduced into a transport line (purple), and thus react ***before*** being injected together into the mercury-containing gas (green)." *Id.* (citing Ex. 1021, 43; Ex. 1022, 42). Petitioner asserts that "there is no disclosure that the transport line contains any mercury-containing gas, as in Claim 19." *Id.* at 30.

Petitioner further argues that annotated Figure 1 of the non-provisional applications "reinforces that in-flight promotion occurs before any injection into the mercury-containing gas," as reproduced below. *Id.* at 31–32.

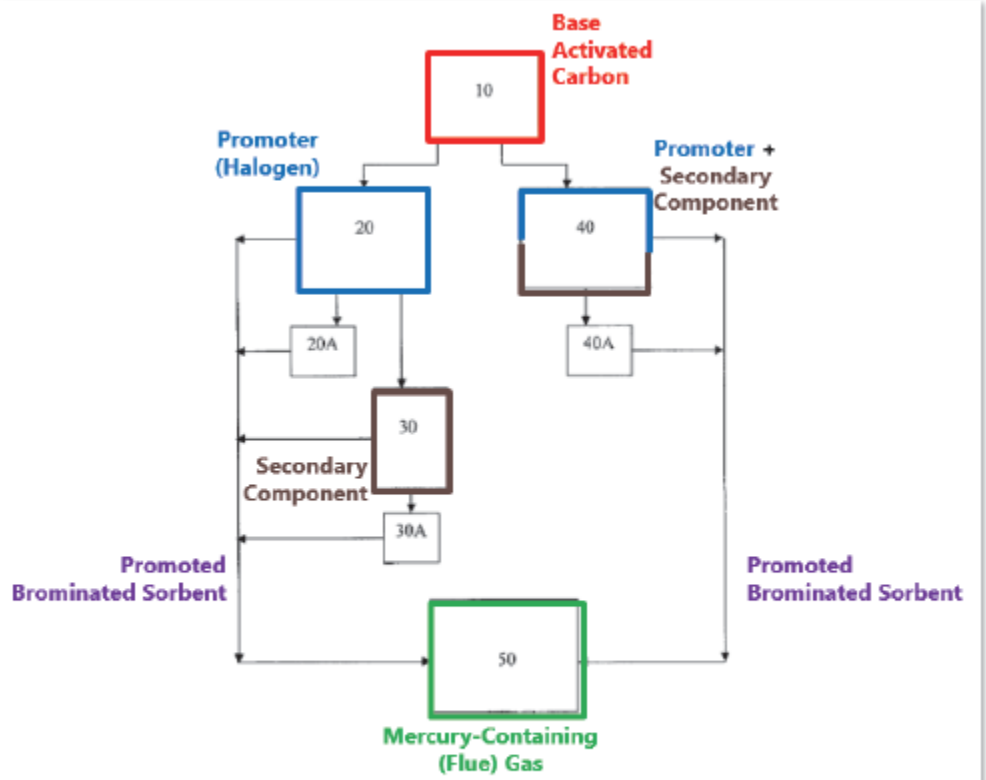


FIG. 1

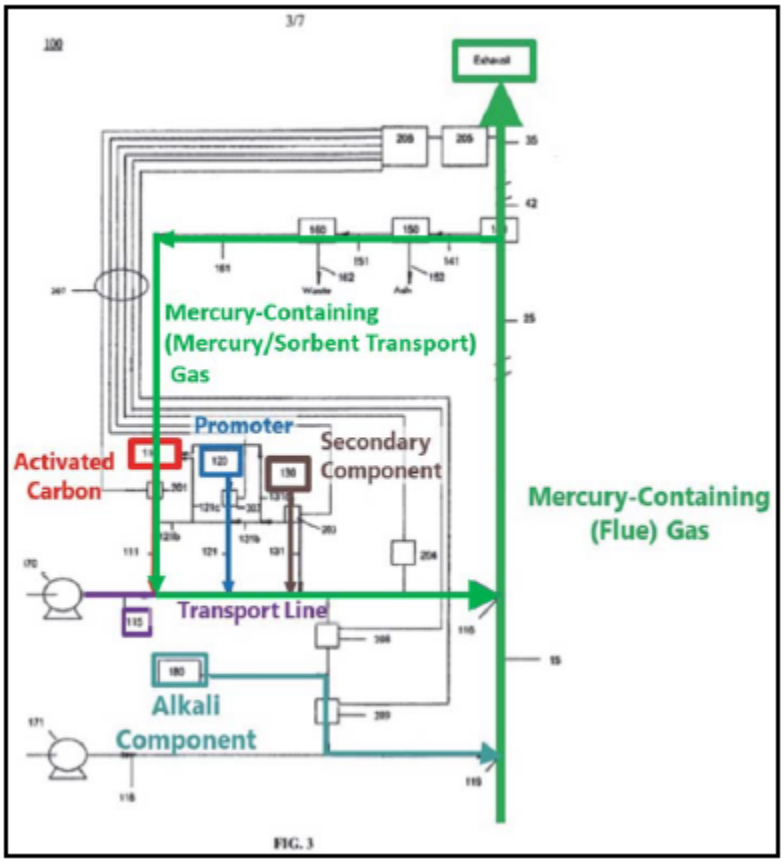
Petitioner contends that "[b]oth 'paths' for the base activated-carbon sorbent (red) illustrate the activated carbon reacting with the promoter (blue) to form a promoted brominated sorbent (purple) ***before*** being injected together into the mercury-containing gas (green), such that they are not injected separately." *Id.* at 31–32. Petitioner contends that Patent Owner cannot rely on replacement Figure 1 of the '147 patent, which includes a direct arrow between base activated carbon 10 and mercury-containing (flue) gas 50, because the replacement Figure 1 was not present in '163 and '595 applications. *Id.* at 32–34.

Patent Owner contends that the non-provisional applications supports claims 18 and 19 because: (1) the non-provisional applications are not

limited to a single point of injection and (2) the non-provisional applications describe a sorbent recycling system. Prelim. Resp. 15–19.

First, Patent Owner contends that the non-provisional applications disclose that "[f]or clarity, single injection points 116 or 119 are shown in Figure 3, although one skilled in the art will understand that multiple injection points are within the scope of the present invention." *Id.* at 15 (quoting Ex. 1021 ¶ 56). Patent Owner contends that "[t]his multiple injection point embodiment satisfies the requirement of 'injecting separately the bromine containing promoter into a gas stream.'" *Id.* at 15–16.

Second, Patent Owner submits a second annotated Figure 3, reproduced below, illustrating a sorbent recycling system.



Patent Owner contends that the '163 application discloses after "mercury is removed from the gas stream by the sorbent particles, the sorbent particles

are separated from the ash particles . . . and the sorbent particles are reinjected into the gas stream." *Id.* at 17 (citing Ex. 1021 ¶ 26). Patent Owner contends that

> [w]hen such a recycling system is in use, a transport gas is used to "reinject" used sorbent back into the transport line for sorbent and promoter. As a result, the transport gas is necessarily a mercury-containing gas because it contains the mercury recycled with the used sorbent. As shown in figure 3, bromine promoter is then separately injected into this mercury-containing transport gas as required by claims 18 and 19.

