UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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FRONTIER WATER SYSTEMS, LLC,
Petitioner,

v.

GENERAL ELECTRIC CORPORATION,
Patent Owner.

_____

Case: IPR2017-01468
U.S. Patent No. 7,790,034

PATENT OWNER'S PRELIMINARY RESPONSE UNDER 37 C.F.R. § 42.107

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EXHIBIT LIST

Exhibit No.	***Description***
2001	Declaration of Brian D. Roche in support of patent owner's motion for *pro hac vice* admission pursuant to 37 C.F.R. § 42.10(c)
2002	Declaration of Glen Daigger in support of patent owner's preliminary response
2003	Curriculum Vitae of Dr. Glen Daigger

I. INTRODUCTION

The Board should deny Frontier Water Systems, LLC's ("Frontier" or "Petitioner") request for *inter partes* review of claims 1-3 and 5-7 of U.S. Patent No. 7,790,034 ("the '034 patent") because there is not a reasonable likelihood that Frontier would prevail at trial with respect to any of these challenged claims. Zenon Technology Partnership ("Zenon" or "Patent Owner") does not oppose instituting review on challenged independent claim 9, which is broader than challenged independent claim 1, and its dependent claims, as obvious over the Fukase reference.

Petitioner asserts six grounds, one alleging anticipation of claims 1 and 3 and the other five alleging obviousness of claims 1-3 and 5-7. The anticipation ground is deficient because the allegedly anticipatory reference does not teach or suggest, and in fact teaches away from, a key claim limitation. And all of the obviousness grounds suffer from the same fatal flaw—Petitioner provides no evidence or argument explaining why one of ordinary skill in the art would have been motivated to modify the prior art to arrive at the claimed invention or why one of ordinary skill in the art would have had a reasonable expectation of success doing so. Petitioner argues that mere similarity between the references provides both the required motivation and expectation of success. Both the Board and the Federal Circuit, however, repeatedly have held that similarity alone cannot carry

Petitioner's obviousness burden. Because Petitioner failed to set forth the required elements of a proper obviousness analysis, all of Petitioner's asserted grounds for claims 1-3 and 5-7 should be denied institution.

II. THE '034 PATENT

A. Background

Wastewater treatment refers to processes used to remove impurities from wastewater. There are many types. For example, wastewater treatment may be distinguished by the type of wastewater to be treated, whether it be sewage, agricultural wastewater, or industrial wastewater. Ex. 2002 at ¶ 40. The impurities in these different types of wastewaters vary widely, and different treatment options are generally used for each. *Id.* Techniques that may be effective at removing an impurity from one type of wastewater may not be effective at removing impurities from another type. *Id.*

Industrial wastewater treatment is further classified by the type of industrial plant producing the wastewater, and, again, there are many types. *Id.* at ¶ 41. For example, industrial wastewater treatment includes treatment of wastewater from petroleum refineries, chemical and petrochemical plants, and electric power plants. *Id.* The impurities in the wastewaters from these different industrial plants vary widely, and different treatment options are generally used for each. *Id.*

A coal-fired plant is one type of electric power plant that presents unique wastewater treatment challenges. In particular, coal-fired plants include technologies used to remove sulfur dioxide (SO_2) from exhaust flue gases of the coal power plant. These technologies, known as flue-gas desulfurization (FGD), produce a wastestream known as FGD blow-down water. FWS1001 at 1:27-29; Ex. 2002 at ¶ 42. The FGD blow-down water contains a wide range of contaminants, depending on the coal being burned. *Id.* The contaminants may include inorganic contaminants such as arsenic, mercury, selenium, and other heavy metals, and organic contaminants such as di basic acid (DBA). FWS1001 at 1:29-32 and 1:51-56. As shown in Table 1 of the ’034 patent, FGD blow-down water may include many other contaminants. FWS1001 at 4:5-6 (“Table 1 shows the contaminants, and their concentrations, assumed for FGD scrubber blow-down water ….”):

TABLE 1

Typical FGD Blowdown Water

Parameter	Typical Value	Min-Max
Chlorides	30,000 ppm	20-40,000 ppm
pH	>5.0 < 6.0	
TDS	75,000 mg/L	50,000-150,000 mg/L
TSS	2% dry wt	1-5% dry wt
Aluminum - Total	960 ppm	80-3700 ppm
Antimony	12 ppm	0.03-49.0 ppm
Ammonia - N	31 ppm	0.25-64 ppm
Nitrate - N	350 ppm	200-450 ppm
Total Nitrogen	200 ppm	50-400 ppm
Arsenic - Total	15 ppm	0.27-100 ppm
Barium - Total	100 ppm	2.0-770 ppm
Beryllium	2.1 ppm	0.06-6.9 ppm
Boron	—	20-40 ppm
Cadmium - Total	0.8 ppm	0.12-1.5 ppm
Calcium	18,000 ppm	10,000-30,000 ppm
Chromium - Total	23 ppm	0.5-210 ppm
Chromium VI	—	3-12 ppm
Cobalt	—	0.05-4 ppm
Copper - Total	1.7 ppm	0.3-6.6 ppm
CO_3/HCO_3	1500 ppm	1-3,000 ppm
Fluoride	360 ppm	61-1600 ppm
Iron - Total	1400 ppm	116-6400 ppm
Lead - Total	19 ppm	0.2-140 ppm
Lithium	—	2-3 ppm
Magnesium	15,000 ppm	10,000-20,000 ppm
Manganese	10 ppm	3.6-200 ppm
Mercury - Total	0.38 ppm	0.5-1.4 ppm
Nickel - Total	10 ppm	0.5-74 ppm
Phosphate - Total	1.0 ppm	0-10 ppm
Potassium	6800 ppm	5000-10,000 ppm
Selenium - Total	17 ppm	1.5-100 ppm
Silver - Total	10.0 ppm	0.002-20 ppm
Sodium	15,000 ppm	10,000-20,000 ppm
Sulfate (SO_4)	60,000 ppm	40,000-80,000 ppm
Thallium	0.76 ppm	0.02-2.2 ppm
Vanadium	—	1.0-11.0 ppm
Total Zinc	15.0 ppm	1.7-50.0 ppm
Temperature	130° F.	125-130° F.

The ’034 patent is directed to a particular process for removing one of these contaminants—selenium—from the FGD blow-down water originating from a coal-fired power plant. FWS1001 at 1:14-19. At the time of the ’034 patent, treatment of FGD blow-down water to remove inorganic contaminants, including selenium, typically involved physical and chemical processes. FWS1001 at 1:51-56. However, these processes required costly chemicals and produced large amounts of unwanted sludge. *Id.* Furthermore, the reduction in concentration of selenium achievable by conventional physical and chemical processes was

unsatisfactory, yielding concentrations of up to 20 ppm of selenium—100 times greater than permitted concentration levels of 200 ppb. FWS1001 at 1:58-62; Ex. 2002 at ¶ 43.

At the time of the ’034 patent, a different selenium-treatment process involved the use of selenium-reducing microbes, or bacteria. FWS1001 at 1:63-67; Ex. 2002 at ¶ 44. In biological treatment processes, wastewater would be mixed with biomass, which was known as an activated sludge or a biological sludge. Ex. 2002 at ¶ 44. The selenium-reducing bacteria could remove dissolved selenium from contaminated wastewater by reducing selenium, causing it to form a precipitate that could then be removed. FWS1001 at 2:4-9; Ex. 2002 at ¶ 44. However, while effective for treatment of selenium in certain types of wastewater, biological treatment options were not particularly effective for treatment of selenium in FGD blow-down water. Ex. 2002 at ¶ 44.

B. The Claimed Invention

The Petition recognizes that “selenium [is] not a simple contaminant to treat.” Pet. at 42. Patent Owner agrees. The ’034 patent is directed to a specific, sequential process for the treatment of selenium in FGD blow-down water from a coal-fired power plant. FWS1001 at 1:14-19.

