

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

APTwater, Inc.
Petitioner

v.

ThinkVillage-Kerfoot, LLC (“TVK”)
Patent Owner

Case IPR2014-00133
Patent 7,537,706

CORRECTED PETITION FOR *INTER PARTES* REVIEW
UNDER 35 U.S.C. §§311-319 AND 37 C.F.R. §42.100 ET SEQ.

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I. INTRODUCTION

APTwater, Inc. (“Petitioner” or “APTwater”) petitions for *Inter Partes* Review (“IPR”) under 35 U.S.C. §§ 311–319 and 37 C.F.R. § 42 of claims 1-37 and 39-58 of U.S. Patent No. 7,537,706 (the “’706 Patent” EX.1001), and asserts that there is a reasonable likelihood that it will prevail with respect to at least one of the claims challenged in this Petition.

II. OVERVIEW

The ‘706 Patent is generally directed to methods and apparatuses for removing volatile organic compounds from a wet soil formation, comprising injecting small bubbles containing air and ozone. The small bubbles are generated using a microdiffuser attached to an air sparging apparatus. In some claims, the bubbles are limited to a size range of about 5 to 200 microns or less than 200 microns.

The ‘706 Patent claims priority to a design (non-utility) provisional application (EX.1002) filed on May 5, 1995, which merely provides pictures of the sparger and claims. There is no disclosure of production of bubbles, let alone bubbles less than 200 μm in size, or using air, oxygen or ozone to produce bubbles as recited in the asserted patent claims. Accordingly, the 1995 application date is not available for the challenged patent claims. Rather, the April 25, 1996 utility application (U.S. Ser. No. 08/638,017 (EX.1003)) may provide the earliest priority

date. Moreover, the '706 Patent arises from an application with different subject matter than the April 25, 1996 application via a Continuation-in-Part utility application (U.S. Ser. No. 08/756,273 (EX.1004)) filed on November 25, 1996. Accordingly, the '706 Patent may therefore be entitled to a later priority date of November 25, 1996.

Under the broadest reasonable interpretation the claims are anticipated or rendered obvious by prior art which was not considered by the Examiner. Specifically, Marley et al. (1992) reviews the known art of ground water remediation using standard air sparging apparatuses and techniques, wherein the injection of air into a wet soil formation results in a phase transfer of contaminants such as hydrocarbons or volatile organic compounds (VOCs) from a dissolved state to a vapor phase, and subsequent venting from the unsaturated zone. Marley et al. specifically teach that a large number of small bubbles will provide better mass transfer characteristics for the removal of VOCs from the aqueous soil phase than will a smaller number of large bubbles or channels. Moreover, Marley states that air diffusers may be used at the sparging point in order to inject small bubbles into a coarse-grained formation. Marley further teaches that combinations of air, ozone and/or hydrogen peroxide as the injected gas provides increased oxidation potential for semivolatile organic compounds.

Kerfoot (1992), also directed to soil sparging systems and techniques, teaches the use of air injections through microporous cylinders to create fine bubbles to strip volatile organics out of groundwater. Kerfoot states that it is preferable to match the air bubble size to the size of the solid particle interstitial space of the soil and suggests using porous plastic cylinders as bubblers rather than slotted well screens. Kerfoot describes cylinders with a 50 micron (μm) pore size to create bubbles 50 microns in diameter.

For reasons provided below, Petitioner asserts that a person of ordinary skill in the art (“POSA”) considering the ‘706 Patent’s claims in light of the prior art and general state of knowledge as of the priority date would have understood that the references cited herein anticipate and/or render obvious the claims of the ‘706 Patent.

III. MANDATORY NOTICES UNDER 37 C.F.R. § 42.8(a)(1)

A. REAL PARTY-IN-INTEREST UNDER 37 C.F.R. § 42.8(b)(1)

APTwater, Inc. is the real party-in-interest for the instant Petition.

APTwater is a corporation organized under the laws of Delaware, having its principal place of business at 100 West Broadway, Suite 200, Long Beach, California 90802, which is the successor-in-interest of Applied Process Technology, Inc.

B. RELATED MATTERS UNDER 37 C.F.R. § 42.8(b)(2)

Petitioner is a named defendant in pending litigation concerning the '706 Patent styled *ThinkVillage-Kerfoot, LLC v. Stantec Consulting Services, Inc.*, Central District of California, Case No. 1:12-09515 GW (FMOx). The complaint was originally filed on November 6, 2012. The complaint was served to on November 9, 2012. *See* EX.1005. Petitioner is not aware of any pending prosecution or administrative proceedings concerning the '706 Patent.

The Petitioner is filing one other *inter partes* review petition requesting review of a patent, also asserted by ThinkVillage-Kerfoot, LLC against Petitioner APTwater, Inc., in the above-captioned lawsuit, U.S. Patent No. 7,032,492 (EX.1006). U.S. Patent No. 7,032,492 and the '706 Patent are both directed to methods and apparatuses involving sparging using air/ozone gas for treating sites containing contaminants.

C. LEAD AND BACK-UP COUNSEL UNDER 37 C.F.R. § 42.8(b)(3)

Petitioner provides the following designation of counsel.

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D. SERVICE INFORMATION UNDER 37 C.F.R. § 42.8(b)(4)

Please address all correspondence to the lead and back-up counsel at the address provided in Section II(C) of this Petition. Petitioner also consents to electronic service by email at:

IPdocketMWE@MWE.com, jmohr@mwe.com and sharlocker@mwe.com

IV. PAYMENT OF FEES – 37 C.F.R. § 42.103

The Patent and Trademark Office is hereby authorized to charge Deposit Account No. 505907 for the fee set in 37 C.F.R. § 42.15(a) for this Petition for *inter partes* review, and for any additional fees that may be due as a result of the submission of this Petition.

V. REQUIREMENTS FOR IPR UNDER 37 C.F.R. §§ 42.104

A. Grounds for Standing Under 37 C.F.R. § 42.104(a)

Petitioner certifies that the '706 Patent is eligible for *inter partes* review and further certifies that Petitioner is not barred or otherwise estopped from requesting *inter partes* review challenging the identified claims on the grounds noted within the present petition. This petition is being filed within one year of the service of the original complaint against Petitioner in the litigation described above (EX.1005).

B. Identification of Challenge Under 37 C.F.R. § 42.104(b) and Relief Requested

Petitioner requests *inter partes* review of claims 1-37 and 39-58 of the '706 Patent on the grounds set forth in the table below and requests that each of the claims be found unpatentable. The statutory grounds upon which claims 1-37 and 39-58 are unpatentable are identified below.

Ground	35 USC	Claims	Prior Art Reference(s)
1	102(b)	46, 47, 50	Marley et al., <i>Groundwater Monitoring & Remediation</i> (GWMR), p. 137-145, Spring 1992 (EX.1007); hereinafter “Marley”
2	103(a)	46, 47, 50	Marley Kerfoot, “Injectable Points for Sandy Soil Sparging Systems”, University of Massachusetts

			7 th Annual Hydrocarbon Contaminated Soils Conference, p. 1-11, September 1992 (EX.1008); hereinafter “Kerfoot”
3	103(a)	46, 47, 50	Marley, Kerfoot Zappi et al., US Army Corp of Engineers, “A Laboratory Evaluation of the Feasibility of Chemical Oxidation Processes for Treatment of Contaminated Groundwaters,” September 1995 (EX.1009); hereinafter “Zappi”
4	103(a)	48, 49, 51	SITE – The Superfund Innovative Technology Evaluation Program: Technology Profiles Fifth Edition, “Oxygen Microbubble In Situ Bioremediation”, November 1992 (EX.1010)
5	103(a)	1	Marley, Kerfoot and SITE Technology
6	103(a)	2-21	Marley and Kerfoot U.S. Pat. No. 4,804,478 (EX.1011); hereinafter the “478 Patent” U.S. Pat. No. 4,141,830 (EX.1012); hereinafter the “830 Patent”