Id. at 17–18. Patent Owner also addresses Petitioner's annotated Figure 1, arguing that both paths may be used simultaneously so that "the promoter 20 in the left path is injected into the mercury-containing gas 50 separately from the activated carbon sorbent in the right path," thereby combining promoter 20 including activated carbon, with separately added activated carbon. *See id.* at 18–19.

Petitioner replies that "[w]hile multiple injection points may be used, the activated carbon and promoter are still injected together at each individual injection point, and not separately." Pet. Reply 5 (citing Ex. 1021, 43; Ex. 1022, 42; Pet. 29–31). Petitioner contends that Figure 3 of the '163 application "shows 'regenerated sorbent stream 161' combining with 'transport line 115' prior to subsequent promoter addition and combined injection into mercury-containing flue gas." *Id.* (citing Ex. 1021, 14–15, 43). And, with reference to Figure 1 of the '163 application, Petitioner asserts that "the intervening applications refer to these as two ***alternative*** embodiments, and do not refer to both paths being used in parallel or in the same embodiment." *Id.* (citing Ex. 1021, 12–13; 1022, 8–9). Further, in each alternative embodiment, "the promoter is combined with the activated

carbon ***prior*** to injection into mercury-containing gas." *Id.* (citing Prelim. Resp. 18; Pet. 30–31).

Patent Owner responds that Figure 3 of the '163 application "depicts a loop of recycled, mercury-containing gas into which activated carbon and bromine-containing promotor are both injected." Sur-reply 4.

On this record, we determine that Petitioner has demonstrated a reasonable likelihood that one or more of the non-provisional applications in the priority chain for the '147 patent lack the written description necessary to support claims 18 and 19 of the '147 patent. We are not persuaded by Patent Owner's arguments to the contrary as we discuss below. Patent Owner's first argument is that Figure 3 depicts multiple injection points 116 and 119 and that the '163 application explains that "single injection points 116 and 119 are shown in Figure 3, although one skilled in the art will understand that multiple injection points are within the scope of the present invention." Prelim. Resp. 15 (quoting Ex. 1021, ¶ 56). However, each of injection ports 116 and 119 depicts a transport gas to inject either the brominated sorbent or optional alkali components, respectively, *into the flue gas*. Ex. 1021, 14. There is no suggestion that bromine and the activated carbon are separately injected into mercury-containing flue gas line 15 through "multiple injection points." *Id.*

We are similarly unpersuaded by Patent Owner's argument regarding the recycle feed containing mercury gas because when activated carbon and regenerated sorbent are injected into transport line 115 through line 118 and the promoter is separately injected into transport line 115 through line 121 "the transport gas is necessarily a mercury-containing gas because it contains the mercury recycled with the used sorbent." Prelim. Resp. 18. At

this stage in the proceeding, it is unclear whether the skilled artisan at the time would have considered the small amount of mercury recycled after the sorbent is regenerated to be a "mercury-containing gas" as recited in claim 18. The '163 application makes clear that that the purpose of the '163 application is to remove mercury from the flue gas stream generated during the burning of coal and other fossil fuels. Ex. 1021, 5. The '163 application effects this purpose by using an electrostatic precipitator, a bag house, or both to remove mercury captured on the sorbent materials. *Id.* at 6, 10, 11, 15, 26, 27, 29. Though the '163 application explains that "the mercury-containing sorbent particles are regenerated to remove some or substantially all of the mercury," the mercury that may remain has formed a "stable bond" with the sorbent. Ex. 1021, 10, 13–14; *see also* Prelim. Resp. 11 ("When these components are mixed into mercury-containing gas, the mercury (Hg) is drawn toward the carbon and the bromine ion, creating a stable bond."). Furthermore, each instance of "mercury containing" gas in the '163 application refers to "mercury-containing flue gas" as opposed to a recycled sorbent containing some amount of mercury. *Id.* at 9, 12, 36. Therefore, without more, we understand the term "mercury-containing gas" to refer to the "mercury-containing flue gas" that is subject to treatment. We encourage the parties to address this issue in subsequent briefing and will revisit this issue based on the full record developed during trial.

Lastly, Patent Owner argues that Figure 1 of the '163 application depicts parallel, simultaneous feeds such that when each path combines with mercury-containing flue gas 50, a feed containing a halogen and a feed containing an activated carbon are separately injected into a mercury-containing gas. Prelim. Resp. 17–18. We are not persuaded by Patent

Owner's position and instead agree with Petitioner that Figure 1 depicts alternate embodiments. According to the '163 application, "Figure 1 schematically illustrates *methods* for preparation of promoted carbon sorbents in accordance with the present invention." Ex. 1021, 10 (emphasis added). The '163 application provides further details of these embodiments and explains that the left-hand path of Figure 1 describes "a preferred embodiment illustrated by path 10-20, block 10 illustrates providing a base activated carbon, and adding a halogen or halide promoter that reacts with the carbon, illustrated at block 20, to produce a product promoted carbon sorbent." *Id.* at 12. According to the '163 disclosure, the right-hand path describes

> *another* preferred embodiment of the process of the present invention is illustrated by path 10-40, comprising providing a base activated carbon as illustrated at block 10, and adding a halogen or halide promoter and a secondary component to the activated carbon together, with which they react as illustrated by block 40, producing a product promoted carbon sorbent.

Id. (emphasis added)

Moreover, although we have only analyzed the '595 and '163 applications, we also look to the incorporation statements in the other applications in the chain leading to the '219 application. The '219 application provides that it "is a continuation of U.S. patent application 12/201,595 . . . which is a division of U.S. patent application 11/209,163 . . . which claims priority *to the extent appropriate* from provisional application 60/604,640." Ex. 1019, 54. The '219 application then states that "Application Serial Numbers 12/201,595; 11/209,163; and 60/604,640 are incorporated herein by reference." *Id.* "To incorporate material by reference, 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." *Zenon Envtl., Inc. v. U.S. Filter Corp*., 506 F.3d 1370, 1378, 1379 (Fed. Cir. 2007) (quoting *Cook Biotech Inc. v. Acell, Inc*., 460 F.3d 1365, 1376 (Fed. Cir. 2006)). It is unclear to us what "to the extent appropriate" means in this context. The '219 application claims priority "to the extent appropriate" and fails to identify with detailed particularity the specific material incorporated and fails to clearly indicate where that material is found in the various documents. *See also* MPEP 211.02 ("In view of this requirement for a specific reference in the later-filed application, the right to rely on a prior art application may be waived by an applicant if a proper reference to the prior application is not included in the later-filed application."). This ambiguity creates an additional concern regarding the chain of priority for the '219 application.

