In the United States Court of Federal Claims

No. 05-1075C

(Filed March 28, 2007)

SEVENSON ENVIRONMENTAL SERVICES, INC.,	*	
Plaintiff,	*	Patent Infringement Case; Markman Claim Construction Proceedings; Patents Relating to Chemical Treatments of Contaminated Soils.
v.	*	
THE UNITED STATES,	*	
Defendant,	*	
and	*	
SHAW ENVIRONMENTAL, INC.,	*	
Defendant-Intervenor.	*	

Brian E. Ferguson, McDermott Will & Emery LLP, Washington, D.C., with whom were *Kevin Szanyi* and *Nelson Perel*, Webster Szanyi LLP, Buffalo, New York, for Plaintiff.

Marcy E. Cook, with whom were *Peter D. Keisler*, Assistant Attorney General, and *John J. Fargo,* Director, United States Department of Justice, Civil Division, Washington, D.C., for Defendant.

Russel O. Primeaux, Kean Miller Hawthorne D'Armond McCowen & Jarman LLP, Baton Rouge, Louisiana, for Defendant-Intervenor.

OPINION AND ORDER

WHEELER, Judge.

Introduction

This is a patent infringement case in which Plaintiff Sevenson Environment Services, Inc. ("Sevenson") seeks compensation from the United States under 28 U.S.C. § 1498(a) for the alleged infringement of U.S. Patent Nos. 5,527,982 ("the '982 patent"); 5,732,367 ("the '367 patent"); 5,916,123 ("the '123 patent"); 5,994,608 ("the '608 patent"); and 6,139,485 ("the '485 patent"). These five patents describe methods for treating soil or other environmental media that have become contaminated with toxic waste, such as lead or radioactive materials. Using the patented processes, the treatment renders contaminants in the soil non-hazardous according to regulatory standards established by the United States Environmental Protection Agency ("EPA"). Sevenson alleges that the U.S. Army Corps of Engineers and its contractors used the patented techniques without authorization in performing cleanup and remediation work at a government-owned site in Colonie, New York. Intervenor Shaw Environmental, Inc. ("Shaw") is one of the parties that contracted with the Corps of Engineers to perform cleanup work at this site.

The statutory provision granting the Court subject matter jurisdiction of this case provides as follows:

> (a) Whenever an invention described in and covered by a patent of the United States is used or manufactured by or for the United States without license of the owner thereof or lawful right to use or manufacture the same, the owner's remedy shall be by action against the United States in the United States Court of Federal Claims for the recovery of his reasonable and entire compensation for such use and manufacture.
>
> * * *
>
> For the purposes of this section, the use or manufacture of an invention described in and covered by a patent of the United States by a contractor, a subcontractor, or any person, firm, or corporation for the Government and with the authorization or consent of the Government, shall be construed as use or manufacture for the United States.

28 U.S.C. § 1498(a). Because Shaw is a contractor for the United States, Shaw's alleged use of the patented methods here qualifies as "use . . . for the United States." Id. Shaw therefore is immune from suit by the owner of the patents, except "by action against the United States in the United States Court of Federal Claims," if two criteria are met: (1) the use is "for the Government;" and (2) the use is "with the authorization and consent of the Government." Id.; see also Hughes Aircraft Co. v. United States, 209 Ct. Cl. 446, 459, 534 F.2d 889, 897-

98 (1976). Accordingly, Sevenson's action for patent infringement is against the United States in this Court.

The Court's analysis in a patent infringement case involves two steps. Catalina Mktg. Int'l, Inc. v. Coolsavings.com, Inc., 289 F.3d 801, 812 (Fed. Cir. 2002); Vitronics Corp. v. Conceptronic, Inc., 90 F.3d 1576, 1581 -1582 (Fed. Cir. 1996). The first step is to determine the scope and meaning of the patents in a Markman claim construction hearing. See Markman v. Westview Instruments, Inc., 517 U.S. 370 (1996); Gen. Am. Trans. Co. v. Cryo-Trans., Inc., 93 F.3d 766, 769 (Fed. Cir. 1996). "Claim construction" is a question of law for the Court to decide. Markman, 517 U.S. at 388-91; Cybor Corp. v. FAS Technologies, Inc., 138 F.3d 1448, 1456 (Fed. Cir. 1998) (en banc). A patent's "claims" define the invention. The claims are the numbered paragraphs "particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention." 35 U.S.C. § 112. The Court must look to the wording of the claims to determine the scope and meaning of the patent. Autogiro Co. of Am. v. United States, 181 Ct. Cl. 55, 60, 384 F.2d 391, 395-96 (1967). In the second step, the patent claims as construed by the Court are compared to the accused device or method to determine alleged patent infringement. Warner-Jenkinson Co., Inc. v. Hilton Davis Chem. Co., 520 U.S. 17, 29 (1997). Those determinations are questions of fact. Bai v. L&L Wings, Inc., 160 F.3d 1350, 1353 (Fed. Cir. 1998).

This opinion concerns the Markman "claim construction" phase of this case. Sevenson has presented for the Court's determination 77 claims from the five patents at issue. The law provides that a claim may be either "independent" or "dependent." 35 U.S.C. § 112. An independent claim stands on its own as stated in a single claim, while a dependent claim refers to and adds a further limitation upon a previously stated claim. Id. In this case, of the 77 presented claims, eleven are independent claims and 66 are dependent claims. Most of the disputed terms are from the independent claims. Some of the disputed terms are common to more than one claim.

The parties submitted a Modified Joint Claim Construction Statement on October 18, 2006, setting forth their respective interpretations of the disputed terms, and the support for their positions.[1] The parties filed opening claim construction briefs on November 8, 2006, and reply briefs on November 29, 2006. The Court conducted a Markman hearing on January 9, 2007 in which counsel for the parties participated in oral argument and provided supplemental written presentations.

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[1] In the parties' initial Joint Claim Construction Statement, filed October 2, 2006, Sevenson presented 115 claims for the Court's determination. While Sevenson reduced this number to 77 claims in the Modified Joint Claim Construction Statement, the number of disputed terms was not significantly altered.

For the reasons explained below, the Court finds for the Government on most of the claim construction issues. The Government has performed a comprehensive and well-supported analysis of the disputed claim terms. The Government's interpretations of the disputed terms are, for the most part, properly based upon the intrinsic evidence within the patents, such as the claim language, the specifications, the examples, and the drawings. The Government also has taken into account the purposes of the inventions as a whole. In contrast, Sevenson's interpretations are drawn almost exclusively from extrinsic dictionary definitions, in an effort to capture the "ordinary meaning" of the disputed terms. While dictionary definitions are a preferred form of extrinsic evidence, and may be consulted in the absence of any relevant intrinsic evidence, dictionary definitions do not substitute for probative information contained in the patents themselves. See, e.g., Vitronics, 90 F.3d at 1582 ("It is well settled that, in interpreting an asserted claim, the court should look first to the intrinsic evidence of record, *i.e.*, the patent itself, including the claims, the specification, and, if in evidence, the prosecution history."); Renishaw PLC v. Marposs Societa' per Azioni, 158 F.3d 1243, 1250 (Fed. Cir. 1998) ("[A] common meaning, such as one expressed in a relevant dictionary, that flies in the face of the patent disclosure is undeserving of fealty.").

In this opinion, the Court will first provide additional background information regarding national hazardous waste cleanup initiatives, the nature of the Sevenson patents, the Corps of Engineers' contracts at the Colonie site, and the parties' prior legal proceedings in the United States District Court for the Western District of New York (Buffalo Division). The Court then will address each of the disputed claim terms, providing the claim construction rationale deemed persuasive in each instance.

Factual Background[2]

A. National Hazardous Waste Cleanup Initiatives

This case involves cleanup and remediation work at one of the many waste disposal sites in the United States that are contaminated with hazardous waste and petroleum products from a variety of industrial sources. According to the EPA, federal, state, and local governments will commit billions of dollars annually in coming years to clean up such sites. This commitment will result in a continuing demand for hazardous waste site remediation services and technologies. See "Cleaning Up the Nation's Waste Sites: Markets and Technology Trends," (EPA, 2004 ed.), Executive Summary at v. There are thousands of sites

[2] This background information is taken from the parties' representations in their briefs. The Court has not received evidence on these facts, and the parties would not be bound by any of the factual assertions herein if these facts later become material to the outcome of the case.

in the United States undergoing or targeted for hazardous waste cleanup. Id. at viii. The major categories of clean-up sites are: (1) National Priorities List (NPL, or Superfund) sites; (2) Resource Conservation and Recovery Act (RCRA) corrective action sites; (3) Underground Storage Tank sites; (4) Department of Defense sites; (5) Department of Energy sites; (6) other federal agency sites; and (7) state and private party sites. Id. at 1-1. The environmental media most likely to contain contaminants at such sites are soil and groundwater. Id. at 1-14. More than three-fourths of sites have contaminated soil or groundwater, or both. Contaminated sediment, sludge, or surface water also are present, but at fewer sites. Id. There are many types of contaminants that may be present at a hazardous site. Volatile organic compounds (VOCs), metals, and radioactive materials are common. Id. at 1-14, 1-15.

A variety of solutions exists for handling contaminated media at hazardous sites, such as treatment, containment, and control. Id. at 2-1. "Treatment" includes the use of technologies such as chemical treatment and thermal desorption on site. "Containment" includes the use of caps, liners, covers, on-site and off-site land-filling, or other means of containing waste. "Control" includes other forms of remediation of a contaminant source, such as institutional controls, monitoring, and population relocation. Id.

The term "treatment technology" means any operation or series of operations that alters the composition of a hazardous substance, pollutant, or contaminant through chemical, biological, or physical means to reduce the toxicity, mobility, or volume of the contaminated materials being treated. Treatment technologies are an alternative to land disposal of hazardous wastes without treatment. Id. at 2-2; see also 40 C.F.R. § 300.5, "Definitions." The general trend since 1985 has been to increase the use of treatment technologies. On-site technologies often are more cost-effective than off-site approaches which require the excavation and handling of hazardous materials. On-site technologies reduce the level of exposure to contaminated substances because no excavation is required. As on-site treatment technologies are used more frequently, site managers and remediation professionals are more willing to use them as a reliable approach. "Cleaning Up the Nation's Waste Sites," at 2-5.

The EPA has established methods for determining whether an environmental medium is contaminated and requires action. Method 1311, the "Toxicity Characteristic Leaching Procedure" (TCLP), is designed to determine "the mobility of both organic and inorganic analytes present in liquid, solid, and multiphase wastes." EPA Publication, TCLP Method 1311 (effective November 8, 1990). To determine "toxicity," EPA's regulations identify 40 possible contaminants and regulatory levels. If any of the contaminants in a representative sample exceeds the regulatory level, the sample is considered toxic and hazardous. 40 C.F.R. § 261.24, Table 1. As relevant here, the regulatory level for lead is 5.0 milligrams per liter (mg/l). Id. Lead is present at hazardous levels at 40 percent of all NPL/Superfund sites.

"Cleaning Up the Nation's Waste Sites" at 3-11. One objective of Sevenson's technology is to reduce the amount of lead at a hazardous site to below EPA's TCLP standard. See '982 Patent, col. 3, lines 42-48 ("It is an object of the present invention to provide a method of treating metal-bearing materials, contaminated soils and waste effluent, and solid wastes containing hazardous levels of leachable metal. It is a further object to provide a method which decreases the leaching of lead in lead-bearing materials to levels below the regulatory limit of 5 mg/l by TCLP test criteria.").

B. Sevenson's Patents

The five Sevenson patents at issue describe processes for treating soil contaminated with lead or other heavy metal, or radioactive materials. The Sevenson patents are based upon treatment processes employing phosphate and sulphate.[3] The patents disclose and claim the use of phosphoric acid, which acts as a source of both phosphate and sulphate, to treat contaminated soil. Two of the five patents (the '367 patent and the '608 patent) are aimed at eliminating radioactive materials. The other three are aimed at eliminating lead or other heavy metal materials.