To create an improved process for the treatment of selenium in FGD blow-down water, the ’034 patent began by recognizing that FGD blow-down water

contains unusually-high concentrations of total dissolved solids (TDS). *See, e.g.*, FWS1001 at 4:12-15 ("FGD blow-down water is generally characterized by very high total dissolved solids (TDS) where the main anion is chloride and the main cations are calcium, magnesium and sodium."). The '034 patent discovered that the very-high concentrations of TDS in FGD blow-down water were inhibiting the effectiveness of biological treatment in two respects. First, the high TDS concentrations were making it difficult for biological treatment to maintain activity, which refers to the rate at which bacteria convert dissolved selenium to a precipitate that can be removed. *See, e.g.*, Ex. 2002 at ¶ 46; FWS1001 at 5:3-4 ("High TDS concentrations make it difficult to maintain activity for biological treatment."); *id.* at 1:41-45 ("[T]he concentration of TDS, [total suspended solids] TSS, Ca and Mg hardness, nitrate, ammonia, and sulfur for example as sulphate are all likely to be high, and various heavy metals may be present, making the blow down water very difficult to treat, particularly to achieve very low levels of contaminants."). Second, high TDS concentrations also inhibited biological treatment by making it difficult to flocculate and settle biomass in the activated sludge process. *See, e.g.*, *id.* at 5:6-7 ("The high TDS also makes it difficult to flocculate and settle biomass in an activated sludge process.").

To overcome these two problems, the '034 patent discloses a sequential process for the treatment of selenium in FGD blow-down water that is illustrated in

Fig. 1. The process generally includes a “pretreatment area 12” followed by a “biological treatment area 14.”

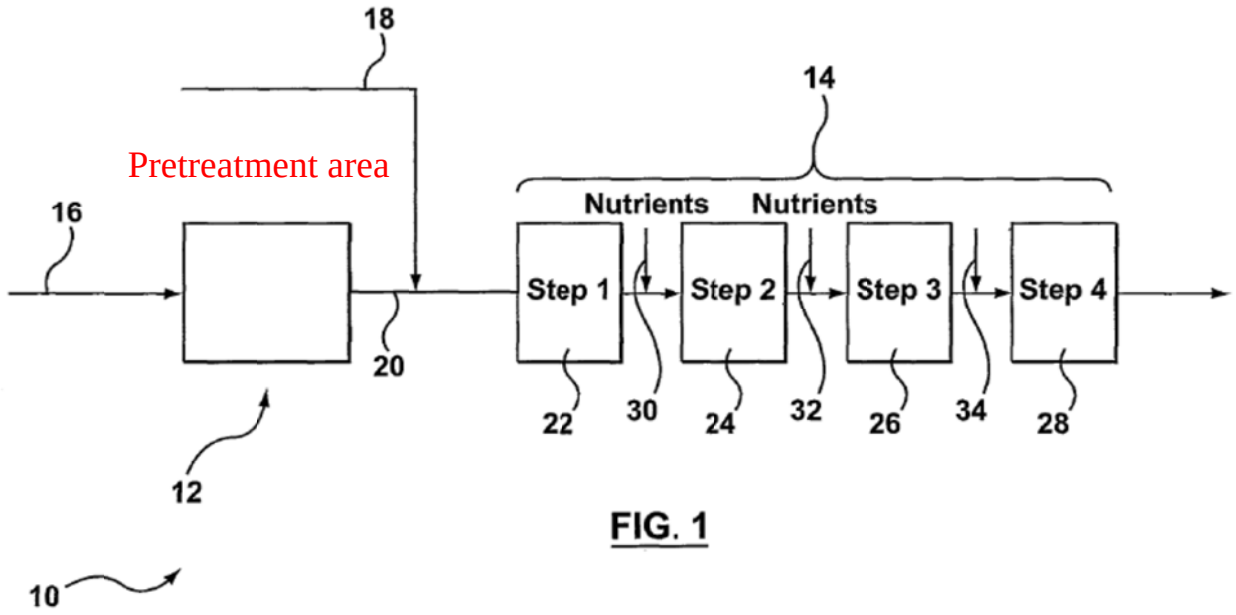


FIG. 1

FWS1001 at Fig. 1 (annotated).

The process begins with a chemical pretreatment step and a physical pretreatment step, shown in pretreatment area 12. *See, e.g.*, *id.* at 6:13-19. The chemical pretreatment step removes calcium and magnesium to soften the waste stream. *See, e.g.*, *id.* at 5:14-22 (“FGD and other industrial waste water can contain high levels of sulfate, calcium and magnesium . . . . These issues may be addressed by a softening pre-treatment, for example lime softening, and optionally by adding acid for pH adjustment upstream of the biological process.”); *id.* at 6:16-19 (“In the pretreatment area 12, a large portion of the TSS in the feed is removed and Ca and Mg are removed to soften the feed 16.”) The chemical pretreatment step can be performed by adding lime or sulfides to the FGD blow-down water. *See, e.g.*, *id.* at

6:20-21 (“[L]ime or sulfides or both may be added to the feed 16 to precipitate calcium, magnesium and metals.”).

The problems of developing and controlling a suspended biomass and bioreactor/membrane plugging may be addressed by this physical pretreatment step, which can include treating the wastewater to coagulate or flocculate and then physically removing suspended solids by settling or floating. *See, e.g.*, *id.* at 5:30-35 (“The high TSS, particularly because it is essentially inorganic, causes problems with developing and controlling a suspended biomass and with bioreactor and membrane plugging. This issue may be addressed by pre-treating the waste stream to coagulate or flocculate and then physically remove (for example by settling or floating) suspended solids.”); *see also e.g.*, *id.* at 6:21-24 (“The precipitates may be removed by clarifiers, for example single stage or double stage clarifiers. Settling can be enhanced by the addition of coagulants or polymers.”) Together, the physical and chemical pretreatment steps combine to remove a large portion of the TSS in the waste stream. *See, e.g.*, *id.* at 6:18-19 (“The pretreatment area 12 uses physical/chemical methods to treat the feed 16”); *id.* at 6:16-17 (“In the pretreatment area 12, a large portion of the TSS in the feed is removed.”).

Following chemical and physical pretreatment, the process proceeds downstream to a biological treatment area 14, which itself is divided into a number of sequential steps, or zones. *See, e.g.*, *id.* at 6:43-49. In particular, the biological

treatment area may have four zones: “an aerobic zone 22; a first anoxic zone 24; a second anoxic zone 26; and, an anaerobic zone 28.” *Id.* at 44-46. Not every zone is required in each embodiment. *Id.* at 6:49-51.

The first zone, aerobic zone 22, is an optional zone that can be used to remove ammonia and oxidize organic carbon. *See, e.g.*, *id.* at 6:59-61 (“The aerobic zone 22 is used to nitrify, assimilate or remove ammonia, to the extent that ammonia has not been stripped in the pretreatment area 12, and to oxidize organic carbon.”); *id*. at 7:1 (“[T]he aerobic zone 22 may be omitted.”).

The second zone, first anoxic zone 24, performs denitrification to reduce the concentration of nitrate in the waste stream. *See, e.g.*, *id.* at 7:3-11. The ’034 patent recognizes the importance of reducing the concentration of nitrate in the waste stream prior to performing biological treatment to remove selenium because the presence of nitrate in the waste stream inhibits biological reduction of selenium. Ex. 2002 at ¶ 52. In particular, the ’034 patent explains that nitrate acts as a preferred electron acceptor. FWS1001 at 7:3-4. As such, the nitrate needs to be removed to facilitate the biological reduction of selenium to lower concentrations in a subsequent zone. *See, e.g.*, *id.* at 5:36-39 (“High nitrate concentrations are a concern because nitrate is a preferred electron acceptor for biological reduction over selenate. This issue may be addressed by decreasing the nitrate concentration upstream of a selenate reducing step.”); *see also, e.g.*, *id.* at 7:4-9 (“The nitrate

may be removed to a concentration which facilitates the biological reduction of selenium in the second anoxic zone 26, considering that nitrate in high concentration will be used as an electron acceptor over low concentrations of selenate or selenite.").

The next zone, second anoxic zone 26, applies biological treatment to the FGD wastewater to remove selenium. *See, e.g.*, *id.* at 7:12-18. In particular, following chemical and physical pretreatment, and following a denitrification step, the FGD blowdown water is optimally primed for efficient removal of selenium using biological treatment. Ex. 2002 at ¶ 53. Fixed or suspended-bed bioreactors are seeded with selenium-reducing bacteria. *See, e.g.*, FWS1001 at 7:16-18. The bacteria reduce selenium present in the wastewater to a solid precipitate, which may then be removed. Ex. 2002 at ¶ 53; FWS1001 at 7:12-14 ("[S]elenium is removed by biological reduction and removal, for example by precipitation into flush flow water or waste sludge.").

Lastly, anaerobic zone 28 is an optional zone in which sulfate-reducing bacteria reduce sulfates to produce insoluble sulfides which may be precipitated out of the stream. *See, e.g.*, FWS1001 at 7:19-26.