In view of the present record, Petitioner has demonstrated that one or more of the applications in the priority chain for the '147 patent lack written description support for challenged claims 18 and 19. Patent Owner, on this record, has not presented persuasive arguments or evidence that claims 18 and 19 of the '147 patent are entitled to a priority date earlier than April 6, 2009, the filing date of the '219 patent.

E. Discretion to Deny Institution

1. 35 U.S.C. § 325 (d)

Patent Owner contends we should deny institution under 35 U.S.C. § 325(d) because "Petitioners fail to demonstrate any pressing need for a separate review of two claims of this patent." Prelim. Resp. 1. Patent Owner further asserts that "Petitioners have already demonstrated that they may raise a priority date dispute in their primary petition," therefore, "the

Board should deny this petition as duplicative and an unnecessary burden on the Board and the parties." *Id.* (citing IPR2020-00834, Paper 16).

Section 325(d) provides that in determining whether to institute an *inter partes* review, "the Director may take into account whether, and reject the petition or request because, the same or substantially the same prior art or arguments previously were presented to the Office." The Board uses a two-part framework in determining whether to exercise its discretion under § 325(d), specifically:

> (1) whether the same or substantially the same art previously was presented to the Office or whether the same or substantially the same arguments previously were presented to the Office; and (2) if either condition of the first part of the framework is satisfied, whether the petitioner has demonstrated that the Office erred in a manner material to the patentability of challenged claims.

Advanced Bionics, LLC v. Med-El Elektromedizinische Geräte GmbH, IPR2019-01469, Paper 6, 8 (PTAB Feb. 13, 2020) (precedential).

We have reviewed Patent Owner's arguments and evidence of record and determine that the *Advanced Bionics* factors weigh against exercising our discretion under § 325(d). Patent Owner does not allege that the Examiner considered any reference offered in the instant Petition or that the same or similar arguments were before the Office during prosecution of the '147 patent. *See generally* Prelim. Resp. 1. And, though Patent Owner argues that this Petition is "duplicative [of Petitioner's primary petition] and an unnecessary burden," Patent Owner fails to explain how the prior art and arguments of the instant Petition—filed contemporaneously with Petitioner's primary petition—that *were not previously presented to the Office* implicates the concerns addressed by the statutory language of § 325(d). Without

more, we decline to exercise our discretion to deny the Petition under 35 U.S.C. § 325(d).

2. 35 U.S.C. § 314(a)

Under § 314(a), we have discretion to deny institution of an *inter partes* review. *Cuozzo Speed Techs., LLC v. Lee*, 136 S. Ct. 2131, 2140 (2016); *SAS Inst. Inc. v. Iancu*, 138 S. Ct. 1348, 1356 (2018); *Harmonic Inc.*, 815 F.3d at 1367 ("[T]he PTO is permitted, but never compelled, to institute an IPR proceeding."); *see also* 37 C.F.R. § 42.4(a) ("The Board institutes the trial on behalf of the Director."). In deciding whether to institute an *inter partes* review, we consider the guidance provided in the Consolidated Trial Practice Guide, which states that

> [b]ased on the Board's prior experience, one petition should be sufficient to challenge the claims of a patent in most situations. Two or more petitions filed against the same patent at or about the same time . . . may place a substantial and unnecessary burden on the Board and the patent owner and could raise fairness, timing, and efficiency concerns.

Patent Trial and Appeal Board Consolidated Trial Practice Guide ("Consolidated TPG") 64 (Nov. 2019), https://www.uspto.gov/sites/default/files/documents/ tpgnov.pdf, 59.

Here, Petitioner filed two petitions on the same day, one challenging claims 18 and 19 and the other challenging claims 17–20 of the '147 patent. Pet. 1; IPR2020-00926, Paper 2, 1.[8] In this Petition, Petitioner presents two obviousness grounds, one based on Lissianski-Presentation as the main reference and the other based on Sjostrom as the main reference. Pet. 10. In

[8] Patent Owner statutorily disclaimed the non-'in-flight' claims of the '147 patent, i.e., claim 1–16 and 21–25, leaving only claim 17–20 remaining. IPR2020-00926, Paper 13.

IPR2020-00926, Petitioner presents four obviousness challenges, the two based on Nelson[9] and Olson-Paper[10] and the remaining two based on Downs-Halogenation,[11] Olson-Paper, and Lissianski.[12] IPR2020-00926, Paper 2, 10.

Petitioner "request[s] that the Board institute on both petitions" but explain that two petitions are warranted because the two petitions assert different priority dates and assert different references, citing the Consolidated Trial Practice Guide's statement that "more than one petition may be necessary . . . when there is a dispute about priority date requiring arguments under multiple prior art references." Explanation 1, 3 (quoting Consolidated TPG 59). According to Petitioner,

> Petitioners expect Patent Owner to argue that all the claims of the '147 Patent can trace priority back to a provisional application filed August 30, 2004, while Petitioners dispute this. Petitioners assert that two of the claims—Claims 18 and 19—have no support in the Provisional or intervening applications, and thus the earliest priority date for these two claims is the filing date of what became the '147 Patent, April 9, 2009.

Id. at 1. The Explanation ranks this Petition second to the Petition in IPR2020-00926. *Id*. at 2.

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[9] Nelson, Jr., US 6,953,494 B2, issued October 11, 2005 (Ex. 1012, "Nelson").
[10] E.S. Olson et al., *Chemical mechanisms in mercury emission control technologies*, 107 J. Phys. IV France 979–982 (2003) (Ex. 1079, "Olson-Paper").
[11] Downs et al., US 2007/0180990 A1, published August 9, 2007 (Ex. 1015, "Downs-Halogenation").
[12] Lissianski et al., US 7,514,052 B2, issued April 7, 2009 (Ex. 1036, "Lissianski").

Petitioner further argues that the issues presented to the Board by the two Petitions are limited, because the Petition in this proceeding uses two primary references and a single secondary reference, whereas the Petition in IPR2020-00926 uses two primary references and two secondary reference. *Id.* at 3. Petitioner also argues that they joined efforts to provide efficiency instead of each party individually filing separate petitions. *Id.* at 4–5.

We find Petitioner's arguments persuasive. The Petitions include different prior art references that address potentially different priority date arguments. Such a situation is contemplated by the Consolidated Trial Practice Guide, which states that "more than one petition may be necessary . . . when there is a dispute about priority date requiring arguments under multiple prior art references." Consolidated TPG 59. Notwithstanding Petitioner's and Patent Owner's post-Petition arguments regarding the similarity of the priority date arguments, the fact remains that the Petitions themselves present different priority date arguments and rely on different prior art references. The Petitions are the documents to which the Patent Owner will be responding in the *inter partes* review proceeding. For the reasons discussed below, *inter partes* review will be instituted in this proceeding. We also institute *inter partes* review in IPR2020-00926 for the reasons discussed in that proceeding.