The Sevenson patents stem from an initial patent application filed with the U.S. Patent and Trademark Office on March 16, 1990. Under EPA's TCLP Method 1311, a solid waste is considered to be hazardous if it exhibits characteristics of ignitability, corrosivity, reactivity, or toxicity. Sevenson's patents are intended to meet the EPA's standards for lead-bearing soils. Other patented techniques for treating hazardous waste existed prior to Sevenson's patent applications, but they involved various combinations of lime, carbon dioxide or bicarbonate, lime with calcium/magnesium carbonate, lime with calcium fluoride, or calcium hydroxide, and phosphate and lime. (See '982 patent, col. 1-2, "Background of the Invention"). These prior techniques suffered from various shortcomings. For example, one of the techniques involved washing the contaminated soil with water or other solutions, resulting in large quantities of toxic waste water that itself required treatment and disposal. (Pltf's Brief at 5). Another technique involved encapsulating the contaminated soil in a cement-like material, which then is removed. This technique greatly increased the volume and weight of the treated soil, adding to the expense of removing and disposing of the soil. Id.

Sevenson's technology is based upon chemical bonding reactions involving lead and radionuclides with sulphates and phosphates. By contacting the contaminated soil with sulphate and phosphate, the amount of leachable lead is reduced to below the EPA's standard

[3] The words "sulphate" and "sulfate" appear to be used interchangeably in the Sevenson patents and in the parties' briefs.

of 5.0 mg/l. Id. at 6. Sevenson's technology purports to accomplish its objectives without generating any hazardous by-products. In Sevenson's patents, the sources and amounts of sulphates and phosphates to be employed in the treatment process vary depending upon different factors, such as the nature of the material to be treated, the leachable lead content of the material, and the total quantity of lead present. Id. Sevenson's patents claim a one-step or two-step process involving the mixing of the lead-bearing material with a mixture or additive. A first component of the mixture supplies sulphate and a second component supplies phosphate. Id. Phosphoric acid is a mixture that contains both sulphate and phosphate. Id. The patents contain examples to show that phosphoric acid may be sufficient to treat lead contaminated materials under the EPA's TCLP test. Id. at 6-7.

The five Sevenson patents contested in this action are all related. The issue dates of the five patents are as follows: '982 patent – June 18, 1996; '367 patent – March 25, 1998; '123 patent – June 29, 1999; '608 patent – November 20, 1999; '485 patent – October 31, 2000. The '982 patent contains 31 claims, of which Sevenson is asserting claims 1-5 and 9. The '367 patent contains 16 claims, of which Sevenson is asserting claims 11, 13, 14, and 16. The '123 patent contains 28 claims, of which Sevenson is asserting claims 1-7 and 15-20. The '608 patent contains 40 claims, of which Sevenson is asserting claims 1-7, 11-24, and 26-30. The '485 patent contains 36 claims, of which Sevenson is asserting claims 1-6 and 15-36.

C. Corps of Engineers' Contracts at the Colonie Site

The contaminated site at Colonie, New York, near Albany, is owned by the United States Government, and has been designated for remediation under the Formerly Utilized Sites Remedial Action Program ("FUSRAP") that the Army Corps of Engineers manages and supervises. The contaminated soil resulted from activities conducted at the Colonie site from 1930 until the 1980s. (Pltf's Brief at 7).

The Corps of Engineers awarded an initial contract to ICF Kaiser Engineers, Inc. ("ICF Kaiser") for cleanup work at the Colonie site. ICF Kaiser retained Kiber Environmental Services, Inc. ("Kiber") to conduct a study for treating the lead contaminated materials at the Colonie site. In March 1999, Kiber produced a report recommending the use of phosphoric acid to treat the soil after evaluating other potential treatment alternatives. Id.

In April 1999, the IT Group, Inc. acquired the Colonie site remediation contract from ICF Kaiser. IT Corporation ("IT") then acquired the contract from the IT Group, and performed the remediation work for the Corps of Engineers at the Colonie site. Id. In 2002, IT filed for bankruptcy. Shaw obtained IT's assets, and continued performing the cleanup work at the Colonie site. Id. at 8. Shaw's relationship with the Government apparently is

defined by two separate contracts with the Corps of Engineers, the "Total Environmental Restoration Contract" ("TERC"), and the "Pre-placed Remedial Action Contract" ("PRAC"). The PRAC replaced the TERC because of funding issues. Sevenson Envtl. Servs., Inc. v. Shaw Envtl. Servs., Inc., 477 F.3d 1361, 1363 (Fed. Cir. 2007).

D. Prior Legal Proceedings

Sevenson asserts that in June 1999, IT decided to implement Kiber's recommendation to use phosphoric acid to treat lead-bearing materials at the Colonie site. (Pltf's Brief at 7-8). Sevenson states that it learned of these plans in August 1999, and advised IT that the use of phosphoric acid would infringe the Sevenson patents. Id. at 8. Sevenson and IT entered into negotiations for IT to obtain a license to use Sevenson's patented technology, but the negotiations ended without an agreement. Id. Sevenson states that IT began treating the material with phosphoric acid in October 1999. Id.

In May 2000, Sevenson filed suit against IT for patent infringement in the United States District Court for the Western District of New York (Buffalo Division). Following IT's bankruptcy filing in 2002, and Shaw's continuation of the contract work, Sevenson sued Shaw for patent infringement on July 23, 2002 in the same court. Id. Shaw thereafter moved for summary judgment pursuant to 28 U.S.C. § 1498, asserting that its actions were taken with the authorization or consent of the Government. On October 11, 2005 Sevenson filed the present action against the United States. Id. On March 22, 2006, the U.S. District Court in Buffalo granted Shaw's motion for summary judgment. Sevenson Envtl. Servs., Inc. v. Shaw Envtl. Servs., Inc., No. 02-CV-527 (W.D.N.Y. Mar. 22, 2006).

Sevenson timely appealed the District Court's ruling to the United States Court of Appeals for the Federal Circuit. The Federal Circuit affirmed the District Court's decision on February 21, 2007. Sevenson, 477 F.3d at 1368.

Discussion

A. Applicable Claim Construction Principles

Patent claims are construed as a person of ordinary skill in the relevant art would understand them. The words of a claim generally are given their ordinary and customary meaning, which is the meaning that the term would have to a person of ordinary skill in the art in question at the time of the invention, (i.e., as of the effective filing date of the patent application). Phillips v. AWH Corp., 415 F.3d 1303, 1312-13 (Fed. Cir. 2005) (*en banc*); see also Abraxis Bioscience, Inc. v. Mayne Pharma (USA) Inc., 467 F.3d 1370, 1376 (Fed. Cir. 2006); CCS Fitness Inc. v. Brunswick Corp., 288 F.3d 1359, 1366 (Fed. Cir. 2002).

The claims themselves are the starting point for any claim construction. Pitney Bowes, Inc. v. Hewlett-Packard Co., 182 F.3d 1298, 1305 (Fed. Cir. 1999). When interpreting a claim, "a court should look first to the intrinsic evidence, *i.e.,* the claims themselves, the written description portion of the specification, and the prosecution history." Bell & Howell Document Mgmt. v. Altek Sys., 132 F.3d 701, 705 (Fed. Cir. 1997); Vitronics, 90 F.3d at 1582. The intrinsic evidence is the documentation that serves as the public record of the patent, protecting the patentee from infringement while allowing competitors "to design around the claimed invention." Bell & Howell, 132 F.3d at 705. Such evidence is "the most significant source of the legally operative meaning of disputed claim language." Vitronics, 90 F.3d at 1582-83.

After reviewing the relevant intrinsic evidence, the Court may look in certain circumstances to any extrinsic evidence concerning relevant scientific principles, the meaning of technical terms, and the state of the art. Innova/Pure Water, Inc. v. Safari Water Filtration Systems, Inc., 381 F.3d 1111, 1116 (Fed. Cir. 2004).

Prosecution history facilitates claim construction by revealing the intended meaning and scope of technical terms, and may even trump the weight of specification language in some circumstances. Vivid Technologies Inc. v. Am. Sci. & Eng'g Inc., 200 F.3d 795, 804 (Fed. Cir. 1999); Bell & Howell, 132 F.3d at 705-706. A patentee may not construe a term one way to win approval from the Patent and Trademark Office and then use the term in a different way against accused infringers. Southwall Technologies, Inc. v. Cardinal IG Co., 54 F.3d 1570, 1576 (Fed. Cir. 1995); Unique Concepts, Inc. v. Brown, 939 F.2d 1558, 1562 (Fed. Cir. 1991). Prosecution history prevents "a patentee from regaining, through litigation, coverage of subject matter relinquished during prosecution of the application for the patent." Wang Labs. v. Mitsubishi Electronics Am., Inc., 103 F.3d 1571, 1577-78 (Fed. Cir. 1997).

Extrinsic evidence, such as prior art, treatises, and expert testimony, may be consulted if genuine ambiguity remains after the Court examines the intrinsic evidence. Vitronics, 90 F.3d at 1584. These sources can provide insight into how a person of ordinary skill in the relevant art would interpret the claim, and whether an otherwise common term has a special meaning in a given field. See Brookhill-Wilk 1, LLC. v. Intuitive Surgical, Inc., 334 F.3d 1294, 1298 (Fed. Cir. 2003); Microsoft Corp. v. Multi-Tech. Sys. Inc., 357 F.3d 1340, 1347 (Fed. Cir. 2004) (*en banc*) (internal citations omitted). The Court also may look to extrinsic evidence for assistance in understanding the underlying patent technology. Vitronics, 90 F.3d at 1584. The Court, however, may not use extrinsic evidence "to arrive at a claim construction that is clearly at odds with the claim construction mandated by the claims themselves, the written description, and the prosecution history, in other words, with the written record of the patent." Key Pharm. v. Hercon Lab. Corp., 161 F.3d 709, 716 (Fed. Cir. 1998); Vitronics, 90 F.3d at 1583 ("In those cases where the public record unambiguously

describes the scope of the patented invention, reliance on any extrinsic evidence is improper.").

The Court also should avoid reading a specification so narrowly as to confine the related claim to the embodiment described by the specification. The Federal Circuit has "expressly rejected the contention that if a patent describes only a single embodiment, the claims of the patent must be construed as being limited to that embodiment." Phillips, 415 F.3d at 1323. The embodiments may, rather, provide examples or representations to help define and clarify the terms of the claim. "[U]pon reading the specification in that context, it will become clear whether the patentee is setting out specific examples of the invention to accomplish those goals, or whether the patentee instead intends for the claims and the embodiments in the specification to be strictly coextensive." Id.

There are three limited instances where the Court should narrow a claim term's meaning from an ordinary and customary meaning:

(1) If a patent specification reveals a *special definition* given to a claim term by the patentee that differs from the meaning it would otherwise possess. In such case, the inventor's definition will govern. Phillips, 415 F.3d at 1316. However, there is a heavy presumption in favor of the ordinary meaning unless the patentee clearly has set forth an explicit definition for a claim term. Prima Tek II, LLC v. Polypap, 318 F.3d 1143, 1148 (Fed. Cir. 2003).

(2) If the patent specification reveals an *intentional disclaimer*, or disavowal, of a claim scope by the inventor. Phillips, 415 F.3d at 1316. This intention must be clear, and cannot draw limitations from a preferred embodiment. Conoco, Inc. v. Energy & Envtl., L.C., 460 F.3d 1349 (Fed. Cir. 2006); Teleflex, Inc. v. Ficosa N. Am. Corp., 299 F.3d 1313, 1325 (Fed. Cir. 2005).