7	103(a)	22	Marley, Kerfoot and SITE Technology
8	103(a)	23-30	Marley and Kerfoot U.S. Pat. No. 5,425,598 (EX.1013); hereinafter the “‘598 Patent”
9	103(a)	31	Marley, Kerfoot and the ‘598 Patent
10	103(a)	32-37, 39-45	Merley, Kerfoot, the ‘478 Patent EPA Ground Water Issue, January 1992 (EX.1014); hereinafter “EPA Jan. 1992” EPA “Behavior and Determination of Volatile Organic Compounds in Soil,” May 1993 (EX.1015); hereinafter “EPA May 1993”
11	103(a)	53-58	Marley, Kerfoot and SITE Technology
12	103(a)	54-58	Marley, Kerfoot, ‘478 Patent, ‘830 Patent, EPA Jan. 1992

As noted below under each section discussing each Ground, the prior art references relied on by Petitioner qualify as prior art under 35 U.S.C. § 102(b), because they were each published more than 1 year before the earliest priority date of the ‘706 Patent. None of the prior art references were made of record during prosecution of the ‘706 Patent and were, therefore, not considered by the examiner.

VI. SUMMARY OF THE '706 PATENT

A. Brief Description

The '706 Patent is generally directed to methods and apparatuses for removing volatile organic compounds from a wet soil formation, comprising injecting small bubbles containing air and ozone. The small bubbles are generated using a microdiffuser attached to an air sparging apparatus. In some claims, the bubbles are limited to a size range of about 5 to 200 microns or less than 200 microns.

The '706 Patent claims priority to a design (non-utility) provisional application (See EX. 1002) filed on May 5, 1995, which merely provides pictures of the sparger and claims. There is no disclosure of production of bubbles, let alone bubbles less than 200 μm in size, or using air, oxygen or ozone to produce bubbles as recited in the asserted patent claims. Accordingly, the 1995 application date is not available for the challenged patent claims under 35 U.S.C. § 120. Rather, the April 25, 1996 utility application (U.S. Ser. No. 08/638,017 (See EX.1003)) arguably may provide the earliest priority date. Moreover, the '706 Patent arises from an application with different subject matter than the April 25, 1996 application via a Continuation-in-Part utility application (U.S. Ser. No. 08/756,273 (See EX.1004)) filed on November 25, 1996. Accordingly, the '706 Patent may therefore be entitled to a later priority date of November 25, 1996.

Under the broadest reasonable interpretation the claims are anticipated or rendered obvious by prior art which was not considered by the Examiner. Specifically, Marley *et al.* (1992) reviews the known art of ground water remediation using standard air sparging apparatuses and techniques, wherein the injection of air into a wet soil formation results in a phase transfer of contaminants such as hydrocarbons or volatile organic compounds (VOCs) from a dissolved state to a vapor phase, and subsequent venting from the unsaturated zone. Marley *et al.* specifically teaches that a large number of small bubbles will provide better mass transfer characteristics for the removal of VOCs from the aqueous soil phase than will a smaller number of large bubbles or channels. Moreover, Marley *et al.* states that air diffusers may be used at the sparging point in order to inject small bubbles into a coarse-grained formation. Marley *et al.* further teaches that combinations of air, ozone and/or hydrogen peroxide as the injected gas provides increased oxidation potential for semivolatile organic compounds.

Kerfoot *et al.* (1992), also directed to soil sparging systems and techniques, teaches the use of air injections through microporous cylinders to create fine bubbles to strip volatile organics out of groundwater. Kerfoot *et al.* states that it is preferable to match the air bubble size to the size of the solid particle interstitial space of the soil and suggests using porous plastic cylinders as bubblers rather than

slotted well screens. Kerfoot *et al.* describes cylinders with a 50 micron (μm) pore size to create bubbles 50 microns in diameter.

For reasons provided below, Petitioner asserts that a person having ordinary skill in the art (“POSA”) considering the ‘706 Patent’s claims in light of the prior art and general state of knowledge as of the priority date would have understood that the references cited herein anticipate and/or render obvious the claims of the ‘706 Patent.

Microporous diffusers which produce micro-fine bubbles were known and in use at the time of the priority date of the ‘706 Patent as evidenced by Kerfoot which refers to SpargepointsTM (E.g., page 5, end of the first paragraph). Kerfoot describes the KVA SpargepointTM, a 1 ft long porous cylinder with 50 micron pores (page 7, first and second full paragraphs).

In sum, it is Petitioner’s position that the claims of the ‘706 Patent are anticipated or obvious to the POSA in view of the knowledge at the time of filing in combination with prior art as described in more detail below.

B. Claim Construction under 37 C.F.R. §§ 42.104(b)(3)

In an *inter partes* review, “[a] claim in an unexpired patent shall be given its broadest reasonable construction in light of the specification of the patent in which it appears.” 37 C.F.R. § 42.100(b). Under the broadest reasonable construction standard, claims are to be given their broadest reasonable interpretation consistent

with the specification, reading claim language in light of the specification as it would be interpreted by one of ordinary skill in the art. *In re Am. Acad. of Sci. Tech. Ctr.*, 367 F.3d 1359, 1364 (Fed. Cir. 2004). In some cases, the ordinary meaning of claim language as understood by a person of skill in the art may be readily apparent even to lay judges, and claim construction in such cases involves little more than the application of widely accepted meaning of commonly understood words. *Phillips v. AWH Corp.*, 415 F.3d 1303, 1314 (Fed. Cir. 2005) (en banc). Consistent with these principles, construction for certain claim terms of the '706 Patent is provided by Petitioner in the table below.

Claim Term	Construction
Bubbles	a film of liquid enclosing a gas
injecting gaseous ozone	introducing a gas which comprises ozone
initial bubble diameter	diameter of a bubble measured immediately upon its creation

Petitioner's position regarding the construction of these terms and the scope of the claims should not be taken as an assertion of its position on the same terms and claims in other adjudicative forums where a different claim interpretation

standard may apply.

VII. THERE IS A REASONABLE LIKELIHOOD THAT AT LEAST ONE CLAIM OF THE '706 PATENT IS UNPATENTABLE

As detailed in the claim charts below, the noted prior art references and/or arguments establish that all the limitations of claims 1-37 and 39-58 of the '706 Patent were well known in the art at least as early as April 25, 1996. Per 37 C.F.R. 42.6(d), copies of the references are filed herewith. The prior art references relied on were not before (or considered by) the Examiner during prosecution of the '706 Patent, and establish that all the limitations of claims 1-37 and 39-58 of the '706 Patent were well known in the art.

A. Ground 1: Claims 46, 47 and 50 are Anticipated by Marley

As shown by the following claim chart and discussion herein, each and every element of claim 46 is disclosed in Marley so as to enable a POSA to make and use the invention broadly set forth in claims 46, 47 and 50 without the need for undue experimentation in light of the general knowledge available in the art. Marley teaches the application of in situ air-sparging technology for the removal of VOCs from the aqueous soil phase, including the use of air, ozone, and/or hydrogen peroxide as the injected gas.

As shown by the following claim chart and discussion below, each and every element of claims 46, 47 and 50 are disclosed in Marley.