Claim 1 of the '034 patent recites a process for treating selenium in FGD blow down water that covers the advantages discussed above: 1) a physical and

chemical pretreatment step, 2) sequential denitrification followed by selenium removal, and 3) use of a fixed film bioreactor:

> 1. A process for treating a waste stream comprising flue gas desulfurization blow down water having steps of
>
> physical and chemical pretreatment to remove suspended solids from the waste stream and soften the waste stream
>
> followed by treatment to denitrify the waste stream
>
> followed by treatment to remove selenium from the waste stream,
>
> wherein the steps of denitrifying the waste stream and removing selenium from the waste stream occur in one or more fixed film bioreactors.

Id. at cl. 1.

C. The Specification of the ’034 Patent is not Prior Art

The Petition relies on the teachings of the ’034 Patent to inform the scope and content of prior art. *See, e.g.*, Pet. at 14 (“It was known to combine bioreactors with physicochemical systems for the removal of degradable organic materials and nitrogen, including denitrification. US ‘034 7:3-11, 8:4-12 ….”); Pet. at 14-15 (“[I]t was known to remove solids physically, through sedimentation, flotation, media filtration and membrane filtration. *See* US ’034 5:30-35 (describing the removal of suspended solids chemically using coagulants or flocculants and physically by settling or floating; US ’034 6:13-24 (describing the use of lime or

sulfides to chemically precipitate solids, optionally with the use of coagulants or polymers, and physical removal through settling in a clarifier).").

The Petition's reliance on the teachings of the '034 patent to support its invalidity arguments is improper. The above quotations are taken from the detailed description of the '034 patent, but even in the background, the '034 patent cautions that the "background discussion does not imply or admit that any process or apparatus described below is prior art or part of the knowledge of people skilled in the art in any country." FWS1001 at 1:23-26. Not only does the '034 patent expressly deny that its disclosure is prior art, but even if it had admitted what was known in the prior art, applicant-admitted prior art is not a "patent or printed publication" under 35 U.S.C. § 311(b) that can form the basis for institution of *inter partes* review. *See Sony Corporation v. Collabo Innovations, Inc.*, IPR2016-00940, Paper No. 7 at 30–31 (Oct. 24, 2016) (denying institution of IPR on grounds that relied on applicant-admitted prior art either alone or in combination with another prior art reference*); see also Kingbright Electronics Co. Ltd. v. Cree, Inc.*, IPR 2015-00741, Paper No. 8 at 3–5 (Aug. 20, 2015) (denying institution on basis that applicant-admitted prior art was not a prior art patent or printed publication within statutory and regulatory requirements).

III. LEVEL OF SKILL OF A PERSON OF ORDINARY SKILL IN THE ART

Petitioner contends that a person of ordinary skill in the art at the time of filing of the application for the ’034 patent would “have at least (1) a B.S. degree in environmental engineering or chemical and biochemical engineering, and at least eight to ten years of experience in the industrial wastewater treatment industry or (2) a M.S. degree in these same disciplines and five years of experience.” Pet. at 11.

Patent Owner disagrees, as this level of experience is more than is needed to understand the prior art references asserted in the Petition. The prior art references asserted in the Petition reflect sufficiently the appropriate level of skill at the time of the claimed invention. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001). Patent Owner believes that this level of skill can be achieved by either (1) a B.S. degree in environmental engineering or chemical and biochemical engineering, coupled with at least two years of experience in the industrial wastewater treatment industry, or (2) a M.S. degree in these same disciplines, coupled with one year of experience. *See* Ex. 2002 at ¶ 57.

IV. CLAIM CONSTRUCTION

In an IPR, the Board applies the broadest reasonable interpretation of the claims in view of the specification. 37 C.F.R. § 42.100(b); *Cuozzo Speed Techs., LLC v. Lee*, 136 S. Ct. 2131, 2146 (2016). The broadest reasonable interpretation,

however, must be construed in light of the specification and cannot be divorced from the claim language. *Microsoft Corp. v. Proxyconn, Inc.*, 789 F.3d 1292, 1298 (Fed. Cir. 2015). An impermissibly broad construction includes one that "does not 'reasonably reflect the plain language and disclosure'" of the specification. *Id.* at 1298 (quoting *In re Suitco Surface, Inc.*, 603 F.3d 1255, 1260 (Fed. Cir. 2010)). The broadest reasonable interpretation does not provide "unfettered license to interpret claims to embrace anything remotely related to the claimed invention." *In re Suitco Surface, Inc.*, 603 F.3d 1255, 1260 (Fed. Cir. 2010).

Contrary to this clear precedent, Petitioner advocates interpreting the claims to make them unreasonably broad, divorced from the specification, and to encompass unclaimed concepts.

A. "one or more fixed film bioreactors" (claim 1)

Petitioner proposes that "bioreactor [sic]" be construed to mean "**a** reaction vessel where biological treatment occurs." Pet. at 12 (emphasis added). Petitioner's proposed construction is deficient in two respects. First, Petitioner's proposed construction is incorrect to the extent it limits the claimed "bioreactors" to only a single bioreactor. On its face, the claim language encompasses "one **or more** fixed film bioreactor**s**." FWS1001 at cl. 1 (emphasis added).

Second, Petitioner's proposed construction is incorrect to the extent it broadens the meaning of "bioreactors" to encompass reaction vessels where

biological treatment occurs that are not "fixed film bioreactors," as required by cl. 1. In particular, fixed film bioreactors include "fixed film reactor[s] having a GAC bed." FWS1001 at Abstract. "The fixed film reactor may comprise a bed of activated carbon or other support materials." *Id.* at 2:63-65. Furthermore, not all bioreactors that satisfy Petitioner's proposed construction of "a reaction vessel where biological treatment occurs" are fixed film reactors. *See* Ex. 2002 at ¶ 62. In particular, activated sludge bioreactors, which the '034 patent criticizes as unsuitable for treatment of FGD blowdown water with high TDS, are not fixed film bioreactors. *See* Ex. 2002 at ¶ 62; *see also, e.g.*, FWS1001 at 5:7-10 ("The high TDS also makes it difficult to flocculate and settle biomass in an activated sludge process. **This issue is addressed by using fixed film bioreactors** or membrane bioreactors which may operate with TDS concentrations at which settlability is low.") (emphasis added). Petitioner offers no explanation in support of its broadening construction, and the statement in Dr. Koon's declaration is conclusory. *See, e.g.*, FWS1009 at ¶ 22 (stating that "bioreactors (which is essentially a reaction vessel where biological treatment occurs) were commonly known," with no elaboration).

Patent Owner believes that the plain language of "one or more fixed film bioreactors" is sufficiently clear such that construction is unnecessary. "[C]laim construction is a matter of resolution of disputed meanings and technical scope

[and] not an obligatory exercise in redundancy." *U.S. Surgical Corp. v. Ethicon, Inc.*, 103 F.3d 1554, 1568 (Fed. Cir. 1997). The Board is "not (and should not be) required to construe every limitation present in a patent's asserted claims." *O2 Micro Int'l Ltd. v. Beyond Innovation Tech. Co.*, 521 F.3d 1351, 1362 (Fed. Cir. 2008). However, to the extent construction is required, "one or more fixed film bioreactors" should be construed to mean "one or more fixed film bioreactors, including fixed film reactors having a GAC bed, and fixed film reactors having a bed of activated carbon or other support materials." Ex. 2002 at ¶ 63.

B. "soften the waste stream" (claim 1)

Petitioner proposes that "soften the waste stream" be construed to mean "add a chemical that reduces the hardness of the wastewater." Pet. at 12. Petitioner's proposed construction unnecessarily rewrites the claim language. In particular, the "reduces the hardness of the wastewater" portion of Petitioner's construction merely replaces "soften" with "reduce[] hardness" and "waste stream" with "wastewater." Petitioner does not explain how these substitutions clarify the meaning of the term. In addition, Petitioner's proposed construction requires that "soften[ing]" be performed by "add[ing] a chemical." While the preferred embodiment softens the waste stream by adding chemicals such as lime or sulfides (FWS1001 at 6:19-21), adding such chemicals is not the only way to soften the waste stream. Ex. 2002 at ¶ 64. Other known ways to soften the waste stream

include ion-exchange devices and reverse osmosis. *Id.* Thus, a person of skill in the art would not understand "soften[ing] the waste stream" to be limited to doing so by "add[ing] a chemical." *Id.*