(3) If a patentee has made a *clear and unmistakable disavowal* of scope during the prosecution of the patent. Purdue Pharma L.P. v. Endo Pharm., Inc., 438 F.3d 1123, 1136 (Fed. Cir. 2006). Such a disavowal is known as the doctrine of prosecution disclaimer. Id.

B. Analysis of Key Terms Appearing in More Than One Patent

Due to the many patent claims asserted by Sevenson, and the number of disputed terms, the claim construction analysis is complex. The Court will first address the key disputed terms that appear in multiple patents. These recurring terms are central to the interpretation of each of the patents, and to understanding the five patents as a group.

1. First Component

The term "first component" is at issue in Claims 1, 4 and 9 of the '982 patent, in claims 1-3, 6, 15-17 and 20 of the '123 patent, in Claims 1-3, 6, 15-17, 20-23, 26 and 27 of the '485 patent, and in Claims 26, 27 and 30 of the '608 patent. For example, claim 1 of the '982 patent provides as follows:

> A method of treating metal-bearing materials to stabilize leachable metal contained therein, said method comprising the steps of:
>
> mixing a metal-bearing material with a first mixture comprising a *first component* and a second component to form a second mixture, wherein said metal-bearing material contains at least one leachable metal selected from the group consisting of lead, aluminum, arsenic (III), barium, bismuth, cadmium, chromium (III), copper, iron, nickel, selenium, silver and zinc, wherein said *first component* supplies at least one member selected from the group consisting of sulphates, halites, and silicates, and wherein said second component supplies at least one phosphate ion;
>
> curing said second mixture for a period to form a cured material such that TCLP metal level for said leachable metal in the cured material is below 5.0 mg/l and no secondary waste streams are generated.

('982 patent, col. 20, ll. 11-14) (emphasis added). The language "at least one member selected from the group consisting of . . ." signals that the listed elements are members of a "Markush" group. See Abbott Labs. v. Baxter Pharm. Prods., Inc., 334 F.3d 1274, 1280 (Fed. Cir. 2003) ("A Markush group is a listing of specified alternatives of a group in a patent claim, typically expressed in the form: a member selected from the group consisting of A, B, and C."). Each occurrence of the term "first component" here is associated with a Markush group. The specific members of the group, however, vary in each patent.

The Government contends that "first component" means a *separate and distinct compound* capable of supplying at least one of the listed members, whereas Sevenson argues that "first component" means a *material* capable of supplying a source of at least one of the listed members. (Mod. Joint Claim Const. Statement, '982 patent at 6). The claim language itself does not state whether the first component is a "separate and distinct compound" or a "material." However, the specification, including the drawings, from each of the patents supports the conclusion that the patentee intended "first component" to mean "a separate and distinct compound."

For example, the "Summary of Invention" section of the specifications of the '982 patent, the '123 patent, and the '485 patent expressly states that "[a] *first group of treatment chemicals* for use in the processes of the present invention includes lime, gypsum, alum, halites, portland cement, and other similar products that can supply sulfates, halites, hydroxides, and/or silicates." ('982 patent, col. 3, ll. 16-19; '123 patent, col. 3, ll. 26-30; '485 patent, ll. 46-49) (emphasis added). In addition, the same section describes "mixing the solid waste with a *sulfate compound*, such as calcium sulfate dihydrate (gypsum powder) or sulfuric acid." ('982 patent, col. 2, ll. 26-28; '123 patent, col 2, ll. 38-40; '608 patent, col. 2, ll. 41-43; '485 patent, col. 3, ll. 4-6) (emphasis added).

Similarly, the "Description of the Preferred Embodiment" section of the specifications of these four patents states that "*[a] first group, 'group one,'* comprises a source of sulfate, hydroxide, chloride, fluoride, and/or silicates." ('982 patent, col. 5, ll. 1-2; '123 patent, col. 5, ll. 6-7; '485 patent, col. 6, ll. 24-25; '608 patent, col. 8, ll. 11-12) (emphasis added); see also '982 patent, col. 19, ll. 54-56 (Example 6); '123 patent, col. 20, ll. 3-5 (Example 6); '608 patent, col. 23, ll. 53-55 (Example 6); '485 patent, col. 22, ll. 40-42) (Example 6) ("The treatability studies are designed to optimize the amount and grade of gypsum powder (*or other sulfate compound*) needed during step 1.") (emphasis added). The references in the specifications to "a first group" and "group one" treatment chemicals are in contrast to the references throughout the specifications to "a second group" and "group two" treatment chemicals. See, e.g., '982 patent, col. 3, ll. 20-26, col. 5, ll. 5-10. The repeated contrast between groups one and two in these patents signifies the "separate and distinct" nature of the first component. As noted, the specification of each patent also indicates that each Markush group member is a "compound."

The drawings accompanying each of the patents also show separate and distinct groups of treatment chemicals. Figures 1, 2a, and 2b in four of the patents clearly identify "Group One Treatment Chemicals" and "Group Two Treatment Chemicals" to be used in the patented method. ('982 patent, Figs. 1, 2a, 2b; '123 patent, Figs. 1, 2a, 2b; '485 patent, Figs. 1, 2a, 2b; '608 patent, Figs. 1, 2a, 2b). These three drawings are reprinted below:

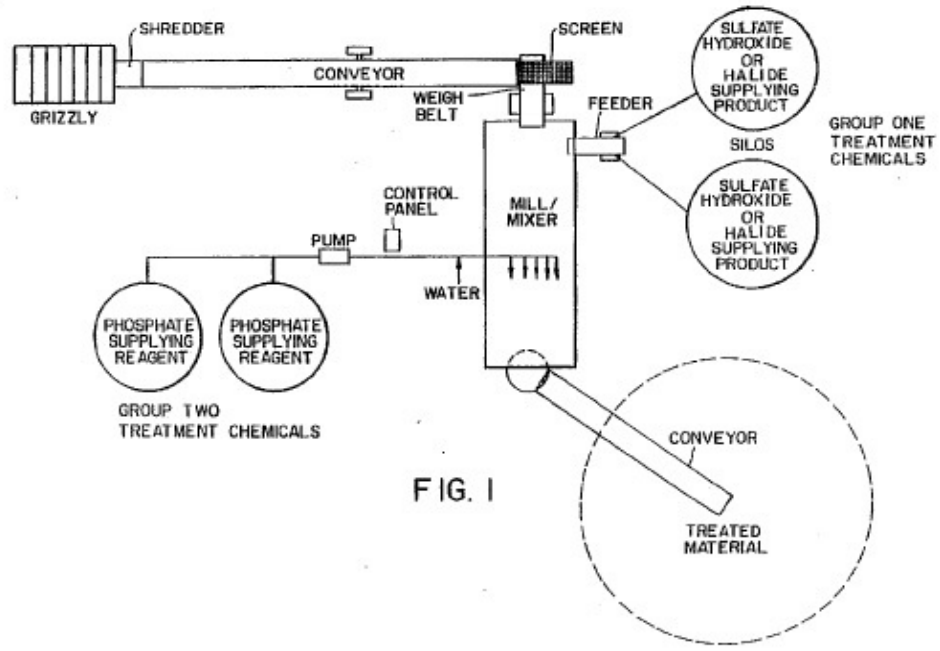

FIG. 1

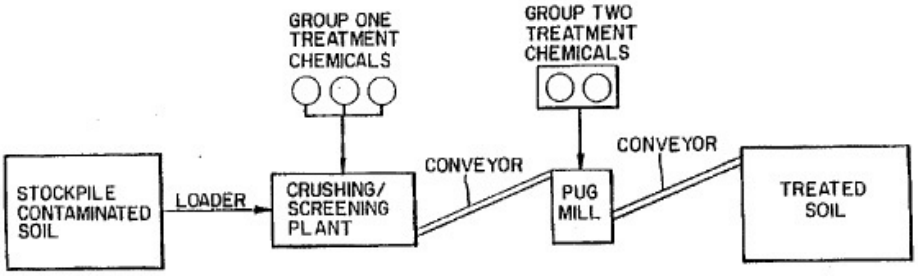

FIG. 2a

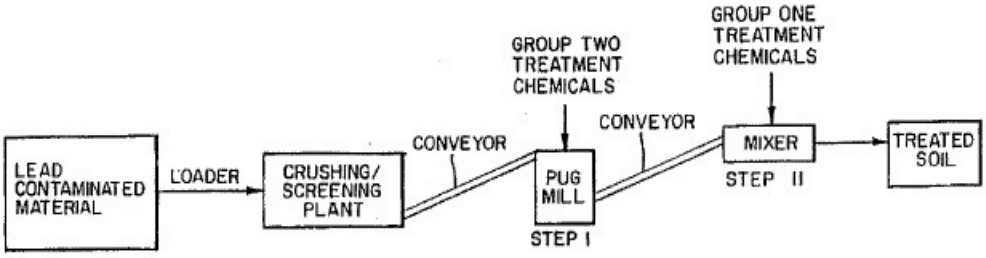

FIG. 2b

In these drawings showing the sequence of the treatment processes, the "Group One Treatment Chemicals" are described as "Sulfate Hydroxide or Halide Supplying Product" and are introduced at the "Feeder" on the right side of Figure 1. The "Group Two Treatment Chemicals" are described as "Phosphate Supplying Reagent" and are introduced to the left of the pump before entering the "Mill/Mixer." In Figure 2a, a similar depiction exists, showing the "Group One Treatment Chemicals" being introduced at the "Crushing Screening Plant," and the "Group Two Chemicals" being introduced at the "Pug Mill." In Figure 2b, the "Group One Treatment Chemicals" are introduced at the "Pug Mill" (Step I) and the "Group Two Treatment Chemicals" are introduced at the "Mixer" (Step II). The drawings certainly show that Group One and Group Two are "separate and distinct."

Where visual representations are used to "flesh out words," such drawings are an important part of the specification to consider when performing claim construction analysis. Autogiro Co. of Am. v. United States, 181 Ct. Cl. 55, 61-62, 384 F.2d 391, 398 (1967). These drawings, as well as the other references described above, would indicate to a person of ordinary skill in the art that "first component" means "a separate and distinct compound." Based upon the totality of the intrinsic evidence, the Government's proposed construction of "first component" is in harmony with the claim language and aligns more naturally with the patent's description of the invention. See Renishaw, 158 F.3d at 1250.

On the other hand, Sevenson's use of the word "material" to define "first component" would create potential confusion in the construction of the patents. The word "material" also is used in the claim language to describe the contaminated soil or other environmental media, such as "lead-bearing material." See, e.g., '982 patent, col. 20, l. 5. The Court does not favor a claim construction where the word "material" would be used to define both the treating chemicals and the contaminated soil. Accordingly, Sevenson's proposed construction is too broad and imprecise, and does not reflect the intentions of the patentee.

2. Second Component

The term "second component" is at issue in Claims 1, 5 and 9 of the '982 patent, in claims 1, 2, 4-6, 15, 16 and 18-20 of the '123 patent, in Claims 1, 2, 4-6, 15, 16, 18-22, 24, 25, 28-33 and 35 of the '485 patent, and in Claims 1, 5, 6, 7, 11, 20, 26 and 28-30 of the '608

patent.[4] For example, Claim 1 of the '982 patent states that "wherein said second component supplies at least one phosphate anion." ('982 patent, col. 20, ll. 14-15) (emphasis added).

As with the interpretation of "first component," the Government contends that "second component" means a *separate and distinct compound* capable of supplying at least one phosphate anion. Sevenson argues that "second component" means a *material* capable of supplying a source of at least one phosphate anion. (Mod. Joint Claim Const. Statement, '982 patent at 9). The claim language itself does not state whether the second component is a "separate and distinct compound" or a "material." However, the specification, including the drawings, from each of the patents supports the conclusion that the patentee intended "second component" to mean "a separate and distinct compound."