Ground 1: Claims 46, 47 and 50 are Anticipated by Marley		
'706 Claim No.	Claim Element	Disclosure in Marley
46	A method comprises: injecting gaseous ozone into a wet soil formation	Page 138, Fig. 1: shows an air sparging system for injecting air into a wet soil formation. Page 139, Col. 1, fifth full paragraph: Less strippable compounds may be remediated with enhancements to the standard sparging process, for example using a combination of air, ozone, and/or hydrogen peroxide as the injected gas to provide increased oxidation potential for semivolatile organic compounds or thorough potential enhancements to the natural biodegradation process by the addition of oxygen.
	at concentrations to effect removal of volatile organic compounds in the soil formation	Page 139, Col. 1, first full paragraph: for the removal of VOCs from the aqueous soil phase. Page 139, Col. 1, fifth full paragraph: Less strippable compounds may be remediated with enhancements to the standard sparging process, for example using a combination of air, ozone, and/or hydrogen peroxide as the injected gas to provide increased oxidation potential for semivolatile organic compounds or thorough potential enhancements to the natural biodegradation process by the addition of oxygen.
	by delivery of the gaseous ozone in bubbles and with the gaseous ozone reacting with the volatile organic compounds.	Page 139, first full paragraph: Air diffusers may be used at the sparging point in order to inject small bubbles into a coarse-grained formation.
47	...wherein injecting gaseous ozone with air occurs in ground water	Page 140, Fig. 2 shows an air sparging system having ground water sparging wells.

	of a subsurface aquifer.	
50	...injecting the gaseous ozone through microporous materials to provide the bubbles.	Page 139, Col. 1, first paragraph: “Air diffusers may be used at the sparging point in order to inject small bubbles prior to entry into a course-grained formation.

B. Ground 2: Claims 46, 47 and 50 Would Have Been Obvious Over Marley and Kerfoot

Even if the Board determines that claims 46, 47 and 50 are not anticipated, these claims nonetheless are unpatentable for obviousness under 35 U.S.C. § 103 when combining the teachings of Marley and Kerfoot. Marley teaches that a large number of small bubbles will provide better mass transfer characteristics for the removal of VOCs from the aqueous soil phase than will a small number of large bubbles or channels and that an air diffuser may be used for this purpose (page 139, Col. 1, first paragraph). Marley also describes an air/ozone mixture for air sparging organic compounds (page 139, Col. 1, fifth full paragraph). A POSA would turn to Kerfoot which provides teachings of air diffusers (microporous diffusers) which will provide a large number of small bubbles (E.g., a 1-foot long porous cylinder with 50 micron pores; page 7, second full paragraph) and combine that with the teachings of Marley to generate and inject air/ozone into a wet soil formation in the form of fine bubbles. Based on the teachings of Marley, a POSA would have been motivated to use the air diffusers of Kerfoot to practice the air sparging method of Marley, specifically, to inject into a soil formation a large

number of fine bubbles comprising ozone. A POSA would have a high expectation of success in generating bubbles and that the gaseous ozone would react with the volatile organic compounds. Therefore, claims 46, 47 and 50 are obvious under 35 U.S.C. § 103(a) over the combination of Marley and Zappi.

C. Ground 3: Claims 46, 47 and 50 Would Have Been Obvious Over Marley in view of Zappi

Petitioner further asserts that claims 46, 47 and 50 are unpatentable for obviousness based on the combination of Marley and Zappi. It would have been obvious to the POSA to adapt the teachings of Marley such that gaseous ozone rather than air is injected into a wet soil formation at concentrations effective to remove volatile organic compounds in the soil formation. Marley teaches that using a combination of air, ozone, and/or hydrogen peroxide as the injected gas to provide increased oxidation potential for semivolatile organic compounds. At the time of the priority date of the '706 Patent, it was known to the POSA that ozone, a very strong oxidative agent, is effective in air sparging for removal of VOCs (Zappi, page 23, second full paragraph: "Sparging of the ozonated air will result in the desorption (stripping) of VOCs from the system influent"). Based on the combined teachings of the prior art, the expectation of success is high for using gaseous ozone for injection into a wet soil formation at concentrations to effect removal of VOCs in the soil formation by delivery of the gaseous ozone in bubbles.

Therefore, claims 46, 47 and 50 are obvious under 35 U.S.C. § 103(a) over the combination of Marley and Zappi.

D. Ground 4: Claims 48, 49 and 51 Would Have Been Obvious Over Marley in view of Kerfoot and SITE Technology

Claims 48, 49 and 51 each depend directly or indirectly from claim 46 and add no more than what is clearly taught or suggested by Kerfoot and SITE Technology as detailed in the claim chart below as discussed with reference to Grounds 1, 2 and 3 above. Kerfoot explicitly states that it would be preferable to match bubble size to the size of the soil particle interstitial space (page 4, second paragraph).

The recitation in claim 48 of a bubble size in a range of about 5 to 200 μm does not contribute to the patentability of the claimed subject matter in view of the teachings by Kerfoot of 50 micron bubbles and the teachings by SITE Technology of bubbles have a size range of 5 to 95 microns ($45 \pm 40 \mu\text{m}$) for in situ bioremediation of ground water in soil formations. It is “an elementary principle of patent law that when, as by a recitation of ranges or otherwise, a claim covers several compositions, the claim is ‘anticipated’ if one of them is in the prior art.” *Titanium Metals Corp. v. Banner*, 778 F.2d 775, 782 (Fed. Cir. 1985); see *King Pharms., Inc. v. Eon Labs, Inc.*, 616 F.3d 1267, 1277 (Fd. Cir 2010). “[W]here the general conditions of a claim are disclosed in the prior art, it is not inventive to

discover the optimum or workable ranges by routine experimentation.” *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955).

A POSA would have had a reasonable expectation of success to arrive at a method for removing VOCs in a soil formation by injecting air including gaseous ozone as bubbles with an initial bubble size in the range of about 5 to 200 μm within the scope of claim 1.

Ground 4: Claims 48, 49 AND 51 are Obvious in View of Marley in View of Kerfoot and SITE Technology			
‘706 Claim No.	Claim Element	Disclosure in Kerfoot	Disclosure in SITE Technology
48	...wherein the bubbles are fine bubbles with an initial bubble size in a range of about 5 to 200 μm	Page 4, second paragraph: With a 50 micron pore size, the bubbling tubes would create bubbles 0.05 mm in diameter or about 2 slot (.002 inches) diameter. Comment: 0.05 mm = 50 microns	Page 282, Col. 1: After passing though[sic] the generator, the resulting 65 percent dispersion of bubbles in the size range of 45 ± 40 microns can be delivered and injected into a saturated solid matrix under pressure. (Describing a process for in situ bioremediation of contaminated groundwater)
49	...wherein the fine bubbles are sized in accordance with a porosity characteristic of the soil formation.	Page 4, second paragraph: It is preferable to match the air bubble size to the size of the soil particle interstitial space.	

51	...injecting the ozone through a slotted well screen to provide the bubbles.	Page 4, first paragraph: An extended slot of a .010 (10 slot) PVC monitoring well screen presents an opening of .010 inch by 2.0 inches for bubble production.	

E. Ground 5: Claim 1 Would Have Been Obvious Over Marley and Kerfoot in further view of SITE Technology and Zappi

The claim chart below sets forth the correspondence between independent claim 1 of the '706 Patent and the combined teachings of Marley and Kerfoot. Similar to claim 46, addressed in Grounds 1, 2 and 3, claim 1 is directed to a method of removal of VOCs in a soil formation comprising injecting air including gaseous ozone into water in the soil formation. Claim 1 further recites, in part, the air and the ozone injected into the water as fine bubbles with an initial bubble size in a range of about 5 to 200 μm .

As discussed for Grounds 1 and 2, Marley describes the use of in situ air sparging for soil and ground water remediation (the removal of VOCs). Marley also teaches that a large number of small bubbles will provide better mass transfer characteristics for the removal of VOCs from the aqueous solid phase than will a smaller number of large bubbles or channels (page 139, Col. 1, first full paragraph). Marley further explains that using a combination of air and ozone as the injected

gas can provide increased oxidation potential for semivolatile organic compounds (page 136, fifth full paragraph).