3. 35 U.S.C. § 312(a)(2)

Patent Owner argues that "35 U.S.C. § 312(a)(2) provides that a petition may only be considered if 'the petition identifies all real parties in interest.'" Prelim. Resp. 1–2. Patent Owner contends that Petitioner lists "dozens of 'potential real parties in interest,' without explanation as to their relationship to petitioners," that this "is not an identification of *all real*

parties in interest," and that, if instituted, this proceeding would be under a cloud of uncertainty because the ambiguity in Petitioner's list "will likely lead to confusion and disputes as to which parties are real parties in interest and which are bound by the estoppel provisions of 35 U.S.C. § 315." *Id.* at 2. For instance, Patent Owner asserts that Petitioner identifies various vendors and suppliers as "potential real parties in interest" but states that "[n]one of these companies or any unnamed entity is funding, controlling, or directing, or otherwise has an opportunity to control or direct this Petition or proceeding" and this implies that these entities are not actually real parties in interest. *Id*. In addition, Patent Owner argues that some entities are identified both as "potential real parties in interest" and "real parties in interest," which creates ambiguity and conflict in the listing of entities. *Id*. For these reasons, Patent Owner contends that "Petitioners have not met their burden of identifying all real parties in interest" and "the Board should deny institution for failure to comply with § 312(a)(2)." *Id.* at 3, 11–12.

We are not aware of, and Patent Owner does not direct us to, any rule, statute, or case law that prohibits Petitioner from identifying multiple real parties-in-interest or multiple potential real parties-in-interest. Petitioner's identification of about a dozen real parties-in-interest does not appear problematic or overly burdensome. Pet. 1–2. Petitioner's identification of numerous potential real parties-in-interest, albeit unusual, also does not appear problematic. *Id.* at 2–6. To the extent Petitioner has identified an entity as both a real party-in-interest and as a potential real party-in-interest, we interpret that to mean that party is identified as a real party-in-interest. Petitioner's reasons for identifying numerous potential real parties-in-interest reasons appear plausible: Petitioner identifies these parties "out of

an abundance of caution" because they "are vendors and suppliers" in the related litigation but have not "agreed to be listed as a real party-in-interest" in this Petition. Pet. 1–6. This provides the Board and Patent Owner notice that other potential entities may be indirectly involved, but also provides reasons for not committing those parties to the real party-in-interest category. Ordinarily, problems regarding identification of real parties-in-interest arise when a petitioner fails to identify a real party-in-interest. *See, e.g., Ventex Co., Ltd. v. Columbia Sportswear N. Am., Inc.*, IPR2017-00651, Paper 152 (PTAB Jan. 24, 2019) (precedential) (terminating proceeding where Petition failed to name time-barred RPI and privy). Here, the alleged problem is over-identification of potential real parties-in-interest. Without express violation of a known rule, statute, or case law, this does not appear to be a problem warranting a denial on institution of *inter partes* review.

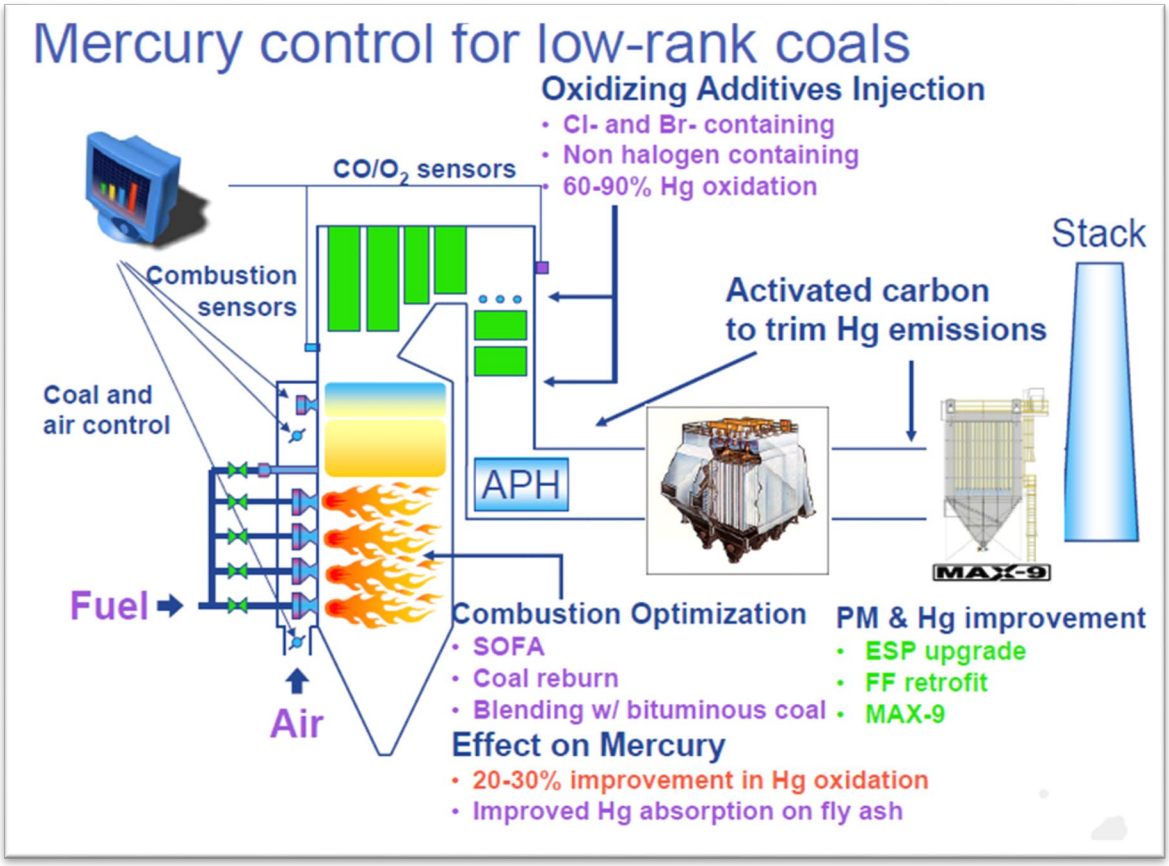
F. Alleged Obviousness Based on Lissianski-Presentation and Olson

Petitioner contends claims 18 and 19 are rendered obvious over the combination of Lissianski-Presentation and Olson. Pet. 34–75. Petitioner also relies on the testimony of Dr. Niksa to support its arguments. *Id.*

1. Lissianski-Presentation (Ex. 1011)

Lissianski-Presentation relates to removing mercury from flue gas of coal-fired power plants using activated-carbon sorbent and halogen-promoter injection. Ex. 1011, 9.

Lissianski-Presentation illustrates a mercury capture process in a figure titled "Mercury control for low-rank coals," reproduced below. Ex. 1011, 9.