For example, the "Summary of Invention" section of the specifications of the '982 patent, the '123 patent, and the '485 patent expressly states that "[a] *second group consists of treatment chemicals* which can supply phosphate ions." ('982 patent, col. 3, ll. 20-21; '123 patent, col. 3, ll. 31-32; '485 patent, ll. 50-51) (emphasis added). Similarly, the "Description of the Preferred Embodiment" section of the specifications of these four patents states that "*[t]he second group, 'group two,'* comprises a source of phosphate anion." ('982 patent, col. 5, ll. 5-6; '123 patent, col. 5, ll. 10-11; '485 patent, col. 6, ll. 28-29; '608 patent, col. 8, ll. 16-17) (emphasis added). Moreover, the specifications of each patent describe "products like phosphoric acid (phosphoric), pyrophosphates, triple super phosphate, trisodium phosphates, potassium phosphates, ammonium phosphates and/or *similar compounds*." ('982 patent, col. 5, ll. 6-10; '123 patent, col. 5, ll. 11-14; '485 patent, col. 6, ll. 29-33; '608 patent, col. 8, ll. 16-20) (emphasis added); see also '982 patent, col. 19, ll. 54-58 (Example 6); '123 patent, col. 20, ll. 3-8 (Example 6); '608 patent, col. 23, ll. 53-57 (Example 6); '485 patent, col. 22, ll. 40-44) (Example 6) ("The treatability studies are designed to optimize . . . the amount and concentration of phosphoric acid (*or other phosphate compound*) needed in step II.") (emphasis added). As with the claim term "first component," the references in the specifications to "a second group" and "group two" treatment chemicals are in contrast to the references throughout the specifications to "a first group" and "group one" treatment chemicals. See, e.g., '982 patent, col. 3, ll. 16-26, col. 5, ll. 1-10. The repeated contrast between groups one and two in these patents signifies the "separate and distinct" nature of the second component. As noted, the specification of each patent also indicates that each Markush group member is a "compound."

[4]In Claims 22, 24, 25, 28, 29, 30, 31, 32, 33 and 35 of the '485 patent, the claim term at issue is "phosphate supplying reagent," rather than "second component." This claim term, however, has the same definition as "second component" as used in each of the patents. In Claims 1, 5, 6, 7, and 11 of the '608 patent, the claim term at issue is "phosphate compound," rather than "second component." This claim term also has the same definition as "second component" as used in each of the patents.

As in the case of the "first component," the drawings accompanying each of the patents show separate and distinct groups of treatment chemicals. Figures 1, 2a, and 2b in four of the patents clearly identify "Group One Treatment Chemicals" and "Group Two Treatment Chemicals" to be used in the patented method. ('982 patent, Figs. 1, 2a, 2b; '123 patent, Figs. 1, 2a, 2b; '485 patent, Figs. 1, 2a, 2b; '608 patent, Figs. 1, 2a, 2b). These drawings, as well as the other references described above, would indicate to a person of ordinary skill in the art that "second component" means "a separate and distinct compound." Based upon the totality of the intrinsic evidence, the Government's proposed construction of "second component" harmonizes with the claim language and aligns more naturally with the patent's description of the invention. See Renishaw, 158 F.3d at 1250.

Another disagreement concerning the term "second component" is whether it means a component capable of supplying "a source of phosphate anion" as the Government contends, or a component capable of supplying "at least one phosphate anion." (Mod. Joint Claim Const. Statement, '982 patent at 9). The specification of each patent states that "[t]he phosphate-supplying reagent includes the phosphate ion sources having one or more reactive phosphate ions, such as phosphoric acid, trisodium phosphate, a potassium phosphate and monobasic or dibasic calcium phosphates." See, e.g., '982 patent, col. 6, ll. 23-27; '123 patent, col. 6, ll. 25-29; '485 patent, col. 7, ll. 41-45. Similarly, the specification of each patent refers to the second group of treatment chemicals as "chemicals which can supply phosphate ions," and states further that "[t]his group includes products such as phosphoric acid, pyrophosphates, triple super phosphates (TSP), trisodium phosphate, potassium phosphates, ammonium phosphates and/or others capable of supplying phosphate anion when mixed with a metal-bearing process material or with a metal-toxic hazardous waste." ('982 patent, col. 3, ll. 20-26; '123 patent, col. 3, ll. 32-37; '485 patent, col. 4, ll. 51-56). While the claim language for "second component" in some cases uses the phrase "at least one phosphate anion," the intrinsic evidence as a whole supports a construction of "second component" in which the patentee intended the term to refer to those compounds capable of supplying a source of phosphate anion. This is the construction that most naturally aligns with the patent's description of the invention. See Renishaw, 158 F.3d at 1250.

3. At Least One Phosphate Anion

The term "at least one phosphate anion" is at issue in Claim 1 of the '982 patent, in Claims 1 and 15 of the '123 patent, and in Claims 1, 15, 24 and 32 of the '485 patent.[5] The Government contends that this term means "a compound capable of supplying a source of one or more phosphate anions, $(PO_4)^{3-}$, per molecule of said compound; for example, triple

[5] In Claims 24 and 32 of the '485 patent, the claim term at issue is "one or more reactive phosphate ions," rather than "at least one phosphate ion." However, this claim term has the same definition as "at least one phosphate anion" as it is used in each of the patents.

super phosphate contains up to three times the amount of available phosphate per molecule." (Mod. Joint Claim Const. Statement, '982 patent at 10). Sevenson asserts that this term means "at least one phosphate anion of $(PO_4)^{3-}$." Id.

The "Summary of the Invention" section of the specifications for the '982 patent, the '123 patent, and the '485 patent expressly states that "[a] second group consists of treatment chemicals which can supply phosphate ions. *This group includes products such as* phosphoric acid, pyrophosphates, triple super phosphate (TSP), trisodium phosphate, potassium phosphates, ammonium phopshates, and/or others capable of supplying phosphate anion . . . ." ('982 patent, col. 3, ll. 21-26; '123 patent, col. 3, ll. 31-35; '485 patent, col. 4, ll. 50-56) (emphasis added). Similarly, the "Description of the Preferred Embodiment" section of the specifications of these patents states that "[t]he second group, 'group two,' comprises a source of phosphate anion. *This group consists of products like* phosphoric acid (phosphoric), pyrophosphates, triple super phosphate, trisodium phosphates, potassium phosphates, ammonium phosphates *and/or similar compounds capable of supplying a phosphate anion*." ('982 patent, col. 5, ll. 5-10; '123 patent, col. 5, ll. 10-15; '485 patent, col. 6, ll. 28-33; '608 patent, col. 8, ll. 16-17) (emphasis added). The specifications of each patent also state that "[t]he phosphate-supplying reagent includes phosphate ion sources having one or more reactive phosphate ions, such as phosphoric acid, trisodium phosphate, a potassium phosphate and monobasic or dibasic calcium phosphates." ('982 patent, col. 6, ll. 23-27; '123 patent, col. 6, ll. 25-29; '485 patent, col. 7, ll. 41-45). These references in the specifications to compounds capable of supplying phosphate anions would indicate to a person skilled in the art that the term "at least one phosphate anion" means "a compound capable of supplying a source of one or more phosphate anions, $(PO_4)^{3-}$, per molecule of said compound; for example, triple super phosphate contains up to three times the amount of available phosphate per molecule." (Mod. Joint Claim Const. Statement, '982 patent at 10).

Sevenson's proposed construction of "at least one phosphate anion of $(PO_4)^{3-}$" does not conform with the purpose of the patent. Sevenson's construction could not chemically achieve the invention's stated purpose of "fixation and stabilization of metals in contaminated materials." See, e.g., '982 patent (title). In patent claim construction, "the problem the inventor was attempting to solve, as discerned from the specification and the prosecution history, is a relevant consideration." CVI/Beta Ventures, Inc. v. Tura LP, 112 F.3d 1146, 1160 (Fed. Cir. 1997). The specifications from the '982 patent, the '123 patent, and the '485 patent indicate that the "problem the inventor was attempting to solve" was to provide a "chemical treatment technology for immobilizing leachable lead in contaminated soils and solid waste materials." ('982 patent, col. 2, ll. 21-23; '123 patent, col. 2, ll. 32-34; '485 patent, col. 2, ll. 66-67 to col. 3, l. 1); see also '982 patent, col. 4, ll. 7-11; '123 patent, col. 4, ll. 17-21; '485 patent, col. 5, ll. 37-40 ("The present invention provides a method which converts metal-toxic process materials and hazardous wastes into a material which has a lower leachability of metal as determined by EPA's TCLP test.").

The preamble for each independent claim also indicates the intended purpose of the invention. For example, the preamble of the '982 patent, Claim 1, states: "A method of treating metal-bearing materials to stabilize leachable metal contained therein . . . ." ('982 patent, col. 20, ll. 2-3). This statement reasonably means that the method of the patents at issue must be performed to effect such a stabilization. See Jansen v. Rexall Sundown, Inc., 342 F.3d 1329, 1333 (Fed. Cir. 2003) (holding that the preamble was a "statement of the intentional purpose for which the method must be performed"). Similarly, in Manning v. Paradis, 296 F.3d 1098 (Fed. Cir. 2002), the Federal Circuit held that where the preamble defined the purpose of the invention as "treating a subject in cardiac arrest," the claim required not just any amount of oxygen to be delivered to the heart, but rather a "therapeutic amount" of oxygen. Id. at 1102. Likewise, the purpose of the patents here is to treat metal-bearing materials to stabilize leachable metal therein. A person skilled in the art would likely understand that more than a single molecule of phosphate is required for that purpose.

In summary, the references in the specifications of the '982 patent, the '123 patent, and the '485 patent support a conclusion that "at least one phosphate anion" means "a compound capable of supplying a source of one or more phosphate anions, $(PO_4)^{3-}$, per molecule of said compound." The specifications, and the preambles to the independent claims, also establish that the purpose of the invention is to treat metal-bearing materials to stabilize leachable metal. This purpose could not be accomplished with a single molecule of $(PO_4)^{3-}$. The Court finds that the Government's proposed construction is consistent with the language of the specifications and the purpose of the invention.

4. Technical Grade Phosphoric Acid

The term "technical grade phosphoric acid" (TGPA) is at issue in Claim 13 of the '367 patent, and in Claim 11 of the '608 patent. For example, Claim 13 of the '367 patent states "[w]herein said single reactant is technical grade phosphoric acid." ('367 patent, col. 36, ll. 26-27). Sevenson contends that TGPA means "[c]ommercially available phosphoric acid having sulfates as an impurity," while the Government asserts that TGPA means "[p]hosphoric acid that contains up to 70% (by weight) phosphate (as P_2O_5) and sulfate (SO_4^{-2}), typically as sulfuric acid in the range of 2.5% to 7% (by weight) as an impurity." (Mod. Joint Claim Const. Statement, '367 patent at 8).

While the Court "should not read a limitation into a claim from the specification," Innova/Pure Water, Inc., 381 F.3d at 1117, it bears repeating the equally important proviso that "the specification may reveal a special definition given to a claim by the patentee that differs from the meaning it would otherwise possess." Phillips, 415 F.3d at 1316. "In such cases, *the inventor's lexicography governs*." Id. (emphasis added). The Federal Circuit in Phillips provided guidance in determining whether language from the specification was limiting:

> One of the best ways to teach a person of ordinary skill in the art how to make and use the invention is to provide an example of how to practice the invention in a particular case. Much of the time, upon reading the specification in the context, it will become clear whether the patentee is setting out specific examples of the invention to accomplish those goals, or whether the patentee instead intends for the claims and the embodiments in the specification to be strictly coextensive.

Id. at 1323. The Federal Circuit also has noted that "[s]tatements that describe the invention as a whole are more likely to be found in certain sections of the specification, such as the Summary of the Invention." C.R. Bard, Inc. v. United States Surgical Corp., 388 F.3d 858, 864 (Fed. Cir. 2004).