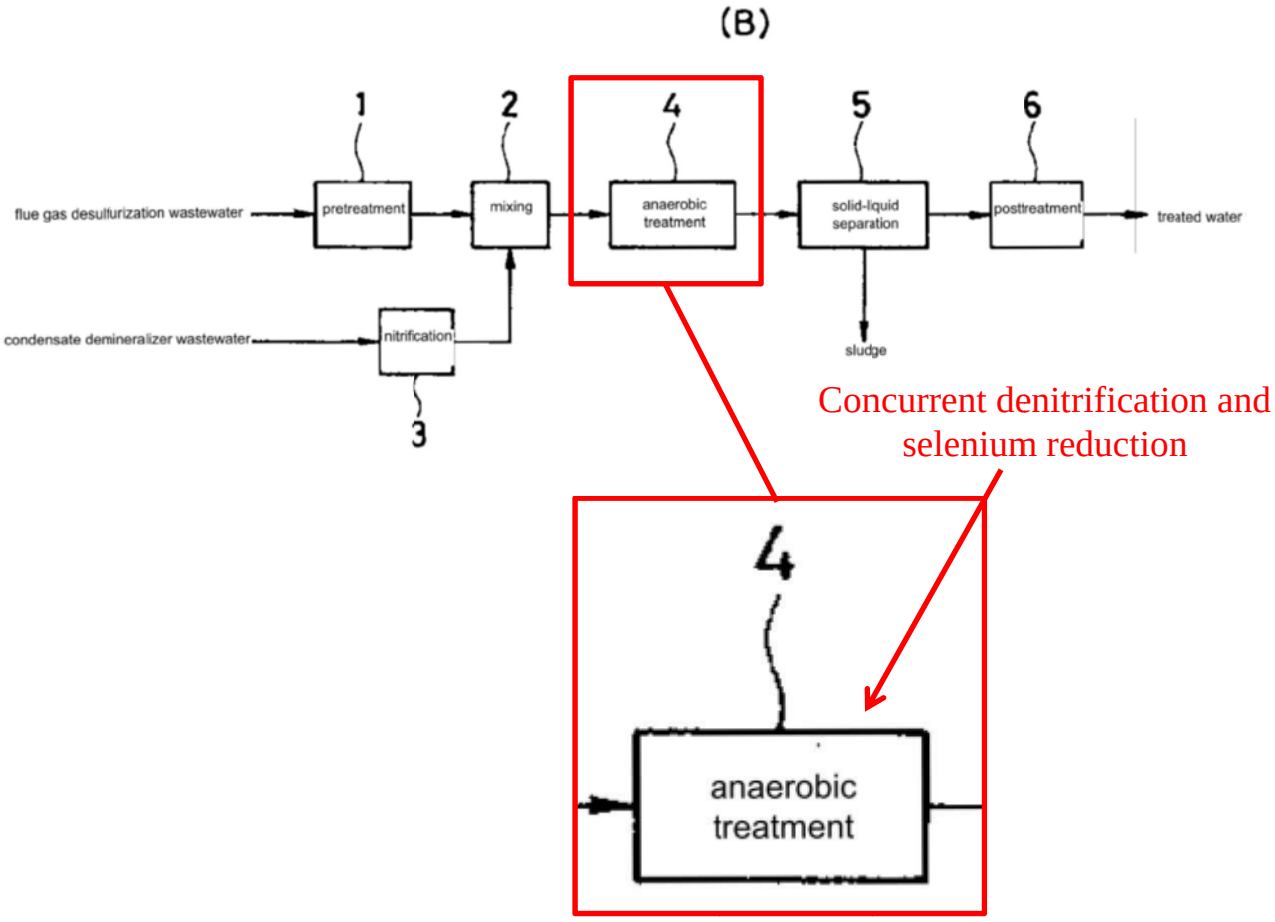
A person of skill in the art would understand that "soften[ing] the waste stream," which is synonymous with reducing the hardness of the waste stream, refers to the removal of calcium and magnesium in hard water. Ex. 2002 at ¶ 65. The specification of the '034 patent is consistent with this meaning. *See, e.g.*, FWS1001 at 6:16-18 ("In the pretreatment area 12, a large portion of the TSS in the feed is removed and **Ca and Mg are removed to soften the feed 16**.) (emphasis added); *see also, e.g.*, *id.* at 5:57-62) ("The presence of various heavy metals, for example Cu, As or Hg, or related oxidized contaminants are a concern …This issue may be addressed in part by precipitating these elements out in a pre-treatment softening step."). Moreover, in Petitioner's complaint in the corresponding district court litigation, Petitioner agreed that softening the wastewater is defined by the removal of dissolved calcium and magnesium from the wastewater. FWS1007 at ¶ 12 ("The SeHawk bioreactor does not "soften" wastewater (**i.e.**, remove dissolved **calcium** and **magnesium**) …") (emphasis added). Accordingly, Patent Owner proposes that "soften the waste stream" be construed to mean "remove calcium and magnesium from the waste stream."

V. GROUND 1 FAILS TO ANTICIPATE CLAIMS 1 AND 3

A. Overview of Fukase

Fukase generally relates to an activated sludge process for treating selenium in FGD blowdown water. Ex. 2002 at ¶ 66; FWS1010 at ¶ 0015 ("The biological sludge used in the anaerobic treatment step is sludge including denitrifying bacteria, which is biological sludge produced by maintaining the mixed wastewater in an anaerobic state, and can be spontaneously generated by collecting biological sludge (**activated sludge**) in an anaerobic treatment method for wastewater, such as an activated sludge treatment method, adding this to the mixed wastewater and maintaining it in an anaerobic state. Denitrifying bacteria are predominant in such biological sludge, and the selenate (selenite) in the mixed wastewater is reduced by these denitrifying bacteria.") (emphasis added). In addition, as expected for an activated sludge process, Fukase teaches that wastewater should be mixed with sludge containing denitrifying bacteria in order to perform denitrification and selenium reduction concurrently in a single step. *See* Ex. 2002 at ¶ 66; FWS1010 at ¶ 0014 ("In the anaerobic treatment step, the **mixed wastewater** after mixing and nitrification in this manner is **contacted with the biological sludge including the denitrifying bacteria**, in the anaerobic state, so as **to perform denitrification and to reduce the selenium compounds**.") (emphasis added). Fukase's preferred bioreactor, known to those skilled in the art as a stirred reactor, mixes the

denitrifying bacteria together with the wastewater and additional nitrates such that denitrification and selenium reduction are performed simultaneously. Ex. 2002 at ¶ 66. Fukase's anaerobic treatment step that performs simultaneous denitrification and selenium reduction step is illustrated in step 4 of Fig. 1B:



See Fukase at Fig. 1B (annotated). Fukase further clarifies that denitrification and selenium reduction are performed simultaneously, rather than sequentially, by explaining that the same bacteria that perform denitrification also perform selenium reduction. *See* Ex. 2002 at ¶ 66; FWS1010 at ¶ 0014 ("Denitrifying bacteria are predominant in such biological sludge, and the **selenate (selenite) in**

the mixed wastewater is reduced by these denitrifying bacteria.") (emphasis added).

B. Fukase does not disclose or suggest the claimed "treatment to denitrify the waste stream followed by treatment to remove selenium from the waste stream" (claim 1)

To anticipate a claim, a single prior art reference must disclose each and every limitation of the claim, either expressly or inherently. *Verdegaal Bros. v. Union Oil Co. of Cal.*, 814 F.2d 628, 631 (Fed. Cir. 1987). A feature is disclosed inherently if it is necessarily present in the single anticipating reference. *Continental Can Co. v. Monsanto Co.*, 948 F.2d 1264, 1268 (Fed. Cir. 1991).

Claim 1 of the '034 patent requires that "treatment to denitrify the waste stream" be "**followed by** treatment to remove selenium from the waste stream." FWS1001 at cl. 1 (emphasis added). Petitioner does not even attempt to show that Fukase teaches or suggests the "followed by" portion of the claim language. *See, e.g.*, Petition at 22 ("Fukase discloses that, following pretreatment step 1, denitrification and selenium removal are performed by biological means **in step 4** ….") (emphasis added); *see also* FWS1009 ¶ 47 (citing the same language of Fukas).