The figure on page 9 shows coal introduced into a combustion chamber to generate a flue gas, followed by an injection of oxidizing additives including chlorine and bromine into the flue gas stream. *Id.* Activated carbon is then introduced into the flue gas stream before being fed through an electrostatic precipitator and baghouse filter to remove mercury. *Id.* Lissianski-Presentation describes the activated carbon sorbent as "Darco FGD." *Id.* at 8.

2. Olson (Ex. 1014)

Olson is the patent application publication of the '163 application, from which the '147 patent claims priority. Ex. 1001, code (60). Petitioner contends that because the '163 application does not support claims 18 and 19 of the '147 patent, Olson qualifies as prior art as of its publication date on

March 9, 2006, prior to the filing date of the '147 patent on April 6, 2009. *See* Pet. 42.

Olson describes the mechanism by which a bromine-promoted activated carbon sorbent captures mercury from flue gas, as illustrated in Figure 2, reproduced below. Ex. 1014 ¶ 54.

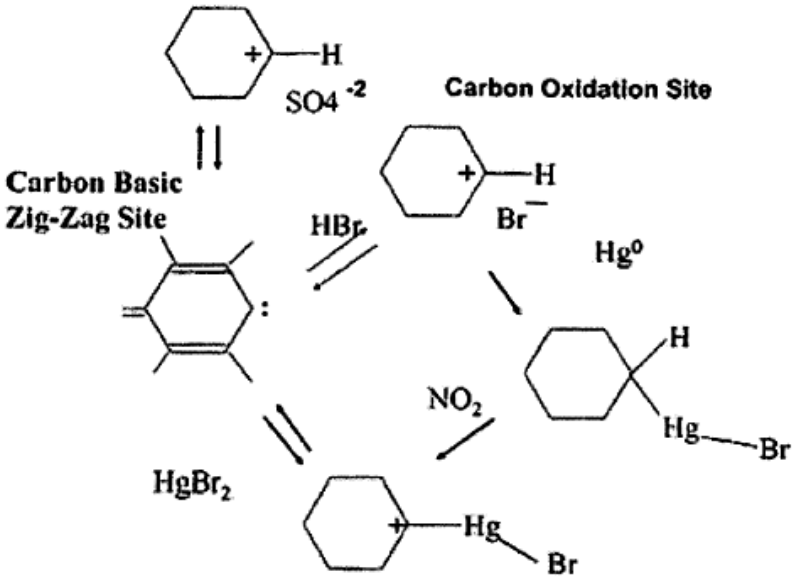


FIG. 2

Figure 2 "illustrates a proposed mechanistic model of the chemical reactions resulting in the oxidation and capture of mercury." *Id.* ¶ 33. Olson discloses that hydrogen bromide reacts with the unsaturated structure of the active carbon by way of a carbene species on the edge of the graphene sheet structures of the carbon. *Id.* ¶ 54.

3. Public Accessibility of Lissianski-Presentation

Petitioner contends that Lissianski-Presentation was a presentation "delivered at the Electric Utilities Environment Conference ("EUEC") in January 2006 and mailed on CD to conference participants within a few

weeks." Pet. at 36. Accordingly, Petitioner contends Lissianski-Presentation qualifies as prior art under: (1) 35 U.S.C. § 102(a) "because it was made available to the relevant public and POSITAs on January 24, 2006 when it was presented" and (2) 35 U.S.C. § 102(b) because it was mailed on CD in February 2006, meeting the standard for public accessibility set forth in *GoPro, Inc. v. Contour IP Holding LLC*, 908 F.3d 690, 693 (Fed. Cir. 2018). *Id.* at 39.

Patent Owner does not dispute whether Lissianski-Presentation was publicly accessible. *See generally* Prelim. Resp.

On this record, Petitioner has demonstrated a reasonable likelihood that Lissianski-Presentation was publicly available. *Hulu, LLC v. Sound View Innovations, LLC*, IPR2018-01039 (PTAB Dec. 20, 2019) (Paper 29) (for purposes of institution, a petitioner must show a reasonable likelihood that an asserted reference qualifies as a printed publication). Petitioner provides evidence that Lissianski-Presentation was presented at the 2006 EUEC on January 22–25, 2006, and that there were over a thousand attendees. *Id.* at 36–37 (citing Ex. 1003 ¶¶ 259–264; Ex. 1047, 27; Ex. 1049, 1–30; Ex. 1048). Petitioner's evidence does not indicate that attendance of the 2006 EUEC was restricted. *Id.* Petitioner also provides evidence of the CD that was mailed to the conference attendees and copies of the Lissianski-Presentation presentation from the CD, without any apparent restriction or expectation of confidentiality. *Id.* at 36–39 (citing Ex. 1003 ¶¶ 269–272; Ex. 1047, 24, 27; Ex. 1049, 1–30; Ex. 1048; *GoPro*, 908 F.3d at 694–95). Therefore, on this record, Petitioner has met its burden of showing that Lissianski-Presentation qualify as printed publications.

4. Analysis of Claims 18 and 19

Although claim 1 is disclaimed and claim 17 is not asserted in the instant Petition, claims 18 and 19 depend from and include the limitations of claims 1 and 17. Ex. 1001, 24:34–41. Accordingly, we review Petitioner's contentions as to claim 1, followed by the additional limitations of claim 17, before we address challenged claims 18 and 19. *See generally id.*, claims.

Petitioner contends that much of claim 1 is suggested by Lissianski-Presentation. Pet. 47–67. Petitioner relies primarily on page 9 of Lissianski-Presentation, reproduced above, to illustrate its contentions. Ex. 1011, 9. With reference to claim 1, Petitioner asserts that Lissianski-Presentation teaches a method for separating mercury from a mercury-containing flue gas because Lissianski-Presentation describes separately introducing both bromine and a chemical sorbent, i.e., activated carbon into a flue gas. Pet. 47–48 (citing Ex. 1011, 1–2, 9), 49–50 (citing Ex. 1003 ¶¶ 538–540). Petitioner asserts that "[t]he system of Lissianski-Presentation would have formed a promoted brominated sorbent that would adsorb mercury to form a mercury/sorbent chemical composition" and then would have used "particulate material separators to remove the mercury-sorbent chemical composition from the flue gas, such as an ESP and a fabric filter (or baghouse)." *Id.* at 48 (citing Ex. 1011, 9); 65–68 (citing Ex. 1001, 9, 10; Ex. 1003 ¶¶ 559–561).