In the "Summary of the Invention" section of the '367 patent and the '608 patent, the specification states that "[t]echnical grade phosphoric acid ('TGPA') . . . contains up to 70% (by weight) phosphate (as P_2O_5) and sulfate (SO_4^{-2}), typically as sulfuric acid in the range of 2.5% to 7% (by weight) as an impurity . . . ." ('367 patent, col. 6, ll. 52-55; '608 patent, col. 6, ll. 6-9). The appearance of this definition in the "Summary of the Invention" section makes it "more likely" a description of the invention as a whole. See C.R. Bard, 388 F.3d at 864. The only other references to TGPA in the patents refer to "TGPA which contains sulfates as an impurity." E.g., '367 patent, abstract. This language from the abstract is not inconsistent with the more precise definition provided in the "Summary of the Invention" section of both patents. Using the guidance of Phillips, it is apparent that the patentee was not merely providing examples of the invention, but rather that the patentee intended for the claims containing the term TGPA and the single embodiment of that term to be coextensive. See Phillips, 415 F.3d at 1323. In this case, the patentee has provided a special definition for the term, and the patentee's intentions should govern.

Sevenson objects to the adoption of specific weight limitations in the definition of TGPA, but the Court notes that the Government's proposed construction does not specify *exactly* 70% (by weight) phosphate, or sulfuric acid *exactly* in the range of 2.5% to 7% (by weight) as an impurity. Rather, the Government's proposed construction, as reflected in the "Summary of the Invention," is that the phosphate may be *up to* 70% by weight, and sulfuric acid *typically* in the range of 2.5% to 7% (by weight) as an impurity. (Deft's Brief at 23-24). This definition does not preclude phosphate that is less than 70% by weight, or sulfuric acid that varies from the typical range of 2.5% to 7% (by weight) as an impurity.

Accordingly, the Court adopts the proposed construction of the Government, that "technical grade phosphoric acid" means "phosphoric acid that contains up to 70% (by weight) phosphate (as P_2O_5) and sulfate (SO_4^{-2}), typically as sulfuric acid in the range of 2.5%

to 7% (by weight) as an impurity." This is the construction that would likely be understood by a person of ordinary skill in the art.

5. Leachable Metal

The term "leachable metal" is at issue in Claims 1 and 2 of the '982 patent, and in Claims 1 and 15 of the '123 patent. For example, Claim 1 of the '982 patent states that "wherein said metal-bearing material contains at least one leachable metal selected from the group consisting of lead, aluminum, arsenic (III), barium, bismuth, cadmium, chromium (III), copper, iron, nickel, selenium, silver and zinc." ('982 patent, col. 20, ll. 8-11). The Government contends that "leachable metal" means one or more of the identified substances, noting that the claims are written in Markush group format, and that the Markush group specifies the alternatives of the group. See e.g., Abbott, 334 F.3d at 1280-81. This construction is "centered on the claim language itself." Innova/Pure Water, Inc., 381 F.3d at 1116.

Sevenson has proposed a definition of "leach" or "leachable" that would accompany the word "metal." Sevenson relies upon a dictionary definition that "leach" means "to be dissolved and washed out by a percolating liquid." The American Heritage Dictionary 743 (2d College ed. 1982) ("American Heritage"). Lacking any relevant intrinsic evidence, and without any objection or alternate construction from the Government, the Court will combine Sevenson's definition of "leach" with the identified list of "metals" on which the parties agree. (Mod. Joint Claim Const. Statement, '982 patent at 4). Accordingly, the Court finds that "leachable metal" means "at least one of the substances selected from the group consisting of lead, aluminum, arsenic (III), barium, bismuth, cadmium, chromium (III), copper, iron, nickel, selenium, silver and zinc, that have been or have the capacity to be dissolved or washed out by a carrier fluid."

6. Leachable [Metal or Lead] Level(s)

The term "leachable metal level(s)" is at issue in Claims 1 and 15 of the '123 patent, and in Claims 1, 15, 22, 28 and 30 of the '485 patent. For example, Claim 1 of the '123 patent states that "the leachable metal level in said cured material is below 5.0 mg/l . . . ." ('123 patent, col. 20, ll. 35-36). The Government contends that this term means the "[c]oncentration (measured in mg/l) of metal [or lead] present in the TCLP extract from a representative sample of waste after performing the TCLP test method."[6] (Mod. Joint Claim Const. Statement, '123 patent at 5). Sevenson contends that "leachable metal level(s)" means

[6] As noted earlier, "TCLP" stands for the EPA's "Toxicity Characteristic Leaching Procedure."

"[t]he amount of metal that can be removed from a material by extraction." Id. The claims do not explicitly define the term "leachable metal level."

The specification of each patent states, in the "Summary of the Invention" section, that an object of the invention is "to provide a method which decreases the leaching of lead in lead-bearing materials to levels below the regulatory limit of 5 mg/l by TCLP test criteria." ('123 patent, col. 3, ll. 56-59; '485 patent, col. 5, ll. 8-11). In the "Background of the Invention" section of the specification, each patent identifies the TCLP test method: "The regulatory threshold limit under Resource Cons. and Recovery Act is 5 mg/l of leachable lead as measured by TCLP . . . test criteria, [EPA] method 1311 (SW-846)." ('123 patent, col. 2, ll. 11-16; '485 patent, col. 2, ll. 44-49). Applicable regulations provide that a waste is toxic if, after performing the TCLP test method (EPA test method 1311), "the extract from a representative sample of the waste contains any of the contaminants listed in table 1 at the concentration [measured in mg/l] equal to or greater than the respective value given in that table." 40 C.F.R. § 261.24(a). Accordingly, to a person of ordinary skill in the art, the term "leachable [metal or lead] level" means the "concentration (measured in mg/l) of metal [or lead] present in the TCLP extract from a representative sample of waste after performing the TCLP test method." Sevenson's proposed construction again is too broad and imprecise, and does not reflect the intentions of the patentee.

7. Stabilize or Immobilize

The term "stabilize" is at issue in Claim 1 of the '982 patent, in Claims 1 and 15 of the '123 patent, and in Claims 1 and 15 of the '485 patent. For example, Claim 1 of the '982 patent states "[w]hat is claimed is: A method of treating metal-bearing materials to stabilize leachable metal contained therein." ('982 patent, col. 20, ll. 1-3). The term "immobolize(ing)" is at issue in Claims 22 through 36 of the '485 patent. For example, Claim 22 of the '485 patent states "[a] method for immobilizing leachable lead in contaminated soils or solid waste materials." ('485 patent, col. 24, ll. 13-14). The Government has proposed identical definitions for "stabilize" and "immobilize," whereas Sevenson has proposed different definitions. (Mod. Joint Claim Const. Statement, '982 patent at 5; '485 patent at 28).

The Government asserts that, in the context of the intrinsic evidence, the terms "stabilize" and "immobilize" mean: "Convert into non-leachable form, i.e., the TCLP metal level is below the regulatory threshold limit under the TCLP test criteria of the EPA." Id. In contrast, Sevenson contends that "stabilize" means "to put within a state of defined limits; not easily decomposed or otherwise modified chemically," and that "immobilize" means "to prevent freedom of movement or effective use." Id.

Based upon Claim 1 of the '982 patent, the term "stabilize" is used to indicate a conversion from leachable into non-leachable form. The specifications for the '982 patent, the '123 patent, and the '485 patent also support this definition. The specification for each of the patents states that "[t]he processes of the present inventions provide reactions that *convert leachable metals, especially lead, into a non-leachable form which is geochemically stable* for indefinite periods . . . ." ('982 patent, col. 3, ll. 10-14; '123 patent, col. 3, ll. 21-25; '485 patent, col. 3, ll. 56-59) (emphasis added). These specifications also describe the purpose of the treatment technology as being "to render the metal substantially *non-leachable, that is, to levels below the regulatory threshold limit under the TCLP test criteria of the USEPA*." ('982 patent, col. 3, ll. 34-36; '123 patent, col. 3, ll. 45-47; '485 patent, col. 4, ll. 64-67) (emphasis added). See also '982 patent, col. 2, ll. 57-59; '123 patent, col. 3, ll. 1-3; '485 patent, col. 3, ll. 35-37 ("The invention relates to treatment methods employed to chemically convert leachable metal in metal-bearing solid and liquid waste materials to a non-leachable form . . . ."). Similarly, each of the patents states that: "It is another object of the present invention to provide a method to immobilize lead to leachable levels below 5 mg/l by TCLP test criteria . . . ." ('982 patent, col. 3, ll. 49-50; '123 patent, col. 3, ll.60-61; '485 patent, col. 5, ll. 12-14).

Sevenson's construction is based on an American Heritage Dictionary definition of "stable" ("not easily decomposed or otherwise modified chemically"). See American Heritage at 1254. Again, the Court finds that the Government's construction is more reasonable in the context of the patent, and considering the purpose of the treatment technology. See Renishaw, 158 F.3d at 1250 (Claim construction "stays true to the claim language and most naturally aligns with the patent's description of the invention."). It is unnecessary in this circumstance to consult a dictionary definition of "stabilize," and thereby add wording that is not contained in the patent. Accordingly, the Court adopts the Government's proposed construction of "stabilize" and "immobilize," and finds that they mean to "convert into non-leachable form, i.e., the TCLP metal level is below the regulatory threshold limit under the TCLP test criteria of the EPA." Sevenson's definition does not vary greatly in proposing that "stabilize" means "to put within a state of defined limits," but the Government's proposed construction specifies the "defined limits," consistent with the patents.

8. Supply(ies)(ing)

The Term "supply(ies)(ing)" is at issue in Claim 1 of the '982 patent, in Claims 1, 3, 15 and 17 of the '123 patent, and in Claims 1, 15, 17 and 24 of the '485 patent. For example, Claim 1 of the '982 patent uses the term "supplies" twice: "wherein said first component *supplies* at least one member selected from the group consisting of sulphates, halites, and silicates, and wherein said second component *supplies* at least one phosphate anion." ('982 patent, col. 20, ll. 11-14) (emphasis added). The parties agree that the term

"supply(ies)(ing)" means in part "to make available." However, the Government contends that the term "supplies" should be construed to mean "to make available for the stabilization process," while Sevenson contends that it should be construed to mean simply "provide or make available one or more reactant(s)." (Mod. Joint Claim Const. Statement, '982 patent at 8).

The specifications for each of the three patents state that the material "treated with a phosphate-supplying reagent reacts chemically to immobilize the remaining leachable lead." ('982 patent, col. 6, ll. 19-26; '123 patent, col. 6, ll. 20-29; '485 patent, col. 7, ll. 36-45). See also '982 patent, col. 9, ll. 26-29; '123 patent, col. 9, ll. 55-59; '485 patent, col. 11, ll. 37-40 ("In addition, the amount of phosphate-supplying reagent is prescribed in an amount sufficient to produce mineral species such as hydroxy-lead apatite in contaminated soil or solid waste material . . . ."). The Government's proposed interpretation adds detail that is consistent with the purpose of the patents. The Court concludes that the specifications would indicate to a person of ordinary skill in the art that the meaning of "supply(ies)(ing)" in the patents at issue is "to make available for the stabilization process."

9. Markush Group Chemical Terms

Of the many disputed claim terms identified in the parties' October 18, 2006 Modified Joint Claim Construction Statement, 15 of them are chemicals that are members of Markush groups. Some of these chemicals appear in more than one of the five patents at issue. In each of these 15 instances, the chemical may be used in the described treatment method. For example, Claim 5 of the '982 patent states that ". . . wherein said second component is at least one member selected from the group consisting of *phosphoric acid, trisodium phosphate, triple super phosphate, pyrophosphates, potassium phosphates, and ammonium phosphates*." ('982 patent, col. 20, ll. 31-34) (emphasis added). The parties' disagreement is the same for all 15 chemicals, and therefore they are treated together. Sevenson maintains that each of these 15 Markush group members is a "material," whereas the Government contends that each member is a "compound." The Government describes this disagreement as "highly technical, but significant." (Deft.'s Brief at 32).