Not only does Fukase fail to disclose sequential denitrification followed by biological treatment to remove selenium, Fukase's method, which teaches that denitrification and selenium reduction should be performed concurrently in the

same step, is incompatible with performing denitrification sequentially followed by selenium reduction. Ex. 2002 at ¶ 72. In particular, as a stirring reactor, Fukase advocates that the same bacteria be used for both denitrification and selenium reduction, which necessitates that denitrification and selenium reduction be performed simultaneously. Ex. 2002 at ¶ 72; FWS1010 at ¶ 0014 ("In the anaerobic treatment step, the **mixed wastewater** after mixing and nitrification in this manner is contacted with the biological sludge including the denitrifying bacteria, in the anaerobic state, so as **to perform denitrification and to reduce the selenium compounds**.") (emphasis added). Likewise, the reactor of Fukase continuously recycles the bacteria that perform simultaneous denitrification and selenium reduction back into the reactor, thereby preventing the formation of a denitrifying zone (*see, e.g.*, '034 Fig. 1 at zone 24) and a separate and subsequent selenium-reducing zone (*see, e.g.*, '034 Fig. 1 at zone 26), as taught by the '034 patent and recited by claim 1. Ex. 2002 at ¶ 72. Accordingly, because Fukase does not teach or suggest the claimed "treatment to denitrify the waste stream followed by treatment to remove selenium from the waste stream," Fukase does not anticipate claim 1.

C. Claim 3

Claim 3 of the ’034 patent depends from claim 1 and therefore includes each limitation of claim 1. For the same reasons that Fukase fails to anticipate claim 1, Fukase likewise fails to anticipate claim 3.

VI. PETITIONER’S OBVIOUSNESS GROUNDS FAIL TO ESTABLISH A REASONABLE LIKELIHOOD OF SUCCESS

The Petitioner bears the burden of proof. *In re Magnum Oil Tools Int'l, Ltd.*, 829 F.3d 1364, 1375, 1377-78 (Fed. Cir. 2016). In particular, Petitioner must prove “that a skilled artisan would have been motivated to combine the teachings of the prior art references to achieve the claimed invention, and that the skilled artisan would have had a reasonable expectation of success in doing so.” *Id.* at 1381 (citations omitted). This is especially important “where the two primary references plainly operate in different manners.” *Id.* at 1378. However, the requirement for a petitioner to show a reasonable expectation of success also applies to obviousness grounds based on only a single prior art reference. *See In re Stepan Co.*, No. 2016-1811, slip op. at fn. 1(Fed. Cir. Aug. 25, 2017). Moreover, “the expectation of success must be founded in the prior art, not in the applicant’s disclosure.” *In re Dow Chem. Co.*, 837 F.2d 469, 473 (Fed. Cir. 1988).

“[S]urface similarities do not control the obviousness analysis.” *Id.* at 1379. “[A] petitioner cannot employ mere conclusory statements.” *Id.* at 1380; *see also In re Dembiczak*, 175 F.3d at 999. Rather, a petitioner must articulate its reasoning

why a person of ordinary skill in the art would have had a reasonable expectation of success. *See, e.g., In re Stepan* at 8; *see also, e.g., Pfizer, Inc. v. Apotex, Inc.*, 480 F.3d 1348, 1365 (Fed. Cir. 2007) ("[T]o have a reasonable expectation of success, one must be motivated to do more than merely to vary all parameters or try each of numerous possible choices until one possibly arrived at a successful result.") (internal citations omitted).

Here, the Petition acknowledges that "selenium was not a simple contaminant to treat." Pet. at 42. Despite this acknowledgment, the Petition fails to articulate any reasoning why a person of ordinary skill in the art would have had a reasonable expectation of success. In particular, the Petition only mentions reasonable expectation of success in one instance, in a general statement of the law. *See* Pet. at 19 (citing M.P.E.P. § 2143). But the Petition includes no subsequent analysis that a person of ordinary skill in the art would have had a reasonable expectation of success. The Petition does not even include a conclusory statement that a person of ordinary skill in the art would have had a reasonable expectation of success with respect to any of its obviousness grounds. Accordingly, the Petition cannot possibly have established a *prima facie* case of obviousness sufficient to shift the burden of proving patentability to Patent Owner. *See In re Stepan* at 9-10.

Petitioner's failure to analyze reasonable expectation of success cannot be remedied after institution. This is because "[i]t is of the utmost importance that petitioners in the IPR proceedings adhere to the requirement that **the initial petition** identify 'with particularity' the 'evidence that supports the grounds for the challenge to each claim.'" *Intelligent Bio-Systems v. Illumina Cambridge*, 821 F.3d 1359, 1369 (Fed. Cir. 2016) (quoting 35 U.S.C. § 312(a)(3) (emphasis added)). Petitioner's conclusory arguments do not "articulate specific reasoning, based on evidence of record, to support the legal conclusion of obviousness" and, therefore, cannot meet Petitioner's burden of showing obviousness. *Magnum Oil*, 829 F.3d at 1380.

VII. GROUND 2 FAILS TO RENDER OBVIOUS CLAIMS 1, 3, AND 5-7

A. Petitioner fails to show that one skilled in the art would have found it obvious to modify Fukase to perform the claimed "treatment to denitrify the waste stream followed by treatment to remove selenium from the waste stream" (claim 1)

A claim is unpatentable under 35 U.S.C. § 103(a) if the differences between the claimed subject matter and the prior art are such that the subject matter, as a whole, would have been obvious at the time of the invention to a person having ordinary skill in the art. *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. *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966). Moreover, an invention is not obvious simply because its constituent components are known in the art. Indeed, there must be a "reasonable expectation" of success that the modified prior art will function as intended. *See e.g.*, *In re Merck & Co., Inc.*, 800 F.2d 1091, 1097, 231 U.S.P.Q. 375 (Fed. Cir. 1986).

The Petition cannot support a finding of obviousness in view of Fukase because it fails to articulate any differences between Fukase and claim 1 that would have been obvious to a person of ordinary skill in the art. In particular, the Petition merely parrots the conclusion that **if** there are any differences between Fukase and claim 1, any difference would have been obvious. *See* Petition at 23 ("[I]f Fukase does not explicitly teach the claimed denitrification and selenium removal in fixed film bioreactors, then a PHOSITA would clearly understand that Fukase's bioreactors could be modified to meet the claimed bioreactor step of claim 1."). The Koon declaration is similarly devoid of the required identification of differences between Fukase and claim 1 that would have been obvious. *See* FWS1009 ¶ 50 ("If for any reason Fukase does not anticipate claims 1 and 3 of US '034, those claims are invalid as obvious based upon each and all of the [anticipation] reasons and citations I have cited above.").

Not only does Fukase fail to disclose sequential denitrification followed by biological treatment to remove selenium, Fukase's method, which teaches that denitrification and selenium reduction should be performed concurrently in the same step and throughout the stirred reactor, teaches away from the claimed method. Ex. 2002 at ¶ 74; FWS1010 at ¶ 14. As the '034 patent explains, the claimed method stresses the importance of reducing the concentration of nitrate in the waste stream prior to performing biological treatment to remove selenium because the presence of nitrate in the waste stream inhibits biological reduction of selenium to low concentrations. Ex. 2002 at ¶ 74; *see also, e.g.*, FWS1001 at 5:36-39 ("High nitrate concentrations are a concern because nitrate is a preferred electron acceptor for biological reduction over selenate. This issue may be addressed by **decreasing the nitrate concentration upstream** of a selenate reducing step.") (emphasis added); *see also, e.g., id.* at 7:4-9 ("The nitrate may be removed to a concentration which facilitates the biological reduction of selenium in the second anoxic zone 26 …"). In contrast, Fukase advocates performing denitrification and selenium reduction concurrently in the same step and with a significant nitrate concentration, thereby leading a person of skill in the art away from the process recited by claim 1. For example, whereas the '034 patent teaches reducing the nitrate concentration relative to that provided by FGD blowdown water, Fukase teaches increasing the nitrate concentration relative to that provided

by FGD blowdown water by adding a supplemental stream of nitrate. Ex. 2002 at ¶ 74. Moreover, the process recited by Fukase is less efficient than that of the ’034 patent, requiring that greater quantities of nutrients be added which would generate a larger biomass than necessary. *Id.* As a result of being less efficient, Fukase would not be able to achieve the same amount of selenium reduction of FGD wastewater as is achievable by the process disclosed by the ’034 patent. *Id.* In particular, the example provided by Fukase only achieved a selenium concentration of 0.1 mg/L (FWS1010 at ¶ 31), whereas the process disclosed by the ’034 patent achieved a much-lower selenium concentration of 0.002 mg/L (*see, e.g.*, FWS1001 at Fig. 7).

In addition, Petitioner has failed to articulate any reasoning that a person of ordinary skill in the art would have had been able to modify Fukase to perform sequential denitrification followed by selenium removal with a reasonable expectation of success. Accordingly, claim 1 is not obvious in view of Fukase.

B. Claims 3 and 5-7

Claims 3 and 5-7 of the ’034 patent depend directly or indirectly from independent claim 1 and therefore include each limitation of claim 1. For the same reasons that Fukase fails to render obvious claim 1, Fukase likewise fails to render obvious claims 3 and 5-7.