Microporous diffusers which produce micro-fine bubbles were known and in use at the time of the priority date of the '706 Patent as evidenced by Kerfoot which refers to SpargepointsTM (E.g., page 5, end of the first paragraph). Kerfoot also describes the KVA SpargepointTM, a 1 ft long porous cylinder with 50 micron pores (page 7, first and second full paragraphs). Kerfoot teaches that it is preferable to match the air bubble size to the size of the solid particle interstitial space (pore size) and that this can be done by using porous plastic cylinders as bubblers with a 50 micron pore size. Such bubbling tubes would create bubbles 50 μm in diameter.

To achieve better mass transfer of VOCs from soils, it would have been obvious to employ microporous diffusers as taught by Kerfoot in order to generate air/ozone micro-bubbles, such as bubbles with a diameter of 50 microns, because Marley teaches that a large number of small bubbles will provide better mass transfer for removal of VOCs from an aqueous solid phase and that an air/ozone mixture is effective in removing semivolatile organic compounds via sparging. As Zappi also shows that ozone is effective in the removal of VOCs via air sparging, there is a high expectation of success in the use of air/ozone micro-bubbles

generated by a microdiffuser taught by Kerfoot for the removal of VOCs in soil and ground water remediation processes.

The recitation in claim 1 of a bubble size in a range of about 5 to 200 μm does not contribute to the patentability of the claimed subject matter in view of the teachings by Kerfoot of 50 micron bubbles and the teachings by SITE Technology of bubbles having a size range of 5 to 95 microns for in situ bioremediation of ground water in soil formations. It is “an elementary principle of patent law that when, as by a recitation of ranges or otherwise, a claim covers several compositions, the claim is ‘anticipated’ if one of them is in the prior art.” *Titanium Metals Corp. v. Banner*, 778 F.2d 775, 782 (Fed. Cir. 1985); see *King Pharms., Inc. v. Eon Labs, Inc.*, 616 F.3d 1267, 1277 (Fd. Cir 2010). “[W]here the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation.” *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955).

A POSA would have had a reasonable expectation of success to arrive at a method for removing VOCs in a soil formation by injecting air including gaseous ozone as bubbles with an initial bubble size in the range of about 5 to 200 μm within the scope of claim 1.

Accordingly, claim 1 is *prima facie* obvious over the teachings of the prior art under 35 U.S.C. § 103.

Ground 5: Claim 1 is Obvious in View of Marley and Kerfoot			
'706 Claim No.	Claim Element	Disclosure in Kerfoot	Disclosure in Marley
1	A method of removal of volatile organic compounds in a soil formation comprises:	Page 1, Abstract: Air bubbled through saturated sands carries out two functions: removal of dissolved volatile organics and aeration of the soil.	Page 137, Abstract, first paragraph: Vapor extraction (soil venting) has been demonstrated to be a successful and cost-effective remediation technology for removing VOCs from the vadose (unsaturated) zone.
	injecting air including gaseous ozone into water in the soil formation with gaseous ozone at concentrations to effect removal of volatile organic compounds by the gaseous ozone reacting with the volatile organic compounds		Page 139, Col. 1, fourth paragraph: Less strippable compounds may be remediated with enhancements to the standard sparging process, for example using a combination of air, ozone, and/or hydrogen peroxide as the injected gas to provide increased oxidation potential for semivolatile organic compounds or thorough potential enhancements to the natural biodegradation process by the addition of oxygen. Zappi, page 23, second full paragraph: Sparging of the ozonated air will result in the desorption (stripping) of

			VOCs from the system influent.
	and with the air and the ozone injected into the water as fine bubbles	Page 2, ll. 2-5: Air injections through microporous cylinders created fine bubbles giving more uniform bubble distribution than injections through slitted PVC well screen.	Page 139, Col. 1, first paragraph: Air diffusers may be used at the sparging point in order to inject small bubbles into a coarse-grained formation.
	with an initial bubble size in a range of about 5 to 200 µm.	Page 4, second paragraph: It is preferable to match the air bubble size to the size of the soil particle interstitial space. This can be done by using porous plastic cylinders as bubblers instead of slotted well screens. With a 50 micron pore size, the bubbling tubes would create bubbles 0.05 mm in diameter or about 2 slot (.002 inches) diameter. Comment: 0.05 mm = 50 microns. Moreover, SITE Technology teaches at Page 282, Col. 1: After passing through[<i>sic</i>] the generator, the resulting 65 percent	Page 139, Col. 1, first full paragraph: Theoretically, a large number of small bubbles will provide better mass transfer characteristics for removal of VOCs from the aqueous soil phase than will a smaller number of large bubbles or channels.

		dispersion of bubbles in the size range of 45 ± 40 microns can be delivered and injected into a saturated solid matrix under pressure.	
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F. Ground 6: Claims 2-21 Would Have Been Obvious Over Marley and Kerfoot as Evidenced by the ‘478 and ‘830 Patents

Claims 2-21 depend directly or indirectly from claim 1, discussed above as Ground 5, and recite additional elements which are found in the Marley and Kerfoot references as shown in the claim chart below and/or which were known to the POSA at the time of the priority date. As shown in the claim chart, claims 2, 3, 5, 7-12 and 18-21 merely recite elements which are described by Kerfoot and/or Marley. When the claims represent the arrangement of old elements with each performing the same function it had been known to perform and yields no more than one would expect from such an arrangement, the combination is obvious (M.P.E.P. § 2141).

Claims 6 and 7 each recite, “mixing the air with the ozone,” suggesting a patentable feature is encompassed by the combination of air and ozone for injection into a soil formation or aquifer. The ‘706 Patent teaches, at col. 2, ll 58-62, “Unlike the prior art, the contaminated groundwater is injected with an air/ozone mixture wherein micro-fine air bubbles strip the solvents from the

groundwater and the encapsulated ozone acts as an oxidizing agent in a gas/gas reaction to break down the contaminates...” Indeed, each of the independent claims recites, in various terminology, air and ozone for injection into soil formations. This could be construed as suggesting a patentable feature is encompassed by the combination of air and ozone for prior to injection into, for example, a soil formation or aquifer. The prevalence of such terminology in the claims prompts Petitioner to consider the following when examining the claims as requested by Petitioner.

The ‘706 Patent specification as filed describes sparging apparatuses comprising an ozone generator (e.g., col. 4, l. 19) but provides no explicit description regarding how the ozone which is injected according to the claims is generated or “mixed with air.” It is Petitioner’s position that the claimed invention envisions the use of any ozone generator which uses air as a starting product or intermediate. Because of its relatively short half-life, ozone is always or almost always generated on-site by an ozone generator. As taught by U.S. Pat. No. 4,804,478 (the “‘478 Patent,” col. 3, l. 7), ozone is produced mainly from air, in some cases from oxygen. The ‘478 Patent describes the production of ozone by quiet electrical discharge (col. 3, 7-10). U.S. Pat. No. 4,141,830 (the “‘830 Patent”) teaches that small amounts of ozone can be produced by ultraviolet lamp which irradiates air in a chamber (col. 1, ll 20-22 and 41-46). Accordingly,

Petitioners assert that any recitation within the claims of a mixture or mixing of air and ozone represents an element which contributes no more than standard, long-known compositions and methods for on-site generation of ozone in the presence of air.

Claims 9, 10, and 11 recite initial bubble size at least between 50 to 200 μm , 20 to 50 μm , and 5 to 20 μm , respectively. Ignoring the indefinite language of “at least between,” these ranges are not patentable over the bubble sizes taught in the prior art as discussed above with respect to Grounds 4 and 5.

Thus, Petitioner respectfully requests *inter partes* review of claims 2-21 on the ground that the claims are obvious under 35 U.S.C. § 103.

Ground 6: Claims 2-21 are Obvious in View of MARLEY, KERFOOT, and Knowledge at the Priority Date				
‘706 Claim No.	Claim Element	Disclosure in Kerfoot	Disclosure in Marley	Knowledge at Priority Date
2	...wherein the fine bubbles are sized in accordance with a porosity characteristic of the soil formation.	Page 4, second paragraph: It is preferable to match the air bubble size to the size of the soil particle interstitial space.”		
3	...providing a plurality of injection wells		Page 138, Figure 1: illustrates a plurality of injection wells.	