The 15 chemicals, the disputed patent claims where they appear, and the respective positions of the parties are as follows:

TERM AND CORRESPONDING PATENT CLAIMS	SEVENSON'S PROPOSED DEFINITION	THE GOVERNMENT'S PROPOSED DEFINITION
Ammonium phosphate(s) '982 patent, Claim 5	A material comprising ammonium and a phosphate anion $(PO_4)^{3-}$	Compounds containing ammonium and a phosphate anion, $(PO_4)^{3-}$
Calcium sulfate '608 patent, Claim 3	A material comprising $CaSO_4$	A compound containing calcium and a sulfate group, $(SO_4)^{2-}$
Chloride(s) '485 patent, Claims 1, 15	A material comprising a chlorine ion, Cl^-	A compound containing a chlorine ion, Cl^-
Fluoride(s) '485 patent, Claims 1, 15	A material comprising a fluorine ion, F^-	A compound containing a fluorine ion, F^-
Halide(s) '485 patent, Claims 1, 15	A material comprising a halogen ion (fluorine, chlorine, bromine, iodine, astatine)	A compound containing a halogen element (fluorine, chlorine, bromine, iodine, astatine)
Halite(s) '982 patent, Claims 1, 4; '123 patent, Claims 1, 15; '485 patent, Claims 1, 15; '608 patent, Claims 1, 20	A material comprising sodium chloride (NaCl)	The compound sodium chloride (NaCl)
Phosphoric acid '982 patent, Claims 5, 9; '123 patent, Claims 5, 6, 19, 20; '485 patent, Claims 5, 6, 19, 20, 21, 25, 27, 29, 33, 35; '608 patent, Claims 29, 30	An acid comprising H_3PO_4	A compound with the chemical formula H_3PO_4
Potassium phosphate(s) '982 patent, Claim 5; '485 patent, Claims 25, 29, 33	A material comprising potassium and a phosphate anion, $(PO_4)^{3-}$	Compounds containing potassium and a phosphate anion, $(PO_4)^{3-}$
Pyrophosphate(s) '982 patent, Claim 5	A material comprising a pyrophosphate $(P_2O_7)^{4-}$	Compounds containing a pyrophosphate group, $(P_2O_7)^{4-}$
Silicate(s) '982 patent, Claim 1; '123 patent, Claims 1, 15; '485 patent, Claims 1, 15; '608 patent, Claims 1, 20	A material comprising silicon, oxygen, and one or more metals with or without hydrogen	A compound having a molecular structure containing silicon, oxygen, and one or more metals

TERM AND CORRESPONDING PATENT CLAIMS	SEVENSON'S PROPOSED DEFINITION	THE GOVERNMENT'S PROPOSED DEFINITION
Sulfuric acid '485 patent, Claims 3, 21, 26, 27, 28, 34, 35, 36; '608 patent, Claim 3	An acid comprising H_2SO_4	A compound with the chemical formula H_2SO_4
Sulphate(s) '982 patent, Claim 1; '123 patent, Claims 1, 3, 6, 15, 17, 20; '485 patent, Claims 1, 6, 15, 20; '608 patent, Claims 1, 3, 4, 20, 27, 30	A material comprising the anion $(SO_4)^{2-}$	A compound containing a sulphate group, $(SO_4)^{2-}$
Sulphates of aluminum '982 patent, Claim 4	A material comprising aluminum and a sulphate $(SO_4)^{2-}$	Compounds containing aluminum and a sulphate group, $(SO_4)^{2-}$
Sulphates of iron '982 patent, Claim 4	A material comprising iron and a sulphate $(SO_4)^{2-}$	Compounds containing iron and a sulphate group, $(SO_4)^{2-}$
Trisodium phosphate '982 patent, Claim 5; '485 patent, Claims 25, 29, 33	A material comprising Na_3PO_4	A compound with the chemical formula Na_3PO_4

Though the parties agree on the chemical composition of each of these terms, the Court still must determine whether the Markush group members are "materials," as Sevenson contends, or "compounds," as the Government contends. A review of the intrinsic evidence supports the Government's position.

Each patent's "Summary of the Invention" section describes "mixing the solid waste with a *sulfate compound*, such as calcium sulfate dihydrate (gypsum powder) or sulfuric acid . . . ." ('982 patent, col. 2, ll. 26-28; '123 patent, col. 2, ll. 38-40; '485 patent, col. 3, ll. 4-6; '608 patent, col. 2, ll. 41-43) (emphasis added). The specifications of each patent describe "products like phosphoric acid (phosphoric), pyrophosphates, triple super phosphate, trisodium phosphates, potassium phosphates, ammonium phosphates, and/or *similar compounds*." ('982 patent, col. 5, ll. 6-10; '123 patent, col. 5, ll. 11-14; '485 patent, col. 6, ll. 29-33, '608 patent, col. 8, ll. 16-20) (emphasis added). See also '982 patent, col. 19, ll. 54-58 (Example 6); '123 patent, col. 20, ll. 3-8 (Example 6); '485 patent, col. 22, ll. 40-44 (Example 6); '608 patent, col. 23, ll. 53-57 (Example 6) ("The treatability studies are designed to optimize the amount and grade of gypsum powder (*or other sulfate compound*) needed during step 1, and the amount and concentration of phosphoric acid (*or other phosphate compound*) needed in step II . . . .") (emphasis added). These references in each

patent would indicate to a person skilled in the art that each of the Markush group members is a "compound."

The definitions of the words "compound" and "material" from Hawley's Condensed Chemical Dictionary support the conclusion that each of the Markush group members is a "compound." This dictionary defines "compound" as "[a] substance composed of atoms or ions of two or more elements in chemical combination." Hawley's Condensed Chemical Dictionary, 302 (11th ed. 1987) ("Hawley's"). This definition is consistent with the chemical compositions of the Markush group members to which the parties have agreed. For example, the parties have agreed that "halite" is sodium chloride (NaCl). In contrast, Hawley's defines the term "material" as "[a] nonspecific term used with various shades of meaning in the technical literature." Id. at 734.

As noted in the discussion of "first component," Sevenson's use of the word "material" to define the Markush group chemicals would create potential confusion in the construction of the patents. The word "material" is used in the claim language to describe the contaminated soil or other environmental media, such as "lead-bearing material." See, e.g., '982 patent, col. 20, l. 5. The Court does not endorse a claim construction where the word "material" would be used to define both the treating chemicals and the contaminated soil.

Sevenson's position also is misplaced in attempting to use the word "comprising." Transitional phrases, such as "comprising," "consisting of," or "consisting essentially of," are terms of art in patent law. Conoco, Inc. v. Energy & Env. Intern., L.C., 460 F.3d 1349, 1360 (Fed. Cir. 2006). Specifically, "comprising" is a "term of art used in claim language which means that the named elements are essential, but other elements may be added and still form a construct within the scope of the claim." Genentech, Inc. v. Chiron Corp., 112 F.3d 495, 501 (Fed. Cir. 1997). Thus, the use of the word "comprising" would signify an open claim. Moleculon Research Corp. v. CBS, Inc., 793 F.2d 1261, 1271 (Fed. Cir. 1986). However, each of the 15 terms at issue here are members of a Markush group, where the group is limited by the specified alternatives listed. By proposing the word "comprising," Sevenson improperly broadens the scope of each Markush group by converting it to an open group where other members could be added. Such a construction would contradict the established law relating to Markush groups. In contrast, the Government's proposed construction does not employ words that are terms of art in patent law, nor does it conflict with the established law of Markush groups.

For the above reasons, the Court adopts the Government's proposed construction of the identified 15 Markush group chemicals, wherein each member is a "compound." The Court finds the Government's construction to be the one that a person of ordinary skill in the art would likely understand.

C. Analysis of Remaining Terms in the '982 Patent

1. Metal-Bearing Materials

The term "metal-bearing materials" is at issue in claims 1 and 3 of the '982 patent. Claim 1 states that "[w]hat is claimed is: A method of treating metal-bearing materials . . . wherein said metal-bearing material contains at least one leachable metal . . . ." ('982 patent, col. 20, ll. 1-7). The Government maintains that "[m]etal-bearing materials" are "materials containing at least one leachable metal." (Mod. Joint Claim Const. Statement, '982 patent at 3). Sevenson contends that "metal bearing materials" are "[m]aterials that have the capacity to yield, produce, or release metals." Id.

In the "Summary of the Invention" section, the specification states that "[t]he metal bearing materials referred to herein which the present invention treats include those materials having leachable lead, aluminum, arsenic (III), barium, bismuth, cadmium, chromium (III), copper, iron, nickel, selenium, silver and zinc." ('982 patent, col. 2, l. 66 to col. 3, ll. 1-3). This statement is consistent with the Government's proposed definition for "metal-bearing materials" and for "leachable metal." The Court adopts the Government's proposed definition because it "stays true to the claim language and most naturally aligns with the patent's description of the invention . . . . ." Renishaw, 158 F.3d at 1250.

2. First Mixture

Claim 1 of the '982 patent contains the disputed term "first mixture." In the context of the patent, the term is used to mean "a first mixture comprising a first component and a second component . . . ." ('982 patent, col. 20, ll. 5-6). The Government contends that "first mixture" means precisely as stated in the claim, where a first component and a second component are mixed together. (Mod. Joint Claim Const. Statement, '982 patent at 5). Sevenson asserts that the term means "[a] first homogeneous or heterogeneous material in any physical state that consists of two or more chemical components that have no firm chemical bonding between them and that are physically separable." Id.

The Court finds that the Government's construction is based upon the claim language itself. Innova/Pure Water, Inc., 381 F.3d at 1116. Sevenson's position would add words that are not found in the patents, and does not consider the plain language of the claims. The terms "first component" and "second component" also are in dispute, and are defined above. The Court concludes that "first mixture" means the "first component plus the second component mixed together." This is the definition that "stays true to the claim language and most naturally aligns with the patent's description of the invention . . . ." Renishaw, 158 F.3d at 1250.

3. Second Mixture

The term "second mixture" is at issue in Claim 1 of the '982 patent. Claim 1 provides for "mixing a metal-bearing material with a first mixture comprising a first component and a second component to form a second mixture . . . ." ('982 patent, col. 20, ll. 5-7). The Government contends that "second mixture" means a "[m]etal-bearing material plus a first mixture mixed together, wherein the first mixture is the first component plus the second component mixed together." (Mod. Joint Claim Const. Statement, '982 patent at 11). Sevenson asserts that "second mixture" means "[a] second homogeneous or heterogeneous material in any physical state that consists of two or more chemical components that have no firm chemical bonding between them and that are physically separable." Id.

As with the definition of "first mixture," the Court finds that the Government's construction is based upon the claim language itself. Innova/Pure Water, Inc., 381 F.3d at 1116. Sevenson's proposed definition again adds words that are not found in the patents, and does not consider the plain language of the claims. The parties have proposed definitions for the terms "metal-bearing material" and "first mixture," thus assuring that the Government's proposed definition is complete and reflects the "ordinary and customary" meaning of the words of the claim.

D. Analysis of Remaining Terms of the '367 Patent

1. Host Material

The term "host material" is at issue in Claims 11 and 14 of the '367 patent. Claim 11 provides for "[a] process for treating a host material comprising solid waste materials containing leachable radionuclides and radioactive compounds . . . ." ('367 patent, col. 36, ll. 10-12). The Government contends that "host material" means "[d]ebris, soil, sludges, and solid materials containing leachable radionuclides and radioactive compounds." (Mod. Joint Claim Const. Statement, '367 patent at 4). Sevenson asserts that "host material" means simply "[m]aterial to be treated." Id.