VIII. GROUND 3 FAILS TO RENDER OBVIOUS CLAIMS 1-3 AND 5-7

A. Overview of Downing

Downing is directed to "to the treatment of drainage water containing selenium leached from soil." FWS1011 at 1:7-8. For example, Downing recognizes that "[s]elenium is often present in water at concentrations of up to 0.5 mg/l, but a concentration of this order is undesirable for purposes such as drinking water or crop irrigation." *Id.* at 1:9-12.

Because Downing is directed to removing selenium from agricultural drainage water, not FGD blowdown water, the composition of Downing's wastewater is materially different than that to which the '034 patent is directed. For example, a comparison of Table 1 of the '034 patent and Examples 1 and 3 of Downing illustrate the different compositions:

<table>
<tr><th>’034 Patent</th><th>Downing</th></tr>
<tr>
<td>
TABLE 1
Typical FGD Blowdown Water
<table>
<tr><th>Parameter</th><th>Typical Value</th><th>Min-Max</th></tr>
<tr><td>Chlorides</td><td>30,000 ppm</td><td>20-40,000 ppm</td></tr>
<tr><td>pH</td><td>>5.0 < 6.0</td><td></td></tr>
<tr><td>TDS</td><td>75,000 mg/L</td><td>50,000-150,000 mg/L</td></tr>
<tr><td>TSS</td><td>2% dry wt</td><td>1-5% dry wt</td></tr>
<tr><td>Aluminum - Total</td><td>960 ppm</td><td>80-3700 ppm</td></tr>
<tr><td>Antimony</td><td>12 ppm</td><td>0.03-49.0 ppm</td></tr>
<tr><td>Ammonia - N</td><td>31 ppm</td><td>0.25-64 ppm</td></tr>
<tr><td>Nitrate - N</td><td>350 ppm</td><td>200-450 ppm</td></tr>
<tr><td>Total Nitrogen</td><td>200 ppm</td><td>50-400 ppm</td></tr>
<tr><td>Arsenic - Total</td><td>15 ppm</td><td>0.27-100 ppm</td></tr>
<tr><td>Barium - Total</td><td>100 ppm</td><td>2.0-770 ppm</td></tr>
<tr><td>Beryllium</td><td>2.1 ppm</td><td>0.06-6.9 ppm</td></tr>
<tr><td>Boron</td><td>—</td><td>20-40 ppm</td></tr>
<tr><td>Cadmium - Total</td><td>0.8 ppm</td><td>0.12-1.5 ppm</td></tr>
<tr><td>Calcium</td><td>18,000 ppm</td><td>10,000-30,000 ppm</td></tr>
<tr><td>Chromium - Total</td><td>23 ppm</td><td>0.5-210 ppm</td></tr>
<tr><td>Chromium VI</td><td>—</td><td>3-12 ppm</td></tr>
<tr><td>Cobalt</td><td>—</td><td>0.05-4 ppm</td></tr>
<tr><td>Copper - Total</td><td>1.7 ppm</td><td>0.3-6.6 ppm</td></tr>
<tr><td>CO_3/HCO_3</td><td>1500 ppm</td><td>1-3,000 ppm</td></tr>
<tr><td>Fluoride</td><td>360 ppm</td><td>61-1600 ppm</td></tr>
<tr><td>Iron - Total</td><td>1400 ppm</td><td>116-6400 ppm</td></tr>
<tr><td>Lead - Total</td><td>19 ppm</td><td>0.2-140 ppm</td></tr>
<tr><td>Lithium</td><td>—</td><td>2-3 ppm</td></tr>
<tr><td>Magnesium</td><td>15,000 ppm</td><td>10,000-20,000 ppm</td></tr>
<tr><td>Manganese</td><td>10 ppm</td><td>3.6-200 ppm</td></tr>
<tr><td>Mercury - Total</td><td>0.38 ppm</td><td>0.5-1.4 ppm</td></tr>
<tr><td>Nickel - Total</td><td>10 ppm</td><td>0.5-74 ppm</td></tr>
<tr><td>Phosphate - Total</td><td>1.0 ppm</td><td>0-10 ppm</td></tr>
<tr><td>Potassium</td><td>6800 ppm</td><td>5000-10,000 ppm</td></tr>
<tr><td>Selenium - Total</td><td>17 ppm</td><td>1.5-100 ppm</td></tr>
<tr><td>Silver - Total</td><td>10.0 ppm</td><td>0.002-20 ppm</td></tr>
<tr><td>Sodium</td><td>15,000 ppm</td><td>10,000-20,000 ppm</td></tr>
<tr><td>Sulfate (SO_4)</td><td>60,000 ppm</td><td>40,000-80,000 ppm</td></tr>
<tr><td>Thallium</td><td>0.76 ppm</td><td>0.02-2.2 ppm</td></tr>
<tr><td>Vanadium</td><td>—</td><td>1.0-11.0 ppm</td></tr>
<tr><td>Total Zinc</td><td>15.0 ppm</td><td>1.7-50.0 ppm</td></tr>
<tr><td>Temperature</td><td>130° F.</td><td>125-130° F.</td></tr>
</table>

FWS1001 at 4:27-63.
</td>
<td>
Downing Example 1:

“Relevant parts of the chemical analysis for this Example 1 were:
30 mg/l nitrate (expressed as nitrogen);
0.36 mg/l selenium (as the selenate ion, expressed as selenium);
4000 mg/l sulphate (expressed as sulphate);
20 mg/l phosphate (expressed as phosphorus).” FWS1011 at 9:23-29.

Downing Example 3:

A feed of 250 ml/hr was passed through the vessel (i.e. retention time one hour), the feed having the following composition (mg/l):
<table>
<tr><td>SO_4</td><td>4000</td></tr>
<tr><td>Cl</td><td>1500</td></tr>
<tr><td>Alkalinity (as $CaCO_3$)</td><td>180</td></tr>
<tr><td>Nitrate (as N)</td><td>30</td></tr>
<tr><td>Phosphate (as P)</td><td>4</td></tr>
<tr><td>Borate (as B)</td><td>10</td></tr>
<tr><td>Selenate (as Se)</td><td>0.32</td></tr>
<tr><td>70% lactic acid (nutrient)</td><td>5</td></tr>
</table>

FWS1011 at 10:35-46.
</td>
</tr>
</table>

As can be seen above, the wastewater to be treated by Downing has a vastly different composition and contains far fewer contaminants. Ex. 2002 at ¶ 68.

In addition, Downing’s method for the treatment of agricultural wastewater generally “involves treating the water in a reactor containing a microbial biomass

in which reducing activity can occur." FWS1011 at 2:19-21. Downing teaches that its biological "reactor can take the form of … stirred reactors." *Id.* at 2:62-66.

B. Petitioner fails to show that Fukase in view of Downing render obvious the claimed "treatment to denitrify the waste stream followed by treatment to remove selenium from the waste stream" (claim 1)

To set forth a prima facie case of obviousness, "it [is] important to identify a reason that would have prompted a person of ordinary skill in the relevant field to combine the elements in the way the claimed new invention does." *Pers. Web Techs., LLC v. Apple, Inc.*, 848 F.3d 987, 991-92 (Fed. Cir. 2017) (quoting *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 418-19 (2007)). In particular, "obviousness concerns whether a skilled artisan not only could have made but would have been motivated to make the combinations or modifications of prior art to arrive at the claimed invention." *Pers. Web Techs.*, 848 F.3d at 994 (quoting *Belden Inc. v. Berk-Tek LLC*, 805 F.3d 1064, 1073 (Fed. Cir. 2015)). In doing so, "petitioner cannot employ mere conclusory statements," but "must instead articulate specific reasoning based on the record, to support the legal conclusion of obviousness." *In re Magnum Oil Tools Int'l, Ltd.*, 829 F.3d 1364, 1380 (Fed. Cir. 2016); *see Securus Techs., Inc. v. Global Tel*Link Corp.*, No. 16-2573, 2017 WL 2992516 at *4 (Fed. Cir. July 14, 2017) (non-precedential) (affirming the Board's conclusion that the petitioner did not meet its burden of proving the challenged claims invalid as obvious and stating that "mere conclusory statements" about similarities between

references "fall short of 'some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.'") (citation omitted). Frontier's Petition fails for the same reasons.