	<p>...introducing the air and ozone as fine bubbles between about 5 to 200 μm through the injection wells.</p>	<p>Page 4, second paragraph: With a 50 micron pore size, the bubbling tubes would create bubbles 0.05 mm in diameter or about 2 slot (.002 inches) diameter. Comment: 0.05 mm = 50 microns Moreover, SITE Technology teaches at Page 282, Col. 1:After passing though[sic] the generator, the resulting 65 percent dispersion of bubbles in the size range of 45 ± 40 microns can be delivered and injected into a saturated solid matrix under pressure.</p>		
4	<p>intermittently agitating water in the well.</p>	<p>Kerfoot, Page 5, second full paragraph:</p>		

		<p>...alternate on-bubbling periods with off-bubbling period...</p> <p>*Petitioners assert this will result in intermittent agitation in view of the '706 Patent Col. 3, ll. 5-13 which describes a pump means for generating and forcing bubbles into the formation and intermittently agitates the water in the well.</p>		
5	...pulsing the injected air including ozone.		Page 139, Col. 2, top paragraph: Pulsing of the air flow into the sparge points is considered...	
6	...mixing the air with the ozone			'478 Patent Col 1., ll 20-22, 41-46; '830 Patent, Col. 3 ll. 7-10: A mixture of air and ozone is inherent

				in the use of an ozone generator.
7	...mixing the air with the ozone			'478 Patent col 1, ll 20-22, 41-46; '830 Patent, col. 3 ll. 7-10: A mixture of air and ozone is inherent in the use of an ozone generator.
	...delivering the air and ozone through a plurality of microporous diffusers to produce the fine bubbles of air and ozone	Page 138, Figure 1: illustrates a plurality of injection wells.		
8	...initial bubble size at least between 50 to 200 μm	Page 4, second paragraph: With a 50 micron pore size, the bubbling tubes would create bubbles 0.05 mm in diameter or about 2 slot (.002 inches) diameter. Comment: 0.05 mm = 50 microns. Moreover, SITE Technology teaches at		
9	...initial bubble size at least between 20 to 50 μm			
10	...initial bubble size at least between 5 to 20 μm			

		Page 282, Col.: After passing though[sic] the generator, the resulting 65 percent dispersion of bubbles in the size range of 45 ± 40 microns can be delivered and injected into a saturated solid matrix under pressure.		
12	...providing a plurality of injection wells	Page 138, Figure 1: illustrates a plurality of injection wells.		
	...injecting the ambient air and ozone as fine ...bubbles through the injection wells by using a corresponding micro-porous diffuser for each one of the plurality of injection wells	Page 2, lines 2-5: Air injections through microporous cylinders created fine bubbles giving more uniform bubble distribution than injections through slitted PVC well screen.		
	...surrounding the micro-porous			US 5,425,598 Col. 3, ll. 14-16:

	diffusers with a sand pack disposed between the micro-porous diffusers and the surrounding soil formation.			The permeable packing material 20 includes, for example, sand pack or some other fluid permeable composition.
13	removal of volatile organic compounds can occur without vapor extraction.			This element is an inherent property of the method of claim 1.
14	agitating with pumped water to disperse said bubbles through the soil formation.	Page 5, second full paragraph: ...alternate on-bubbling periods with off-bubbling period...		
15	...wherein the soil formation contains chlorinated hydrocarbons.			POSA/EPA May 1993, page 24, second full paragraph describes volatile organic compounds in soil, including chlorinated hydrocarbons, dichloroethene, trichloroethene, and tetrachloroethene.
16	...wherein the soil formation contains organic and hydrocarbon material.			
17	...wherein the volatile organic compounds include chlorinated solvents including dichloroethene,			

	trichloroethene, and/or tetrachloroethene.			
18	...wherein microporous diffusers are used to generate said fine bubbles	Page 2, lines 2-5: Air injections through microporous cylinders created fine bubbles giving more uniform bubble distribution than injections through slitted PVC well screen.		
	...the microporous materials of the microporous diffusers have a pore size selected to match a porosity characteristic of the surrounding soil formation.	Page 4, second paragraph: It is preferable to match the air bubble size to the size of the soil particle interstitial space. This can be done by using porous plastic cylinders as bubblers instead of slotted well screens.		
19	...wherein the microporous materials of the microporous	Page 4, second paragraph: It is preferable to match the air		

	diffusers have a pore size selected to match a porosity characteristic and a permeability characteristic of the surrounding soil formation.	bubble size to the size of the soil particle interstitial space. This can be done by using porous plastic cylinders as bubblers instead of slotted well screens.		
20	...wherein the microporous diffusers are used to generate said fine bubbles and	Page 2, ll. 2-5: Air injections through microporous cylinders created fine bubbles		
	...the microporous materials of the microporous diffusers have a pore size selected to match a permeability characteristic of the surrounding soil formation.	Page 4, second paragraph: It is preferable to match the air bubble size to the size of the soil particle interstitial space. This can be done by using porous plastic cylinders as bubblers instead of slotted well screens.		
21	...generating an oxidizing agent		Page 139, Col. 1, fifth full	

	<p>comprising ozone at concentrations to effect removal of contaminants</p>		<p>paragraph: Less strippable compounds may be remediated ...using a combination of air, ozone, and/or hydrogen peroxide as the injected gas to provide increased oxidation potential for semivolatile organic compounds.</p>	
	<p>...mixing air with ozone to produce the air including ozone.</p>			<p>‘478 Patent Col. 1, ll 20-22, 41-46; ‘830 Patent, Col. 3 ll. 7-10: A mixture of air and ozone is inherent in the use of an ozone generator.</p>

G. Ground 7: Claim 22 Would Have Been Obvious Over Marley and Kerfoot in further view of SITE Technology

Claim 22 is directed to a sparging apparatus for injecting a gas comprising ozone into aquifer regions. The claim recites standard components of air spargers such as a gas generator and compressor, detailed in the claim chart below. Claim 22 further recites elements related to the use of an air and ozone mixture for

injection into the aquifer and a microdiffuser for the generation of microbubbles having an initial diameter in the range of about 5-200 μm. As discussed above, these elements were taught prior to the priority date of the '706 Patent at least by the Kerfoot and Marley references. As discussed with respect to Ground 6, when the claims represent the arrangement of old elements with each performing the same function it had been known to perform and yields no more than one would expect from such an arrangement, the combination is obvious (M.P.E.P. § 2141).

Thus, Petitioner respectfully requests *inter partes* review of claim 22 on the ground that the claim is obvious under 35 U.S.C. § 103.

Ground 7: Claim 22 is Obvious in View of Marley and Kerfoot			
'706 Claim No.	Claim Element	Disclosure in Kerfoot	Disclosure in Marley
22	Apparatus for injection of a gas into aquifer regions for removal of volatile organic compounds by reaction with ozone, comprising		Page 137, Abstract, first paragraph: Vapor extraction (soil venting) has been demonstrated to be a successful and cost-effective remediation technology for removing VOCs from the vadose (unsaturated) zone.
	a gas generator for generating an oxidizing agent		Ozone generators were well-known in the art long before the priority date, E.g., U.S. Pat. No. 4,650,573 , issued in 1987