The Court finds that the plain language of the claim supports the Government's proposed definition. For "host material," the specification states: "the present invention relates to a chemical treatment process that reduces the leachability and solubility of radionuclides and other radioactive substances contained in debris, soils, sludges, and solid materials ('the host material' or the 'host matrix')." ('367 patent, col. 5, ll. 4-8). Sevenson is critical of the Government's proposed interpretation for adding references to leachable radionuclides and radioactive compounds, but the purpose of the invention is to reduce the leachability and solubility of these materials. The "host material" must contain leachable

radionuclides and radioactive compounds in order to achieve the purpose of the invention. Accordingly, the Court adopts the Government's proposed construction.

2. Single Reactant

The term "single reactant" is at issue in Claims 11 and 13 of the '367 patent. Claim 11 provides for "a single reactant comprising a source of a sulfate ion and a phosphate ion . . . ." ('367 patent, col. 36, ll. 14-15). Claim 13, a dependent claim, states: "The process of Claim 11, wherein said single reactant is technical grade phosphoric acid . . . ." Id. at ll. 26-27. The Government contends that "single reactant" means "[a] source of a sulfate ion and a phosphate ion that acts with the host material to form a new set of molecules, wherein a sulfate ion is the negative ion $(SO_4)^{2-}$ and wherein a phosphate anion is the negative ion $(PO_4)^{3-}$." (Mod. Joint Claim Const. Statement, '367 patent at 4). Sevenson asserts that "single reactant" means simply "[o]ne entity in a chemical reaction." Id.

As noted, the claim language in Claim 11 describes the term "single reactant" as "a source of a sulfate ion and a phosphate ion." ('367 patent, col. 36, ll. 14-15). The language in Claim 13 states that "single reactant" is "technical grade phosphoric acid." Id. at ll. 26-27. Thus, the description of "single reactant" varies between the two claims. The Government's proposed definition is specific to Claim 11, but does not account for the differing description in Claim 13.

The term "reactant" is not defined in the patents or the prosecution histories, and therefore resort to a dictionary definition is appropriate. The McGraw-Hill Dictionary of Scientific and Technical Terms defines "reactant" as "the molecules that act upon one another to make a new set of molecules." McGraw-Hill Dictionary of Scientific and Technical Terms 1570 (4th ed. 1989) ("McGraw-Hill"). The Court concludes that Sevenson's definition, "one entity in a chemical reaction," is the most reasonable under the circumstances because it can be applied to both claims at issue. The Government's proposed definition of "single reactant" does not accomplish this objective.

3. Source of a Phosphate Ion

The term "source of a phosphate ion" is at issue in Claim 11 of the '367 patent. Claim 11 provides for "a single reactant comprising a source of a . . . phosphate ion . . . ." ('367 patent, col. 36, ll. 14-15). The Government contends that "source of a phosphate ion" means "[o]ne or more compounds which supplies a reactive phosphate ion, wherein a phosphate anion is the negative ion $(PO_4)^{3-}$." (Mod. Joint Claim Const. Statement, '367 patent at 6). Sevenson states that "source of a phosphate ion" means "[t]he point of origin for a reactive phosphate ion, wherein a phosphate ion is the negative ion $(PO_4)^{3-}$." Id. Sevenson's proposed construction would allow only one molecule of phosphate to satisfy the claim.

The patent claims do not explicitly define this term, but the specifications of the '367 patent are instructive. The specification states that "[a] second group consists of treatment chemicals which can *supply phosphate ions*[,]" and further explains that "[t]his group includes products such as phosphoric acid, pyrophosphates, triple super phosphate (TSP), trisodium phosphate, potassium phosphates, ammonium phosphates and/or others capable of *supplying phosphate anion* . . . ." ('367 patent, col. 4, ll. 8-13) (emphasis added). In addition, the specification states that "[t]he second group, 'group two', comprises a *source of phosphate anion*. This group consists of products like phosphoric acid (phosphoric), pyrophosphates, triple super phosphate, trisodium phosphates, potassium phosphates, ammonium phosphates and/or similar compounds capable of *supplying a phosphate anion*." ('367 patent, col. 8, ll. 55-60) (emphasis added). From these references, a person of ordinary skill in the art would likely understand that the term "source of a phosphate ion" refers to a compound, such as phosphoric acid, triple super phosphate, or potassium phosphate, which is capable of supplying a phosphate ion.

Further, the specification indicates that the phosphate ion must be reactive, which when viewed in the context of the patent as a whole, means that it must convert leachable metals into non-leachable form. The specification states that "[t]he phosphate-supplying reagent includes *phosphate ion sources having one or more reactive phosphate ions*, such as phosphoric acid, trisodium phosphate, a potassium phosphate and monbasic or dibasic calcium phosphates." ('367 patent, col. 9, ll. 66-67 to col. 10, ll. 1-3) (emphasis added). More generally, the specification states that "[t]he processes of the present invention provide reactions that convert leachable metals, especially lead, into a non-leachable form . . . ." ('367 patent, col. 3, ll. 66-67 to col. 4, l. 1). To convert leachable metal into non-leachable form, more than a single molecule of phosphate is required, and therefore Sevenson's proposed construction must be rejected. When viewed in the context of the patent as a whole, a person of ordinary skill in the art would likely understand that the term "source of a phosphate ion" means "one or more compounds which supplies a reactive phosphate ion, wherein a phosphate anion is the negative ion $(PO_4)^{3-}$."

4. Source of a Sulfate Ion

The term "source of a sulfate ion" is at issue in Claim 11 of the '367 patent. Claim 11 provides for "a single reactant comprising a source of a sulfate ion . . . ." ('367 patent, col. 36, ll. 14-15). The Government contends that "source of a sulfate ion" means "[o]ne or more compounds which supplies a reactive sulfate ion, wherein a sulfate ion is the negative ion $(SO_4)^{2-}$." (Mod. Joint Claim Const. Statement, '367 patent at 5). Sevenson maintains that "source of a sulfate ion" means "[t]he point of origin for a reactive sulfate ion, wherein a sulfate ion is the negative ion $(SO_4)^{2-}$." Id. Again, Sevenson's proposed construction would allow only one molecule of sulfate to satisfy the claim.

The patent claims do not explicitly define this term, but the specifications of the '367 patent are instructive. The specification states that "sulfuric acid, or alum in liquid or powder form can also be used as *sources of sulfate ion* in certain solid wastes that contain sufficient calcium prior to treatment." ('367 patent, col. 9, ll. 13-17) (emphasis added). In addition, the specification states that "[a] first group of treatment chemicals for use in the processes of the present invention includes lime, gypsum, alum, halites, portland cement, and other similar products that can *supply sulfates*, halites, hydroxides, and/or silicates." ('367 patent, col. 4, ll. 4-8) (emphasis added); see also '367 patent, col. 8, ll. 51-52 ("[a] first group, 'group one', comprises a source of sulfate, hydroxide, chloride, fluoride, and/or silicates."). From these references, a person of ordinary skill in the art would likely understand that the term "source of a sulfate ion" refers to a compound, such as gypsum, alum, or portland cement, which is capable of supplying a sulfate ion.

Further, the specification establishes that the sulfate ion must be reactive in order to convert leachable metals into a non-leachable form. For example, in the "Summary of the Invention" section, the specification states that in the first step of the patented process, the waste is mixed with a sulfate compound "having at least one sulfate ion for contacting waste particles and reacting with said leachable lead to produce a substantially insoluble lead composition." ('367 patent, col. 3, ll. 16-18). The specification also states that "[t]he processes of the present invention provide reactions that convert leachable metals, especially lead, into a non-leachable form . . . ." ('367 patent, col. 3, ll. 66-67 to col. 4, l. 1). To convert leachable metal into non-leachable form, more than a single molecule of sulfate is required, and therefore Sevenson's proposed construction must be rejected. The Government's proposed definition of "source of a sulfate ion" also is parallel with its definition of "source of a phosphate ion."

Finally, the Government's proposed definition of "source of a sulfate ion" is consistent with the patentee's use of TGPA in the patent. In the specification, the patentee states:

> Technical grade phosphoric acid ('TGPA') that contains up to 70% (by weight) phosphate (as P_2O_5) and sulfate (SO_4^{-2}), typically as sulfuric acid in the range of 2.5% to 7% (by weight) as an impurity, is a source of both a sulfate ion and a phosphate ion and can, therefore, be used as a single reactant.

('367 patent, col. 6, ll. 52-57). The Government's proposed definition allows for "one or more" compounds, and therefore a single compound such as TGPA can satisfy the Government's proposed definition. The Government's proposed definition also requires that the compound (or compounds) supply a reactive sulfate ion. Therefore, the reactive sulfate ion must be present in large enough quantities to participate measurably in the chemical

reactions defined in the patents. In the typical range of sulfate impurities defined by the patentee (2.5% to 7%), the TGPA as defined herein satisfies this standard.

For the reasons stated, when viewed in the context of the patent as a whole, a person of ordinary skill in the art would likely understand that the term "source of a sulfate ion" means "one or more compounds which supplies a reactive sulfate ion, wherein a sulfate ion is the negative ion $(SO_4)^{2-}$."

5. Mixture

The term "mixture" is at issue in Claim 11 of the '367 patent. Claim 11 provides for mixing a "single reactant comprising a source of a sulfate ion and a phosphate ion to form a mixture; said mixture containing substantially insoluble Apatitic-structure mineral species[.]" ('367 patent, col. 36, ll. 14-17). The Government contends that "mixture" means "[h]ost material plus single reactant mixed together, containing substantially insoluble Apatitic-structure mineral species." (Mod. Joint Claim Const. Statement, '367 patent at 7). Sevenson asserts that "mixture" means "[a] homogeneous or heterogeneous material in any physical state that consists of two or more chemical components that have no firm chemical bonding between them and that are physically separable." Id.

As the Government points out, Sevenson's proposed definition is not tied to the language of the claims. It is fundamental in patent law that "a claim construction analysis must begin and remain centered on the claim language itself . . . ." Innova/Pure Water, Inc., 381 F.3d 1116. Here, the claim language defines "mixture" as the "host material plus single reactant mixed together, containing substantially insoluble Apatitic-structure mineral species." The Court finds that the Government's proposed definition is true to the claim language, and should be adopted.

6. Concentration of Leachable Radionuclides and Radioactive Compounds

The term "concentration of leachable radionuclides and radioactive compounds" is at issue in Claim 11 of the '367 patent. Claim 11 provides that "the concentration of leachable radionuclides and radioactive materials is decreased . . . ." ('367 patent, col. 36, ll. 20-21). The Government contends that "concentration of leachable radionuclides and radioactive compounds" means "[t]he amount of picocuries per liter (pCi/l) in the TCLP extract of a sample." (Mod. Joint Claim Const. Statement, '367 patent at 7). Sevenson asserts that "concentration of leachable radionuclides and radioactive compounds" means "[t]he amount of leachable picocuries in a mass or volume of material." Id.

The patent claims do not suggest a definition for this term. The examples presented in the specification for the '367 patent, however, provide guidance. In Example 7, treated

and controlled samples were extracted using the TCLP test method, and then tested for radioactivity. The example states: "All results presented below are in the units of picocuries per liter (pCi/l)." ('367 patent, col. 24, ll. 41-42 (Example 7)). See also '367 patent, col. 25, ll. 15-16 (Example 7), col. 28, l. 26 (Table XV, Example 9), col. 29, l. 15 (Table XVI, Example 10) (reporting results in the units of picocuries per liter). In addition, Hawley's notes under the definition for "concentration" that "[f]or radioactivity, the concentration is usually expressed as milicuries per milliliter (mC/mL) or millicuries per millimol (mCi/nM)." Hawley's at 303.