In particular, the Petition argues that that Downing is analogous art. *See* Pet. at 31-33. In addition, with respect to claim 1, the Petition argues that "Downing also discloses anoxic biological denitrification followed by anoxic biological removal of selenium in one or more fixed film bioreactors." Pet. at 34. Even assuming both of these arguments are correct, the Petition fails to set forth a plausible argument that claim 1 is obvious. In particular, the Petition's single-sentence argument that Downing discloses denitrification followed by selenium reduction provides no explanation why a person of ordinary skill in the art would have been motivated to modify Fukase in that manner. *See Belden*, 805 F.3d at 1073 ("obviousness concerns whether a skilled artisan not only *could have made* but *would have been motivated to make* the combinations or modifications of prior art to arrive at the claimed invention" (emphasis in original)); *see also, e.g.*, *Rockwell Automation, Inc. v. Automation Middleware Solutions, Inc.*, IPR2017-00023, Paper 15, Denying Institution, at 15-16 (Apr. 7, 2017) ("[W]e agree that merely showing that disclosing a reference 'could' meet the elements of a claim is insufficient. Mere speculation is not a substitute for substantial evidence." (citations omitted)).

Petitioner does not provide any reason why, even if an ordinary artisan could make the modification, he or she would have done so. Pet. at 34. For example, Petitioner fails to explain what modifications would be necessary, how they would be achieved, why the ordinary artisan would expect them to be successful, or what the benefit of such modifications would be. *JTEKT Corp. v. GKN Automotive Ltd.*, IPR2016-00046, Paper 27, at 22 (Jan. 23, 2017); *Spectrum*, IPR2015-01562, Paper 35, at 33. In particular, given that Downing also teaches a stirred reactor, Petitioner has failed to explain why an ordinary artisan would have been motivated to modify Fukase's stirred reactor. Furthermore, given that Downing is directed to treating wastewater in the presence of relatively-few contaminants, Petitioner has failed to explain why an ordinary artisan would have had a reasonable expectation of success applying the cited portions of Downing to the relatively-high concentration of contaminants in the FGD-blowdown water of Fukase. Absent this evidence, Petitioner's statement cannot provide "sufficient evidence on which to base [a] legal conclusion of obviousness." *Magnum Oil*, 829 F.3d at 1380; *see also Securus*, 2017 WL 2992516 at *4. Accordingly, Petitioner has failed to articulate any reasoning that a person of ordinary skill in the art would have had been motivated to modify Fukase in view of Downing to perform sequential denitrification followed by selenium removal with a reasonable expectation of success.

Petitioner's failure to provide any motivation to modify Fukase, and to do so with a reasonable expectation of success, cannot be remedied after institution. *See Intelligent Bio-Systems*, 821 F.3d at 1369 (Fed. Cir. 2016). Petitioner's conclusory arguments do not "articulate specific reasoning, based on evidence of record, to support the legal conclusion of obviousness" and, therefore, cannot meet Petitioner's burden of showing obviousness. *Magnum Oil*, 829 F.3d at 1380.

Because Petitioner provides no other argument (and provides no evidence) with respect to the claimed "treatment to denitrify the waste stream followed by treatment to remove selenium from the waste stream," of claim 1, Petitioner cannot show a reasonable likelihood that claim 1 is obvious over Fukase in view of Downing.

C. Claims 2-3 and 5-7

Claims 2-3 and 5-7 of the '034 patent depend directly or indirectly from independent claim 1 and therefore include each limitation of claim 1. For the same reasons that Petitioner cannot show a reasonable likelihood that claim 1 is obvious over Fukase in view of Downing, Petitioner cannot show a reasonable likelihood that claims 2-3 and 5-7 are obvious over Fukase in view of Downing.

IX. GROUND 4 FAILS TO RENDER OBVIOUS CLAIMS 1-3 AND 6

The obviousness challenge presented in the Petition is based on classic hindsight, relying on an amalgamation of prior art references and misguided

application of manufacturing principles in an effort to justify modifying Katagawa to arrive at the invention claimed in the ’034 patent. As explained below, one of ordinary skill in the art would not have been motivated to modify Katagawa to include Downing, as suggested by the Petition. In addition, Petitioner has failed to articulate any reasoning that a person of ordinary skill in the art would have had been able to modify Katagawa in view of Downing with a reasonable expectation of success.

A. Overview of Katagawa

Katagawa generally relates to a conventional system for treating FGD blowdown water. *See* FWS1012 at 1. In particular, Katagawa is directed to the problem of minimizing the cost of reducing the environmental impact of fly ash collected from a coal-fired power plant that is deposited in a landfill. Ex. 2002 at ¶ 69. For example, Katagawa explains that “the majority [of fly ash collected from a coal-fired power plant] must be disposed of in landfills.” FWS1012 at 2. Landfill disposal presented an issue of “the impact on the surrounding environment, because the water that leaches from the fly ash is alkaline.” *Id.* Systems prior to Katagawa could address this environmental-impact issue by adding slaked lime to neutralize the pH, but the addition of slaked lime was costly. FWS1012 at 2 (“[C]austic soda and slaked lime were added [but] operational costs increased due to the cost of these chemicals.”). Accordingly, Katagawa is primarily concerned

with reducing the environmental impact of fly-ash disposal while reducing or eliminating the need to add caustic soda or slaked lime. Ex. 2002 at ¶ 69; FWS1012 at 2 ("An object of the present invention is to remove heavy metals and fluorine without adding caustic soda or slaked lime, or with reduced amounts added."

Nothing in Katagawa pertains to the removal of selenium. Ex. 2002 at ¶ 70. In addition, nothing in Katagawa relates to the removal of contaminants in wastewater using any form of biological treatment. *Id.*

B. Katagawa is not analogous art

Katagawa is not "reasonably pertinent to the particular problem with which the inventor is involved," and thus Petitioner cannot rely on Katagawa for its obviousness arguments. *K-TEC, Inc. v. Vita-Mix Corp.*, 696 F.3d 1364, 1375 (Fed. Cir. 2012). As explained above, Katagawa is directed to the problem of safely disposing of coal fly ash in a landfill while eliminating or reducing the cost of adding chemicals such as caustic soda or slaked lime. In contrast, the inventors of the '034 patent were focused on the problem of creating an improved process for removal of selenium in FGD blow-down water using biological treatment. *See* FWS1001 at 1:14-19. Nothing in Katagawa bears any pertinence to this problem. Ex. 2002 at ¶ 79. For example, nothing in Katagawa relates to selenium removal,

and nothing in Katagawa relates to the removal of contaminants in wastewater using any form of biological treatment. *Id.*

Both Katagawa and the ’034 patent are related to treatment of wastewater from a coal-fired power plant, but the similarities end there. Ex. 2002 at ¶ 80. The problem solved by Katagawa and the ’034 patent and the means of doing so is vastly different, and one of ordinary skill in the art would not have looked to the teachings of Katagawa when considering the problems faced by the inventors of the ’034 patent. *Id.* Accordingly, because Katagawa is not “reasonably pertinent” to the problems faced by the inventor, it is not analogous art. *K-TEC, Inc.*, 696 F.3d at 1375.

C. Petitioner fails to show that a person of ordinary skill would have had a motivation to combine Katagawa and Downing or would have had a reasonable expectation of success in doing so

A patent challenger must demonstrate that a skilled artisan would have had a reason to combine the teachings of the prior art references to achieve the claimed invention, and that the skilled artisan would have had a reasonable expectation of success from doing so. *See PAR Pharm., Inc. v. TWI Pharm., Inc.*, 773 F.3d 1168, 1193 (Fed. Cir. 2014). In demonstrating a motivation to combine, conclusory statements alone are insufficient and must be supported by a reasoned explanation. *See, e.g., In re Nuvasive*, 842 F.3d 1376, 1384–85 (Fed. Cir. 2016) (vacating PTAB decision on obviousness for failing to articulate motivation to

combine beyond conclusory statements that did not explain specific benefits); *Shopkick, Inc. v. Novitaz, Inc.*, IPR2015-00279, Paper No. 7, at 26–30 (May 29, 2015) (denying institution on obviousness grounds because petition failed to "show some reason why a person of ordinary skill in the art would have thought to combine particular available elements of knowledge, as evidenced by the prior art, to reach the claimed invention.").

Nothing in Katagawa suggests that its process should or could be modified to incorporate biological treatment. Ex. 2002 at ¶ 81. Likewise, nothing in Downing suggests that its disclosed process for biological treatment could be improved by any pretreatment processes or steps. *Id.* Moreover, as explained above, Downing is directed to removing selenium from agricultural drainage water, not FGD blowdown water. *See, e.g.*, FWS1011 at 1:7-8. Consequently, the agricultural wastewater treated by Downing did not include high levels of TDS, such as those that are present in FGD blowdown water, that require pretreatment. Ex. 2002 at ¶ 81; *compare* FWS1001 at 4:27-63 (table showing composition of typical FGD blowdown water) with FWS1011 at 9:23-29 and FWS1011 at 10:35-46 (listing composition of agricultural wastewater). Accordingly, a person of skill in the art would not have been motivated to combine Katagawa with Downing. Ex. 2002 at ¶ 81.