	<p>comprising ozone for injection of air including ozone into the aquifer;</p>		<p>Marley Page 139, Col. 1, second full paragraph: The choice of sparging gas to be used at a specific site may be based on.....Less strippable compounds may be remediated with....using a combination of air, ozone and/or hydrogen peroxide as the injected gas to provide increased oxidation potential.....</p>
	<p>a microporous diffuser coupled to the gas generator,</p>		<p>Page 140, Col. 2, first full paragraph: The typical sparging apparatus consists of an oil-free air compressor manifolded to one or more air-sparging wells.</p>
	<p>microporous diffuser including a body having a porous portion</p>	<p>Page 7, second full paragraph: A 1 ft long...porous cylinder with 50 micron pores was placed...</p>	
	<p>with a pore size in the range of about 5-200 µm; and</p>	<p>Page 4, second paragraph: With a 50 micron pore size, the bubbling tubes would create bubbles 0.05 mm in diameter or about 2 slot (.002 inches) diameter. Comment: 0.05 mm = 50 microns. Moreover, SITE Technology teaches at Page 282, Col. 1:After passing though[sic] the</p>	

		generator, the resulting 65 percent dispersion of bubbles in the size range of 45 ± 40 microns can be delivered and injected into a saturated solid matrix under pressure.	
	a compressor coupled to the gas generator to provide the gas to the microporous diffuser at an elevated pressure		Page 140, Col. 2, first full paragraph: The typical sparging apparatus consists of an oil-free air compressor manifolded to one or more air-sparging wells.
	to deliver microbubbles having an initial diameter in a range of about 5 microns to 200 microns into the aquifer regions.	<p>Page 4, second paragraph: With a 50 micron pore size, the bubbling tubes would create bubbles 0.05 mm in diameter or about 2 slot (.002 inches) diameter.</p> <p>Comment: 0.05 mm = 50 microns.</p> <p>Moreover, SITE Technology teaches at Page 282, Col. 1:After passing though[sic] the generator, the resulting 65 percent dispersion of bubbles in the size range of 45 ± 40 microns can be delivered and injected into a saturated solid matrix under pressure.</p>	

H. Ground 8: Claims 23-30 Would Have Been Obvious Over Marley in view of Kerfoot and as evidenced by the ‘598 Patent

Claims 23-30 each depend directly or indirectly from claim 22. Claims 23-25 and 29 are primarily directed to common elements of air-spargers as described, for example, in the ‘598 Patent. These elements are presented in the claim chart below and are known to the POSA in the field of air sparging for water remediation in, for example, wet soil formations. Claims 26-28 recite the position of the microporous diffuser, as described in Kerfoot, relative to the casing. Such positioning is mentioned only in these claims, having no further description in the specification or figures. Again, the claims represent no more than a rearrangement of old elements for same function as taught in the prior art relied upon as discussed in Grounds 6 and 7. Thus, Petitioner respectfully requests *inter partes* review of claims 23-30 on the ground that the claims are obvious under 35 U.S.C. § 103.

Ground 8: Claims 23-30 are Obvious in View of Marley and the ‘598 Patent			
‘706 Claim No.	Claim Element	Disclosure in the ‘598 Patent	Disclosure in Marley
23	The apparatus of claim 22 further comprising a casing	Col. 3, l. 9: ...includes a well casing 12...	Page 141, Col. 1, first full paragraph: Air-sparging wells may be constructed of ...or metal casing and screen.
	...a packer disposed through the casing	‘598 Patent Col. 3, ll. 16-17: includes, for example, sand pack or some other fluid	Page 141, Col. 1, first full paragraph: The well screen or air diffuser must be sealed within a sand

		permeable composition..	filter pack...
	...an outlet screen coupled to the casing.	'598 Patent, Col. 3, ll. 10-12 and Figure: first section 14 which has perforations or similar openings to allow fluid flow corresponds to "outlet screen" of the '706 Patent.	
24	...wherein the outlet screen is coupled to the casing at a lower portion thereof	'598 Patent, Col. 3, ll. 10-12 and Figure: first section 14 which has perforations or similar openings to allow fluid flow corresponds to "outlet screen" of the '706 Patent.	
	the apparatus further comprising an inlet screen coupled to the casing at an upper portion of the casing	'598 Patent, Col. 3, ll. 10-12 and Figure: second section 16 which has perforations or similar openings to allow fluid flow corresponds to "inlet screen" of the '706 Patent.	
25	...wherein the packer is disposed through the casing between the inlet and outlet screens coupled to the casing.	Col. 3, ll. 14-15 and figure: ...includes permeable packing material 20	
	...wherein the apparatus	Col. 3, ll. 9-11: The well casing comprises a	

	further comprises a second microporous diffuser disposed below the casing	first section and a second section, both of which have perforations; Figure 1 shows the first and second sections with respect to the well casing	
29	...wherein the casing and apparatus are disposed within a well, the well provided on a site having an aquifer	Col. 3, ll. 2-6: “The system 2 utilizes a ...borehole 6 , and includes a well 10 ...”	
	...an outlet screen portion of the casing disposed in the aquifer	‘598 Patent, Col. 3, ll. 10-12 and Figure: first section 14 which has perforations or similar openings to allow fluid flow corresponds to “outlet screen” of the ‘706 Patent.	
	...in inlet screen portion of the casing disposed above said outlet screen.	‘598 Patent, Col. 3, ll. 10-12 and Figure: second section 16 which has perforations or similar openings to allow fluid flow corresponds to “inlet screen” of the ‘706 Patent.	
30	...agitation means for intermittently agitating water in the	Kerfoot, Page 5, second full paragraph: ...alternate on-bubbling periods with off-bubbling	

	well.	period...	
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I. Ground 9: Claim 31 Would Have Been Obvious Over Marley and Kerfoot as Evidenced by U.S. Pat. No. 5,425,598

The claim chart below sets forth correspondence between claim 31 of the ‘706 Patent and the combined teachings of Marley and Kerfoot, in further view of the ‘598 Patent. Claim 31 is directed to a method of removal of VOCs similar to that claimed in claim 1, and the Marley and Kerfoot teachings and reasons to combine the teachings apply, accordingly, as discussed above at Ground 5.

Notably, claim 31 recites “bubbles with an initial bubble diameter less than 200 microns” rather than a size in a range of about 5 to 200 μm. Petitioner asserts that “diameter less than 200 microns” is obvious over the bubble sizes taught by Kerfoot and SITE Technology for reasons discuss for Ground 5 above, specifically in view of the teachings by Kerfoot of a 50 micron pore size and teachings by SITE Technology of a pore size of 45 ± 40 microns.

Claim 31, also recites in part, “...the bubbles forming at least in part by delivering the air and gaseous ozone through a surrounding sand pack disposed about a region where the air and ozone are injected into a site.” A surrounding sand pack, such as that taught by the ‘598 Patent, is a standard component of air sparging systems used for the removal of contaminants from wet soils and ground water. As noted in the ‘598 Patent, the sand pack must be fluid permeable.

Accordingly, a POSA would understand that the sand pack is inherently permeable to injected air including gaseous ozone. As Marley teaches, any sand pack around the sparging point should have a grain size that will prevent coalescing of the small bubbles prior to entry into the natural formation. This same teaching is provided in the '706 Patent (Col. 11, ll. 16-19: "The surrounding sand pack placed between the spargepoint **26** and natural material to fill the zone of drilling excavation should also be compatible in channel size to reduce coalescing of the produced bubbles."). The specification of the '706 Patent does not describe bubbles forming at least in part by delivering the air and gaseous ozone through a surrounding sand pack disposed about a region where the air and ozone are injected into a site, nor any methods or apparatuses for achieving this feature. Petitioner accordingly concludes that recitation in claim 31 of "the bubbles forming at least in part by delivering the air and gaseous ozone through a surrounding sand pack disposed about a region where the air and ozone are injected into a site," represents a feature which is clearly inherent in the injection of the air and gaseous ozone as taught by the specification and claimed. This element thereby contributes nothing to the patentability of claim 31 or to the claims dependent thereupon.

In view of the prior art discussed above and common knowledge in the field, a POSA would have had a reasonable expectation of success to arrive at a method for removing VOCs in a soil formation by injecting air including gaseous ozone as

bubbles with an initial bubble diameter less than 200 microns with the gaseous ozone at concentrations to effect removal of VOCs in a subsurface aquifer with the bubbles forming at least in part by delivering the air and gaseous ozone through a surrounding sand pack disposed about a region where the air and ozone are injected into a site. Thus, Petitioner respectfully requests *inter partes* review of claim 31 on the ground that the claim is obvious under 35 U.S.C. § 103.