According to Petitioner, a person of ordinary skill in the art "would have understood that the bromine and activated carbon would have contacted and reacted in the flue gas to form promoted-brominated sorbent." *Id.* at 51 (citing Ex. 1003 ¶ 541). Relying on the testimony of Dr. Niksa, Petitioner explains that "at least some of the bromine-containing promoter

injected into the flue gas of Lissianski-Presentation would have contacted the sorbent in mercury-containing gas, at or downstream[,] of the sorbent injection point, because not all of the bromine would have been consumed in oxidizing mercury in the gas-phase." *Id.* at 53–54 (citing Ex. 1003 ¶ 546). Petitioner states that "even though Lissianski-Presentation identifies oxidation of the mercury with bromine, it would have been obvious to use a sufficient amount of bromine such that the sorbent also is promoted" because "[i]t was well-known . . . that halogens improve the ability of activated carbon to capture mercury." *Id.* at 54–55 (citing Ex. 1003 ¶¶ 547; Ex. 1062, 2–3, 1079, 979). And Olson similarly "teaches the advantages of promoting activated-carbon sorbent with bromine containing promoter" that comprises "gaseous HBr or Br_2." *Id.* at 55 (citing Ex. 1014 ¶¶ 43, 66), 56–57 (citing Ex. 1014, 12, 54; Ex. 1003 ¶¶ 549–551), 58–59 (describing gaseous bromine) (citing Ex. 1011, 9; 1014, ¶¶ 52, 66; 1003 ¶¶ 128–129, 150–163; Ex. 1041).

Both Lissianski-Presentation and Olson exemplify Darco FGD, i.e., the activated carbon sorbent, which Olson teaches includes graphene sheets having a carbene species on edge sites. *Id.* at 59–61 (Ex. 1014 ¶¶ 54, 95; Ex. 1003 ¶¶ 554–555). Petitioner argues that Olson provides details of the chemical reaction that occurs between the bromine species and the unsaturated carbon. *Id.* at 61–62 (citing Ex. Ex. 1014 ¶¶ 93, 96; Ex. 1003 ¶ 556). And, according to Petitioner, a person of ordinary skill in the art "would have understood that the promoted brominated sorbent . . . would have chemically reacted with elemental mercury in the mercury containing gas (i.e., flue gas) to form a mercury/sorbent chemical composition," as

described in Olson. *Id.* at 62–64 (citing Ex. 1011, 9; Ex. 1014 ¶¶ 43, 128; Ex. 1003 ¶¶ 557–558).

Petitioner contends that the skilled artisan would have had reason to combine the teachings of Lissianski-Presentation and Olson because Olson teaches that a halogen, like bromine, can be used "to increase the effectiveness of a conventional sorbent (activated carbon) to capture mercury from coal flue gas" and that Olson "provides certain implementational details . . . such as which specific 'Br-containing' chemicals to use and the ratios of bromine promoter to activated-carbon sorbent." *Id.* at 42–47 (citing Ex. 1011, 1–2, 8–9, 19; Ex. 1014 ¶¶ 54, 66, 75, 95, 111, 113; Ex. 1003 ¶¶ 529–537).

Petitioner similarly alleges that the subject matter of claim 17 is suggested by the combination of Lissianski-Presentation and Olson. *Id.* at 68–73. Specifically, Petitioner contends that Lissianski-Presentation separately injects the bromine promoter and activated carbon sorbent into the flue gas stream. *Id.* at 68–70 (citing Ex. 1011, 9; 1014 ¶¶ 57, 66, Fig. 3; Ex. 1003 ¶ 562). Petitioner argues that a person of ordinary skill in the art would have understood that an in-flight reaction would occur between the bromine promoter and activated carbon. *Id.* at 70–72 (citing Ex. 1014 ¶¶ 11, 22, 24, 27, 43, 62, 66, 77–78; Ex. 1003 ¶¶ 563–566). Finally, Petitioner contends that Olson discloses a bromine promoter to sorbent ratio "from about 1 to about 30 grams per 100 grams of activated carbon." *Id.* at 72 (quoting Ex. 1014 ¶ 23, claims 3, 17, 37, 47).

Claim 18 additionally requires that the "gas stream is a mercury containing gas." Ex. 1001, 24:42–43. Petitioner contends that Lissianski-Presentation "discloses injecting the bromine-containing promoter into

mercury-containing flue gas upstream of the air preheater ("APH"), and separately injecting the activated-carbon sorbent either between the APH and [electrostatic precipitator ("ESP")], or between the ESP and fabric filter" ("FF"). Pet. 74. Petitioner contends that a person of ordinary skill in the art "would have understood that coal combustion produced a mercury containing flue gas, which would be created at or before the bromine injection points." *Id.* at 74–75 (citing Ex. 1003 ¶ 570).

Claim 19 additionally requires that the "gas stream is a transport gas." Ex. 1001, 24:44–45. Petitioner contends that Lissianski-Presentation "discloses an in-flight reaction in the flue gas between bromine and activated carbon to form an improved sorbent. A [person of ordinary skill in the art] would have understood that coal combustion produced a mercury-containing flue gas, and that the mercury-containing gas transported the bromine-containing promoter of Lissianski-Presentation to the activated-carbon sorbent." *Id.* at 75 (citing Ex. 1003 ¶ 571).

Patent Owner does not substantively address Petitioner's contentions regarding the teachings of Lissianski-Presentation and Olson, but rather rests on arguments advanced above regarding the priority date of claims 18 and 19 of the '147 patent. *See generally* Prelim. Resp.; *see also id.* at 1 n.1 ("For purposes of this preliminary response only, Patent Owner does not dispute that the asserted art renders the claims at issue unpatentable, and will only focus on the priority dispute."). Based on the preliminary record before us, we determine that Petitioner's arguments and evidence are sufficient to show each limitation of claims 18 and 19 is present in the combination of Lissianski-Presentation and Olson. Because we determined above (*supra* Section II.D.) that claims 18 and 19 of the '147 patent are not entitled to a