D. Petitioner fails to show that Katagawa in view of Downing render obvious the claimed "chemical pretreatment to … soften the waste stream" (claim 1)

As explained above, Katagawa is directed to the problem of safely disposing of coal fly ash in a landfill while eliminating or reducing the cost of adding chemicals such as caustic soda or slaked lime. Although Katagawa discloses adding slaked lime, the purpose for which Katagawa adds the slaked lime is not to soften the waste stream, but to adjust the pH. Ex. 2002 at ¶ 82. Rather, Katagawa explains that slaked lime can be added, if needed, to achieve a pH of between 6 and 8. FWS1012 at 2 ("In the event that the pH value does not rise to the [a value between 6 and 8] when the fly ash 5 is added, slaked lime 6 may also be added to the fly ash 5."). Katagawa does not teach or suggest that adding slaked lime would cause calcium or magnesium to be removed. Ex. 2002 at ¶ 82. Furthermore, a pH range of between 6 and 8 confirms that Katagawa's process does not soften the waste stream. In particular, softening requires a pH above 8. *Id.* In addition, in Petitioner's complaint in the corresponding district court litigation, Petitioner agreed that softening requires a minimum pH level which must be greater than 8. *See* FWS1007 at ¶ 12 ("[S]oftening water requires a pH level of 10 or more …"). Patent Owner disagrees that the minimum pH-level to perform softening is 10, but Patent Owner agrees it is greater than 8.

Even if the addition of slaked lime as described by Katagawa could be considered a chemical softening step, Katagawa explains that "[a]n object of the present invention is to remove heavy metals and fluorine **without adding caustic soda or slaked lime**, or with reduced amounts added." FWS1012 at 2. Similarly, Katagawa explains that slaked lime is preferably not added and only would be added if pH value had not risen to a neutral value based on the previous step. Ex. 2002 at ¶ 83; FWS1012 at 2 ("[F]ly ash 5 is added so that the pH value of the reaction tank 3 becomes 6 to 8, according to a pH meter 12. In the event that the pH value does not rise to the predetermined value when the fly ash 5 is added, slaked lime 6 may also be added to the fly ash 5."). Petitioner has failed to articulate why a person of skill in the art would add slaked lime to a process that combines Katagawa and Downing when Katagawa teaches that slaked lime is preferably not added.

Furthermore, utilizing Katagawa's process as a pretreatment step for Downing would not be successful. In particular, employing Katagawa's process in Downing would not sufficiently reduce the TDS concentration, including calcium and magnesium, to improve Downing's biological treatment. Ex. 2002 at ¶ 83. Thus, Petitioner has failed to articulate a reasonable expectation of success.

Because Petitioner has not shown that Katagawa is analogous art, has not shown that a person of skill in the art would have been motivated to combine

Katagawa with Downing, and has not shown that Katagawa in view of Downing render obvious the claimed "chemical pretreatment to … soften the waste stream" step, Petitioner cannot show a reasonable likelihood that claim 1 is obvious over Katagawa in view of Downing.

E. Claims 2-3 and 6

Claims 2-3 and 6 of the '034 patent depend directly or indirectly from independent claim 1 and therefore include each limitation of claim 1. For the same reasons that Petitioner cannot show a reasonable likelihood that claim 1 is obvious over Katagawa in view of Downing, Petitioner cannot show a reasonable likelihood that claims 2-3 and 6 are obvious over Katagawa in view of Downing.

X. GROUND 5 FAILS TO RENDER OBVIOUS CLAIMS 1-3 AND 5-7

A. Overview of Okazoe

Okazoe generally relates to an "activated sludge" process for treatment of selenium in wastewater. For example, Okazoe discloses a "microbial treatment step" that uses "a stirring tank." FWS1013 at ¶ 6. As such, Okazoe is similar to the type of biological treatment recommended by Fukase that simultaneously performs denitrification and selenium reduction in the same step. Ex. 2002 at ¶ 71.

B. Petitioner fails to show that a person of ordinary skill would have had a motivation to combine Katagawa, Downing, and Okazoe, or would have had a reasonable expectation of success in doing so

As explained above, Katagawa is not analogous art, and a person of ordinary skill in the art would not have had a motivation to combine Katagawa and Downing. Adding Okazoe to the mix does change this analysis. In particular, a person of ordinary skill in the art would not have had a motivation to combine Okazoe with Katagawa, Downing, or both. Ex. 2002 at ¶ 85.

Petitioner's only rationale for combining Katagawa and Downing with Okazoe is that "Okazoe further refines the wastewater treatment systems described in Katagawa and Downing," and that a person of skill in the art would be "motivated to apply Okazoe's teaching to arrive at a more refined, effective, and cost-efficient process." Pet. at 53. But Petitioner's analysis fails to articulate what, if anything, in Katagawa or Downing that would be in need of refinement. Thus, Petitioner has not met its burden to demonstrate a motivation to combine Katagawa and Downing with Okazoe.

C. Okazoe teaches away from the claimed "treatment to denitrify the waste stream followed by treatment to remove selenium from the waste stream" (claim 1)

With respect to biological treatment, Okazoe teaches that denitrification should advantageously be performed simultaneously with selenium reduction. Ex. 2002 at ¶ 86; FWS1013 at ¶ 13 ("[B]ecause hexavalent **selenium reduction can be**

performed simultaneously with denitrification treatment, the device configuration for the microbial treatment step can be achieved with the same device configuration (equipment configuration excluding activated sludge) as conventional wastewater treatment devices that perform a nitrification treatment (aerobic treatment) and a denitrification treatment (anaerobic treatment) without modification.") (emphasis added). Moreover, Okazoe disparages performing denitrification and selenium reduction in separate steps. *See id.* ("[O]verall treatment time is markedly reduced compared to the case of performing hexavalent selenium reduction and denitrification treatment in different steps.").

A prior art reference must be considered in its entirety, i.e., as a whole, including portions that would lead away from the claimed invention. *W.L. Gore & Assoc., Inc. v. Garlock, Inc.,* 721 F.2d 1540, 220 USPQ 303 (Fed. Cir. 1983), *cert. denied,*469 U.S. 851 (1984). Because Okazoe teaches that denitrification and selenium reduction should be performed simultaneously, not in separate steps, Okazoe teaches away from performing "treatment to denitrify the waste stream followed by treatment to remove selenium from the waste stream," as recited by claim 1. Furthermore, Okazoe's teaching away cannot lead to a reasonable expectation of success. *See Institut Pasteur v. Focarino*, 738 F.3d 1337, 1344-46 (Fed. Cir. 2013).

XI. GROUND 6 FAILS TO RENDER OBVIOUS CLAIMS 5-7

Claims 5-7 of the ’034 patent depend directly or indirectly from independent claim 1 and therefore include each limitation of claim 1. As explained above with respect to ground 3, Petitioner cannot show a reasonable likelihood that claim 1 is obvious over Fukase in view of Downing. Petitioner does not argue that Okazoe cures the deficiencies of Fukase and Downing with respect to claim 1. Accordingly, for the same reasons that Petitioner cannot show a reasonable likelihood that claim 1 is obvious over Fukase in view of Downing, further in view of Okazoe, Petitioner cannot show a reasonable likelihood that claims 5-7 are obvious over Fukase in view of Downing, further in view of Okazoe.

Date: September 7, 2016

Respectfully submitted,

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CERTIFICATION UNDER 37 CFR § 42.24(d)

Under the provisions of 37 CFR § 42.24(d), the undersigned hereby certifies that the word count for the foregoing Preliminary Response, not inclusive of table of contents, table of authorities, mandatory notices under §42.8, certificate of service or word count, or appendix of exhibits or claim listing, totals no more than 9,197, which is less than the 14,000 allowed under 37 CFR § 42.24(b)(1).

Respectfully submitted,

Date: September 7, 2016

/s/ David Pollock
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CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. § 42.6(e)(4), the undersigned certifies that on September 7, 2017, a complete and entire copy of Patent Owner's Preliminary Response Under 37 C.F.R. § 42.107 was provided electronically via email, pursuant to agreement of the parties under 37 C.F.R. § 42.6(e)(1), to the Petitioner by serving the correspondence address of record of lead and back-up counsel as follows:

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