Ground 9: Claim 31 is Obvious in View of Marley, Kerfoot and the '598 Patent			
'706 Claim No.	Claim Element	Disclosure in Kerfoot	Disclosure in Marley
31	A method of removal of volatile organic compounds comprises:		Page 137, Abstract, first paragraph: Vapor extraction (soil venting) has been demonstrated to be a successful and cost-effective remediation technology for removing VOCs from the vadose (unsaturated) zone.
	injecting air including gaseous ozone,		Page 139, Col. 1, fourth paragraph: Less strippable compounds may be remediated with enhancements to the standard sparging process, for example using a combination of air, ozone, and/or hydrogen peroxide as the injected gas to provide increased oxidation potential for semivolatile

			organic compounds or thorough potential enhancements to the natural biodegradation process by the addition of oxygen.
as bubbles with an initial bubble diameter less than 200 microns	<p>Page 4, second paragraph: using porous plastic cylinders as bubblers instead of slotted well screens. With a 50 micron pore size, the bubbling tubes would create bubbles 0.05 mm in diameter or about 2 slot (.002 inches) diameter.</p> <p>Comment: 0.05 mm = 50 microns.</p> <p>Moreover, SITE Technology teaches at Page 282, Col. 1:After passing though[sic] the generator, the resulting 65 percent dispersion of bubbles in the size range of 45 ± 40 microns can be delivered and injected into a saturated solid matrix under pressure.</p>	<p>Page 139, Col. 1, first full paragraph: Theoretically, a large number of small bubbles will provide better mass transfer characteristics for removal of VOCs from the aqueous soil phase than will a smaller number of large bubbles or channels.</p>	
with the gaseous ozone at concentrations to effect removal of volatile organic compounds in		<p>Page 139, Col. 1, fourth paragraph: Less strippable compounds may be remediated with enhancements to the standard sparging process, for example using a combination of air, ozone, and/or hydrogen peroxide</p>	

	a subsurface aquifer		as the injected gas to provide increased oxidation potential for semivolatile organic compounds...
	with the bubbles forming at least in part by delivering the air and gaseous ozone through a surrounding sand pack disposed about a region where the air and ozone are injected into a site.		Page 139, first full paragraph: However, any sand pack around the sparging point should have a grain size that will prevent coalescing of the small bubbles prior to entry into the natural formation.; and ‘598 Patent Col. 3, ll. 14-16: The permeable packing material 20 includes, for example, sand pack or some other fluid permeable composition.”

J. Ground 10: Claims 32-45 Would Have Been Obvious Over Marley and Kerfoot in Further View of Knowledge in the Art as of the Priority Date

Claims 32-37 and 39-45 depend directly or indirectly from claim 31 addressed in Ground 9 and recite elements which are found in the prior art as shown in the claim chart below and are known to the POSA at the time of the priority date. Claims 9, 10, and 11 recite initial bubble size at least between 50 to 200 μm , 20 to 50 μm , and 5 to 20 μm , respectively. Ignoring the indefinite language of “at least between,” these ranges do not contribute patentability over

the bubble sizes taught in the art as discussed above with respect to Grounds 4, 5 and 6. Thus, Petitioner respectfully requests *inter partes* review of claim 31 on the ground that the claims 32-45 are obvious under 35 U.S.C. § 103.

Ground 10: Claims 32-37 and 39-45 are Obvious in view of Marley, Kerfoot, and Knowledge at the Time of the Priority Date			
'706 Claim No.	Claim Element	Disclosure in Kerfoot or Marley	Knowledge in the art
33	...fine bubbles have an initial bubble size at least between 5 to 200 μm	Kerfoot Page 4, second paragraph: It is preferable to match the air bubble size to the size of the soil particle interstitial space. This can be done by using porous plastic cylinders as bubblers instead of slotted well screens. With a 50 micron pore size, the bubbling tubes would create bubbles 0.05 mm in diameter or about 2 slot (.002 inches) diameter. Comment: 0.05 mm = 50 microns. Addressed further in Ground 4.	
34	...fine bubbles have an initial bubble size at least between 20 to 50 μm		
35	...fine bubbles have an initial bubble size at least between 5 to 20 μm		
36	...providing a plurality of injection wells	Marley, Page 138, Figure 1: illustrates a plurality of injection wells.	

	...introducing the air and ozone in the bubbles through the injection wells	Marley, Page 139, Col. 1, fourth paragraph: using a combination of air, ozone, and/or hydrogen peroxide as the injected gas to provide increased oxidation potential for semivolatile organic compounds...	
37	...mixing the air with the ozone		'478 Patent col 1, ll 20-22, 41-46; '830 Patent, col. 3 ll. 7-10: A mixture of air and ozone is inherent in the use of an ozone generator.
	...delivering the air and ozone through a microporous diffuser to produce along with the sand pack the bubbles of air and ozone	Kerfoot, Page 2, ll. 2-5: Air injections through microporous cylinders created fine bubbles giving more uniform bubble distribution than injections through slitted PVC well screen.	
39	...providing a plurality of injection wells	Marley Page 138, Figure 1: illustrates a plurality of injection wells.	
	...injecting the ambient air and ozone as fine bubbles through the injection wells by using a corresponding	Kerfoot Page 2, lines 2-5: "Air injections through microporous cylinders created fine bubbles giving more uniform bubble distribution than	

	microporous diffuser for each one of the plurality of injection wells	injections through slitted PVC well screen. Marley Page 138, Figure 1: illustrates a plurality of injection wells.	
	...a plurality of sand packs including the surrounding sand pack, with one of the plurality of sand packs being disposed between each one of the microporous diffusers and the surrounding soil formation	Kerfoot Page 2, lines 2-5: Air injections through microporous cylinders created fine bubbles giving more uniform bubble distribution than injections through slitted PVC well screen. Marley Page 138, Figure 1: illustrates a plurality of injection wells.	
40	...the soil formation contains chlorinated hydrocarbons.		POSA/EPA May 1993, page 24, second full paragraph describes volatile organic compounds in soil, including chlorinated hydrocarbons, dichloroethene, trichloroethene, and tetrachloroethene.
41	..the soil formation contains organic and hydrocarbon material.		
42	...the volatile organic compounds include chlorinated solvents including dichloroethene,		

	trichloroethene, and/or tetrachloroethene		
43	...a microporous diffuser is used to generate the fine bubbles and microporous material of the microporous diffuser has a pore size selected in accordance with the determined porosity characteristic of the surrounding soil formation.	Kerfoot Page 4, second paragraph: It is preferable to match the air bubble size to the size of the soil particle interstitial space. This can be done by using porous plastic cylinders as bubblers instead of slotted well screens.	
44	...the microporous material of the microporous diffuser has a pore size selected to match the determined porosity characteristic and a permeability characteristic of the surrounding soil formation.	Page 4, second paragraph: It is preferable to match the air bubble size to the size of the soil particle interstitial space. This can be done by using porous plastic cylinders as bubblers instead of slotted well screens. With a 50 micron pore size, the bubbling tubes would create bubbles 0.05 mm in diameter or about 2 slot (.002 inches) diameter. Comment: 0.05 mm = 50 microns.	

45	... further comprising generating an oxidizing agent comprising the ozone at concentrations to effect removal of contaminants	Marley Page 139, Col. 1, fourth paragraph: Less strippable compounds may be remediated with enhancements to the standard sparging process, for example using a combination of air, ozone, and/or hydrogen peroxide as the injected gas to provide increased oxidation potential for semivolatile organic compounds or thorough potential enhancements to the natural biodegradation process by the addition of oxygen.”	
	...mixing the air with the ozone to produce the air including ozone		‘478 Patent Col. 1, ll. 20-22, 41-46; ‘830 Patent, Col. 3, ll. 7-10: A mixture of air and ozone is inherent in the use of an ozone generator.