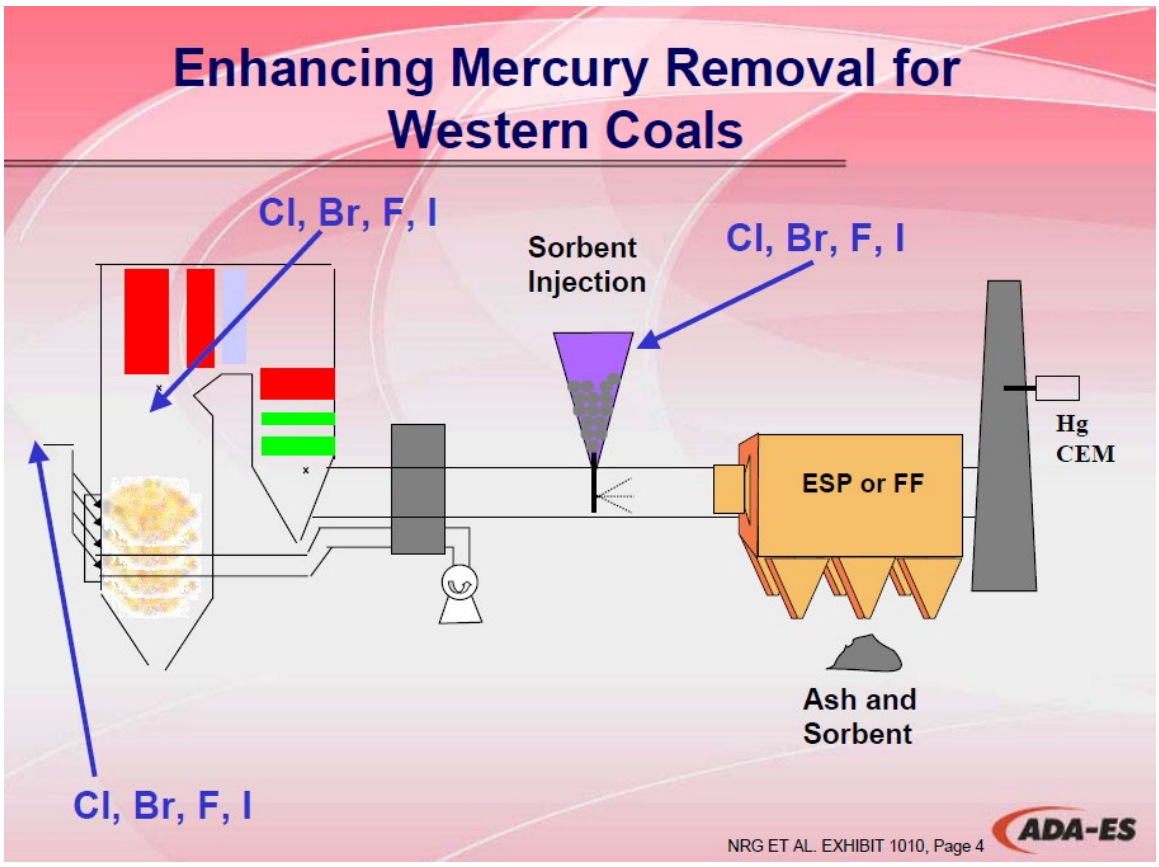
date of invention prior to the filing of date of the '147 patent, i.e., April 6, 2009, we determine that Petitioner has established a reasonable likelihood of prevailing on its challenge to claims 18 and 19 as obvious over the combination of Lissianski-Presentation and Olson.

G. Alleged Obviousness Based on Sjostrom and Olson

Petitioner contends claims 18 and 19 are rendered obvious over the combination of Sjostrom and Olson. Pet. 75–104. Petitioner also relies on the testimony of Dr. Niksa to support its arguments. *Id.*

1. Sjostrom (Ex. 1010)

Sjostrom relates to methods for enhancing mercury removal from coal flue gas. Ex. 1010, 4. Sjostrom illustrates a mercury capture process in a figure titled "Enhancing Mercury Removal for Western Coals," reproduced below. Ex. 1010, 4.



The figure on page 4 illustrates a coal combustion process including combusting coal, injecting halogens, separately injecting a halogenated sorbent, and collecting particulates. *See id.* Sjostrom discloses using Powder River Basin "(PRB") coal having a mercury content of "0.04–0.1 ppm-dry." *Id.* 12, 18. Sjostrom discloses that flue gas treated with existing equipment, i.e., without halogen-promoted activated carbon, contains 11.2 μg/dncm mercury. *Id.*, 3.

2. Public Accessibility of Sjostrom

Petitioner contends that Sjostrom was a presentation "delivered at the EUEC in January 2005 and mailed on CD to conference participants within a few weeks." Pet. at 78. Accordingly, Petitioner contends Sjostrom qualifies as prior art under: (1) 35 U.S.C. § 102(a) "because it was made available to the relevant public and POSITAs on January 25, 2005—the date it was presented" and (2) 35 U.S.C. § 102(b) because it was mailed on CD in February 2005. *Id.* at 80.

Patent Owner does not dispute whether Sjostrom was publicly accessible. *See generally* Prelim. Resp.

On this record, Petitioner has demonstrated a reasonable likelihood that Sjostrom was publicly available. *Hulu*, IPR2018-01039 (Paper 29) (for purposes of institution, a petitioner must show a reasonable likelihood that an asserted reference qualifies as a printed publication). Petitioner provides evidence that Sjostrom was presented in Tucson, Arizona on January 25, 2005, at the 2005 EUEC and that there were over eight hundred attendees. Pet. 78 (citing Ex. 1003 ¶¶ 265–268; Ex. 1030, 2–3, 23, 106–118; Ex. 1031). Petitioner's evidence does not indicate that attendance of the 2005 EUEC was restricted. *Id.* Petitioner also provides evidence of the CD that was

mailed to the conference attendees and copies of the Sjostrom presentation from the CD, without any apparent restriction or expectation of confidentiality. Ex. 1003 ¶ 267–268; Ex. 1030, 2–3; Ex. 1010; Ex. 1011; *GoPro*, 908 F.3d at 694–95. Therefore, on this record, Petitioner has met its burden of showing that Sjostrom qualifies as printed publications.

3. Analysis of Claims 18 and 19

Although claim 1 is disclaimed and claim 17 is not asserted in the instant Petition, claims 18 and 19 depend from and include the limitations of claims 1 and 17. Ex. 1001, 24:34–41. Accordingly, we review Petitioner's contentions as to claims 1 and 17, before we address the additional limitations of challenged claims 18 and 19. *See generally id.*, claims.

Petitioner contends that much of claim 1 is suggested by Sjostrom. Pet. 84–96. Petitioner relies primarily on page 4 of Sjostrom, reproduced below, to illustrate its contentions. *Id.* With reference to claim 1, Petitioner asserts that Sjostrom teaches a method for separating mercury from a mercury-containing flue gas because Sjostrom describes separately introducing both bromine and a chemical sorbent into a flue gas, from a coal-fired power plant, followed by the removal of particulate material. *Id.* at 84–85 (citing Ex. 1010, 1, 12, 18; Ex. 1003 ¶¶ 107–108, 579). Petitioner explains that "Sjostrom describes passing the flue gas through an electrostatic precipitator (ESP) or fabric filter (FF) after the bromine and sorbent injection, each of which separate mercury/sorbent particulates and fly ash." *Id.* at 95–96 (citing Ex. 1003 ¶¶ 597–599; Ex. 1010, 4).

According to Petitioner, a person of ordinary skill in the art "would have understood that the bromine and activated carbon would have contacted and reacted in the flue gas to form promoted-brominated sorbent"

when implementing the embodiment where bromine is added at location 2. *Id.* at 85–86 (citing Ex. 1003 ¶ 580–581; Ex. 1010, 4). Petitioner argues that a person of ordinary skill in the art "would have understood that the bromine-containing promoter added at Location 2 of Sjostrom would have contacted the sorbent in the flue gas at or downstream of the sorbent injection point" and that introducing bromine would have "improved mercury capture both by reacting with mercury in the gas-phase to oxidize mercury, and also by reacting with the activated-carbon sorbent." *Id.* at 88 (citing Ex. 1010, 4; Ex. 1003 ¶ 583). Petitioner asserts that like Sjostrom, Olson "proposes that reactions between HBr(g) and/or Br_2(g) and activated-carbon sorbent are one of promotion, as described" by the claims. *Id.* at 89 (citing Ex. 1014 ¶ 12); *see id.* at 88–90 (citing Ex. 1010, 4; Ex. 1014 ¶¶ 12, 14, 43, 54, 66; Ex. 1003 ¶¶ 583–587).

Petitioner contends that Sjostrom and Olson each describe using activated carbon sorbents, particularly Darco FGD. *Id.* at 87 (citing Ex. 1010, 4, 10–11, 16, 20), 91 (citing Ex. 1010, 16; Ex. 1014 ¶ 95). Olson describes its sorbent as having "a carbene species on the edge of the graphene sheet structure of the activated carbon." *Id.* at 91 (citing Ex. 1014 ¶¶ 54, 95). According to Petitioner, Olson describes "the brominated carbon contains both covalent carbon-bound (organic) bromide as well as ***anionic bromide***" and "that this reaction "provides a highly reactive bromine containing reagent that can oxidize the mercury and promote its capture on the activated carbon." *Id.* at 93 (citing Ex. 1014 ¶¶ 93, 96; Ex. 1003 ¶ 594). Petitioner further asserts that a person of ordinary skill in the art would have understood that the brominated sorbent would have chemically reacted with the mercury in the flue gas to form a mercury/sorbent composition," as

described in Olson. Pet. 93–94 (citing Ex. 1010, 16; Ex. 1014 ¶¶ 43, 128; Ex. 1003 ¶¶ 595–596).

Petitioner contends that the skilled artisan would have had reason to combine the teachings of Sjostrom and Olson because Olson provides "well-known details regarding the chemicals and proposed reaction mechanisms underlying the system of Sjostrom for mercury control from coal flue gas" and because Olson describes specific bromine species, i.e., HBr or Br_2, as useful in a bromination reaction. *Id.* at 80–84 (citing Ex. 1011, 1–2, 4, 10–11, 15–16; Ex. 1014 ¶¶ 22, 54, 66, 95, Fig. 2; Ex. 1003 ¶¶ 572–578).

Petitioner further alleges that the subject matter of claim 17 is suggested by the combination of Sjostrom and Olson. *Id.* at 97–102. Specifically, Petitioner contends that "Sjostrom teaches injecting bromine into the boiler, upstream of the sorbent injection point." *Id.* at 97 (citing Ex. 1010, 4; Ex. 1003 ¶ 600–601). Petitioner asserts that a person of ordinary skill in the art would have understood that the halogen is injected at Location 2, while an untreated carbon is separately injected into the flue gas. *Id.* at 98–99 (citing Ex. 1010, 4, 16; Ex. 1003 ¶ 601; Ex. 1009, 4676). Alternatively, Petitioner alleges that "even if a [person of ordinary skill in the art] were to include bromine at both Location 2 and Location 3 (i.e., creating a brominated sorbent at Location 3), this brominated sorbent is still a 'sorbent material comprising activated carbon,' which means that [the] sorbent can include other components besides activated-carbon, such as halogens." *Id.* at 99–100 (citing Ex. 1001, 7:44–46, 10:34–57; Ex. 1003 ¶ 602). Petitioner argues that an in-flight reaction occurs between the bromine promoter and activated carbon. *Id.* at 100–101 (citing Ex. 1014 ¶¶ 11, 22, 24, 27, 62, 66, 77–78; Ex. 1003 ¶¶ 603–605). Lastly, Petitioner

contends that Olson discloses a bromine promoter to sorbent ratio "from about 1 to about 30 grams per 100 grams of activated carbon." *Id.* at 102 (quoting Ex. 1014 ¶ 23, claims 3, 17, 37, 47 and citing Ex. 1003 ¶¶ 606–607).

With respect to claim 18, Petitioner contends that "Sjostrom describes injecting 'Br' promoter into a coal-fired boiler (e.g., combustion chamber)." Pet. 102 (citing Ex. 1010, 4). Petitioner contends that Sjostrom discloses both the coal and the flue gas contain mercury; thus, the Sjostrom discloses injecting bromine into a mercury-containing gas. *Id.* at 103–104. Petitioner further contends that "the sorbent is also injected into a mercury-containing gas." *Id.* at 104. Sjostrom shows injection of the sorbent into the flue-gas ductwork prior to the ESP or FF. Ex. 1010, 4.

Petitioner further asserts that Sjostrom "discloses an in-flight reaction in the mercury-containing flue gas between bromine and activated carbon to form an improved sorbent. A POSITA would have understood that coal combustion produced a mercury containing flue gas, and that the mercury-containing gas transported the bromine containing promoter of Sjostrom to the activated-carbon sorbent" as required by claim 19. *Id.* at 104 (citing Ex. 1003 ¶ 611).

Patent Owner does not substantively address Petitioner's challenge of claims 18 and 19, aside from arguing the priority of the '147 patent, as discussed above. *See generally* Prelim. Resp.; *see also id.* at 1 n.1 ("For purposes of this preliminary response only, Patent Owner does not dispute that the asserted art renders the claims at issue unpatentable, and will only focus on the priority dispute."). On this record, we determine that Petitioner's arguments and evidence are sufficient to suggest each of the

limitations of claims 18 and 19 is present in the combination of Sjostrom and Olson. Because we determined above (*supra* Section II.D.) that claims 18 and 19 of the '147 patent are not entitled to a date of invention prior to the filing of date of the '147 patent, i.e., April 6, 20009, we determine that Petitioner has established a reasonable likelihood of prevailing on its challenge to claims 18 and 19 as obvious over the combination of Sjostrom and Olson.

III. CONCLUSION

For the reasons set forth above, we determine that Petitioner has demonstrated a reasonable likelihood of prevailing with respect to at least one challenged claim of the '147 patent. Thus, we institute an *inter partes* review on all challenged claims and on all grounds presented.

IV. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that an *inter partes* review is instituted on each of the grounds asserted in the Petition; and

FURTHER ORDERED that, pursuant to 35 U.S.C. § 314(c) and 37 C.F.R. § 42.4, notice is hereby given of the institution of a trial, which shall commence on the entry date of this decision.

FOR PETITIONER:

Brian Oaks
David Tobin
Elizabeth Flannery
Thomas Carter Jr.
BAKER BOTTS L.L.P.

brian.oaks@bakerbotts.com
david.tobin@bakerbotts.com
liz.flannery@bakerbotts.com
thomas.carter@bakerbotts.com

FOR PATENT OWNER:

Hamad Hamad
Justin T. Nemunaitis
CALDWELL, CASSADY & CURRY P.C

hhamad@caldwellcc.com
jnemunaitis@caldwellcc.com
midwest@caldwellcc.com