K. Ground 11: Claim 53 Would Have Been Obvious Over Marley

The claim chart below sets for the correspondence between independent claim 53 of the ‘706 Patent and the teachings of Marley and Kerfoot. Claim 53 recites, in part, a method of removal of VOCs comprising injecting air including gaseous ozone into water in a solid formation with gaseous ozone at concentrations

to effect removal of volatile organic compounds. Further, the air and the ozone are injected into the water as fine bubbles with an initial bubble diameter in a range of about 5 to 200 μm . Marley describes the use of in situ air sparging for soil and ground water remediation (the removal of VOCs). Marley states that a large number of small bubbles will provide better mass transfer characteristics for the removal of VOCs from the aqueous solid phase than will a smaller number of large bubbles or channels (page 139, Col. 1, first full paragraph). Marley further explains that using a combination of air and ozone as the injected gas can provide increased oxidation potential for semivolatile organic compounds. Kerfoot teaches that it is preferable to match the air bubble size to the size of the solid particle interstitial space (pore size) and that this can be done by using porous plastic cylinders as bubblers with a 50 micron pore size. Such bubbling tubes would create bubbles 50 μm in diameter.

The recitation in claim 1 of a bubble size in a range of about 5 to 200 μm does not support patentability of the subject matter as discussed with respect to Grounds 4 and 9. It is “an elementary principle of patent law that when, as by a recitation of ranges or otherwise, a claim covers several compositions, the claim is ‘anticipated’ if one of them is in the prior art.” *Titanium Metals Corp. v. Banner*, 778 F.2d 775, 782 (Fed. Cir. 1985); see *King Pharms., Inc. v. Eon Labs, Inc.*, 616 F.3d 1267, 1277 (Fd. Cir 2010). “[W]here the general conditions of a claim are

disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation.” In re Aller, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955).

A POSA would have had a reasonable expectation of success to arrive at a method for removing VOCs in a soil formation by injecting air including gaseous ozone as bubbles with an initial bubble size in the range of about 5 to 200 μm in view of the teachings of Kerfoot and SITE Technology. Thus, Petitioner respectfully requests *inter partes* review of claims 53 on the ground that the claim is obvious under 35 U.S.C. § 103.

Ground 11: Claim 53 is Obvious in View of Marley and Kerfoot			
‘706 Claim No.	Claim Element	Disclosure in Kerfoot	Disclosure in Marley
53	A method of removal of volatile organic compounds comprises:	Page 1, Abstract: “Air bubbled through saturated sands carries out two functions: removal of dissolved volatile organics and aeration of the soil.”	Page 137, Abstract, first paragraph: “Vapor extraction (soil venting) has been demonstrated to be a successful and cost-effective remediation technology for removing VOCs from the vadose (unsaturated) zone.”
	injecting air including gaseous ozone into water in a soil formation with gaseous		Page 139, Col. 1, fourth paragraph: “Less strippable compounds may be remediated with enhancements to the standard sparging process,

	<p>ozone at concentrations to effect removal of volatile organic compounds</p>		<p>for example using a combination of air, ozone, and/or hydrogen peroxide as the injected gas to provide increased oxidation potential for semivolatile organic compounds or thorough potential enhancements to the natural biodegradation process by the addition of oxygen.”</p>
	<p>with the air and ozone injected into the water as fine bubbles</p>	<p>Page 2, lines 2-5: Air injections through microporous cylinders created fine bubbles giving more uniform bubble distribution than injections through slitted PVC well screen.</p>	<p>Page 139, first col., first paragraph: Air diffusers may be used at the sparging point in order to inject small bubbles into a coarse-grained formation.</p>
	<p>with an initial bubble diameter in a range of about 5 to 200 µm.</p>	<p>Page 4, second paragraph: This can be done by using porous plastic cylinders as bubblers instead of slotted well screens. With a 50 micron pore size, the bubbling tubes would create bubbles 0.05 mm in diameter or about 2 slot (.002 inches) diameter. Comment: 0.05 mm = 50 microns. Moreover, SITE Technology teaches at Page 282, first</p>	

		<p>col.:”After passing though[sic] the generator, the ... dispersion of bubbles in the size range of 45 ± 40 microns can be delivered and injected into a saturated solid matrix under pressure.</p>	
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L. Ground 12: Claims 54-58 Would Have Been Obvious Over Marley

Claims 54-58 each depend directly from claim 53 discussed with respect to Ground 10 and recite elements which are found in the Marley and Kerfoot references as shown in the claim chart below and/or were known to the POSA at the time of the priority date. As noted above, claims which represent no more than a rearrangement of old elements for same function as taught in the prior art relied upon are obvious. Claim 56 recites intermittently agitating water in the well. Petitioners assert that the periodic pulsing of injected air as taught by Kerfoot and recited in claim 57 inherently results in intermittent agitation of water in the well. The ‘706 patents states (Col. 3, ll 5-13) states, “The C-SpargerTM also incorporates pumps means for pumping the an[sic] multi-gas oxidizing mixture... The pump means intermittently agitates the water in the well...” Thus, Petitioner respectfully requests *inter partes* review of claims 54-58 on the ground that the claims are obvious under 35 U.S.C. § 103.

Ground 12: Claims 54-58 are Obvious in View of Marley, Kerfoot and Knowledge in the Art at the Time of the Priority Date

'706 Claim No.	Claim Element	Disclosure in Kerfoot or Marley	Knowledge in the Art
54	...the fine bubbles are sized in accordance with a porosity characteristic of the soil formation	Marley Page 137, Abstract, first paragraph: Vapor extraction (soil venting) has been demonstrated to be a successful and cost-effective remediation technology for removing VOCs from the vadose (unsaturated) zone.	
55	...introducing the air and ozone through microporous media to provide the bubbles	Kerfoot, Page 2, lines 2-5: "Air injections through microporous cylinders created fine bubbles giving more uniform bubble distribution than injections through slitted PVC well screen. Marley Page 139, Col. 1, fourth paragraph: ...sparging process, for example using a combination of air, ozone, and/or hydrogen peroxide as the injected gas to provide increased oxidation potential for	

		semivolatile organic compounds...	
56	...intermittently agitating water in the well.	Kerfoot, Page 5, second full paragraph: ...alternate on-bubbling periods with off-bubbling period...	
57	...periodically pulsing the injected air including ozone.	Kerfoot, Page 5, second full paragraph: ...alternate on-bubbling periods with off-bubbling period...	
58	...mixing the air with the ozone		'478 Patent Col. 1, ll. 20-22, 41-46; '830 Patent, Col. 3 ll. 7-10: A mixture of air and ozone is inherent in the use of an ozone generator.

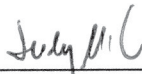
VIII. CONCLUSION

The cited prior art references identified in this Petition contain pertinent technological teachings, either explicitly or inherently disclosed, which were not previously considered in the manner presented herein or relied upon on the record during original examination of the '706 Patent, and therefore should be considered important in determining patentability. In sum, these references provide new, non-cumulative technological teachings not previously considered and relied upon on the record, which indicate a reasonably likelihood of success as to Petitioner's claim that claims 1-37 and 39-58 of the '706 Patent are not patent eligible pursuant

to the grounds presented in this Petition. Accordingly, Petitioner respectfully requests institution of *inter partes* review for claims 1-37 and 39-58 of the '706 Patent for each of the grounds presented herein, and that the claims accordingly be canceled as being unpatentable.

Respectfully submitted,

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CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. §§ 42.6(e) and 42.105, the undersigned certifies that on November 21, 2013, a complete and entire copy of this Corrected Petition for *Inter Partes* Review was sent via FedEx, directed to the attorneys of record for the patent, at the following address:

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