Although the differences in the parties' proposed definitions appear minor, the Court finds that the Government's proposed definition is true to the intrinsic evidence in the patent, and should be adopted. The Government's proposed definition provides a unit measure contained in the specification examples, and refers to the TCLP test method that would be used in the patented process. Sevenson's proposed definition is lacking these features.

7. Contaminated

The term "contaminated" is at issue in Claim 16 of the '367 patent. Claim 16 provides that "said solid waste materials are contaminated fine-grained solids." ('367 patent, col. 36, ll. 33-34). The Government contends that "contaminated" means "[c]ontaining leachable radionuclides and radioactive compounds . . . ." (Mod. Joint Claim Const. Statement, '367 patent at 9). Sevenson states that "contaminated" means "[t]o contain an undesirable or unwanted material." Id.

The abstract of the patent states that the invention treats "soils or contaminated materials containing radionuclides and radioactive wastes . . . ." ('367 patent, abstract). The title of the patent, "Reduction of Leachability and Solubility of Radionuclides and Other Radioactive Substances in Contaminated Soils and Materials," strongly suggests that the purpose of the patent is to treat materials contaminated with radioactive compounds. See CVI/Beta Ventures, 112 F.3d at 1160 ("In construing claims, the problem the inventor was attempting to solve, as discerned from the specification and the prosecution history, is a relevant consideration.").

The Court concludes that the Government has proposed a definition that is true to the intrinsic evidence in the patent, and that considers the objectives of the patent as a whole. Sevenson has not relied on intrinsic evidence in the patent, but has offered simply an extrinsic dictionary definition. The Court finds that the Government has proposed the more reasonable construction.

8. Fine-Grained Solids

The term "fine-grained solids" is at issue in Claim 16 of the '367 patent. Claim 16 provides that "said solid waste materials are contaminated fine-grained solids." ('367 patent, col. 36, ll. 33-34). The Government contends that "fine-grained solids" means "[s]ubstance(s) of a definite shape and volume, not liquid or gaseous, having a smooth, even grain, wherein grain is the relative size of the particles composing the substance." (Mod. Joint Claim Const. Statement, '367 patent at 9). Sevenson asserts that "fine-grained solids" means "[m]aterial having no free liquids comprising solid small particles." Id. The patents and the prosecution histories do not suggest a definition for this term.

Lacking any intrinsic evidence, the Court will refer to a dictionary to define "fine-grained solids." American Heritage at 505 defines "fine-grained" as "having a fine, smooth, even grain." The same dictionary defines "grain" as "the relative size of the particles composing a substance," id. at 570, and "solid" as "of definite shape and volume." Id. at 1163. The Government's proposed construction best presents the essence of these definitions.

E. Analysis of Remaining Terms of the '123 Patent[7]

1. Treatment Additive

The term "treatment additive" is at issue in Claims 1 and 15 of the '123 patent. For example, Claim 1 provides for preparing a "treatment additive comprising a first component and a second component to form a mixture . . . ." ('123 patent, col. 20, ll. 22-23). Claim 15 contains identical language. Id. at col. 21, ll. 27-29. The Government contends that "treatment additive" means "[f]irst component plus second component mixed together." (Mod. Joint Claim Const. Statement, '123 patent at 5). Sevenson states simply that "treatment additive" is "[a] reactant." Id.

Here, the patent's claim language defines the term "treatment additive" as a first component and a second component mixed together. Sevenson's proposed definition does not refer to the plain language of the claims. See Innova/Pure Water, Inc., 381 F.3d at 1116. The Court previously has defined the terms "first component" and "second component." The proposed definition of "treatment additive" thus is complete and reflects the "ordinary and customary" meaning of the words of the claim. The Court concludes that the Government's proposed definition should be adopted.

[7] The Court has addressed earlier the terms "metal-bearing materials" and "mixture," and adopts the construction of those terms for purposes of this patent.

2. Aqueous Phosphate Reagent

The term "aqueous phosphate reagent" is at issue in Claims 4 and 18 of the '123 patent. For example, Claim 4 provides that "wherein said second component is an aqueous phosphate reagent." ('123 patent, col. 20, ll. 45-46). Claim 18 contains identical language. Id. at col. 22, ll. 2-3. The Government contends that "aqueous phosphate reagent" means "a compound made with water capable of supplying a source of phosphate anion, $(PO_4)^{3-}$, wherein water is a compound with the chemical formula H_2O." (Mod. Joint Claim Const. Statement, '123 patent at 14). Sevenson asserts that "aqueous phosphate reagent" means "a liquid material containing water capable of supplying a source of phosphate anion, $(PO_4)^{3-}$, wherein water is a compound with the formula H_2O." Id. The differences in the parties' proposed definitions appear minor, centering only on whether the reagent is a "compound" or a "material."

The issue here is similar to whether the Markush group chemicals, addressed supra, are "compounds" or "materials." The specifications support the conclusion that a person of ordinary skill in the art would likely understand "aqueous phosphate reagent" to be a "compound" and not a "material." For example, the '123 patent's specification describes "products like phosphoric acid (phosphoric), pyrophosphates, triple super phosphates, trisodium phosphates, potassium phosphates, ammonium phosphates and/or *similar compounds* . . . ." ('123 patent, col. 5, ll. 11-14) (emphasis added). See also '123 patent, col. 20, ll. 3-7 (Example 6) ("The treatability studies are designed to optimize . . . the amount and concentration of phosphoric acid (*or other phosphate compound*) needed in step II . . . .") (emphasis added). Based upon these references, as well as the authorities cited under "Markush Group Chemical Terms," supra, the Court concludes that "aqueous phosphate reagent" is a "compound." The Court adopts the Government's proposed definition.

F. Analysis of Remaining Terms of the '608 Patent[8]

1. Material

The term "material" is at issue in Claims 1, 2, 12-18, 20-22 and 24 of the '608 patent. For example, Claim 1 provides for "[a] process for treating a material that contains leachable radioactive substances . . . ." ('608 patent, col. 34, ll. 42-43). The Government contends that "material" means "[d]ebris, soil, sludges, and solid materials containing leachable radioactive substances." (Mod. Joint Claim Const. Statement, '608 patent at 3). Sevenson states that "material" means "[c]omposed of or relating to physical substances; relating to matter." Id.

[8] The Court has addressed earlier the terms "mixture," "first mixture," "second mixture," and "treatment additive," and adopts the construction of those terms for purposes of this patent.

The patent defines the term "host material" in the specification, where it provides: "[T]he present invention relates to a chemical treatment process that reduces the leachability and solubility of radionuclides and radioactive substances contained in debris, soils, sludges, and solid materials ('the host material' or 'the host matrix')." ('608 patent, col. 4, ll. 30-34). The specification also describes the material as "consisting of, or containing, radionuclides and other radioactive substances." ('608 patent, col. 6, ll. 4-6). In the context of the patent, the term "material" is uniformly described as the substance to be treated in the patent's process, just as "host material" is treated elsewhere. Accordingly, the Court finds that "material" should have the same definition as "host material" does in other sections of the patents. Sevenson's proposed definition comes solely from a dictionary, and is not based upon any intrinsic evidence in the '608 patent. The Court will adopt the Government's proposed definition.

2. Concentration of Leachable Radioactive Substances

The term "concentration of leachable radioactive substances" is at issue in Claims 1, 15-17, and 20 of the '608 patent. For example, Claim 1 provides that "the concentration of leachable radioactive substances in said material so treated is decreased . . . ." ('608 patent, col. 34, ll. 50-51). The Government contends that "concentration of leachable radioactive substances" means "[t]he amount of picocuries per liter (pCi/l) in the TCLP extract of a sample." (Mod. Joint Claim Const. Statement, '608 patent at 6). Sevenson asserts that "concentration of leachable radioactive substances" means "[t]he amount of leachable picocuries in a mass or volume of material." Id.

The patent's claims do not suggest any definition for this term. The specification, however, is instructive. For instance, in Example 7, treated and control samples were extracted using the TCLP test method, and then tested for radioactivity. The example states that "[a]ll results presented below are in the units of picocuries per liter (pCi/l). ('608 patent, col. 24, ll. 33-34 (Example 7)). See also '608 patent, col. 25, ll. 7-8 (Example 7); col. 28, l. 18 (Table XV, Example 9); col. 29, l. 15 (Table XVI, Example 10) (reporting results in the units of picocuries per liter). In addition, Hawley's notes under the definition for "concentration" that "[f]or radioactivity, the concentration is usually expressed as milicuries per milliliter (mC/mL) or millicuries per millimol (mCi/nM)." Hawley's at 303.

The present term is similar to the term "concentration of leachable radionuclides and radioactive compounds" used in the '367 patent. Although the differences in the parties' proposed definitions again appear minor, the Court finds that the Government's proposed definition is true to the intrinsic evidence in the patent, and should be adopted. The Government's proposed definition provides a unit measure contained in the specification examples, and refers to the TCLP test method that would be used in the patented process. Sevenson's proposed definition is lacking these features.

3. Non-Leachable Solid Materials

The term "non-leachable solid materials" is at issue in Claims 1 and 20 of the '608 patent. For example, Claim 1 provides that "non-leachable solid materials are formed." ('608 patent, col. 34, ll. 51-52). Claim 20 contains identical language. Id. at col. 35, ll. 48-49. The Government contends that "non-leachable solid materials" means "[m]aterials of a definite volume and shape with a TCLP metal level below the regulatory threshold limit under the TCLP test criteria of the EPA." (Mod. Joint Claim Const. Statement, '608 patent at 7). Sevenson asserts that "non-leachable solid materials" means "[m]aterials having a definite volume and shape containing entities not removable by extraction fluids." Id.

The parties agree that "solid" means "having a definite volume and shape," but they disagree as to the meaning of "non-leachable." The claim language of the patent does not suggest any definition for this term. However, the "Summary of the Invention" section provides guidance. There, the patentee states that the purpose of the invention is "to render the metal substantially non-leachable, that is, to levels below the regulatory threshold limit under the TCLP test criteria of the USEPA." ('608 patent, col. 3, ll. 44-51). The Court finds that the definition of "non-leachable" should be tied to the purpose of the invention. The Government's proposed definition properly refers to the TCLP test criteria of the EPA. Therefore, the Court concludes that "non-leachable solid materials" means "materials of a definite volume and shape with a TCLP metal level below the regulatory threshold limit under the TCLP test criteria of the EPA." Sevenson's proposed definition does not refer to the intrinsic evidence found in the patent.

4. Water-Soluble Phosphate

The term "water-soluble phosphate" is at issue in Claim 7 of the '608 patent. Claim 7 provides: "wherein said phosphate compound is a water-soluble phosphate." ('608 patent, col. 34, ll. 64-65). The Government contends that "water-soluble phosphate" means "[a] phosphate compound capable of dissolving in water, wherein water is a compound with the chemical formula H_2O." (Mod. Joint Claim Const. Statement, '608 patent at 10). Sevenson states that "water-soluble phosphate" means "[a] phosphate capable of dissolving in water, wherein water is a compound with the chemical formula H_2O." Id. As with the Markush group chemicals addressed supra, the parties' only disagreement is whether "water-soluble phosphate is a "compound," as the Government contends, or simply a "phosphate," as Sevenson contends.

The patent's specifications support the conclusion that, to a person of ordinary skill in the art, "water-soluble phosphate" is a "compound," and not simply a "phosphate." The specification of the '608 patent describes "products like phosphoric acid (phosphoric), pyrophosphates, triple super phosphate, trisodium phosphates, potassium phosphates,

ammonium phosphates, and/or *similar compounds* . . . ." ('608 patent, col. 8, ll. 17-20) (emphasis added). See also '608 patent, col. 23, ll. 53-57 (Example 6) ("The treatability studies are designed to optimize . . . the amount and concentration of phosphoric acid (*or other phosphate compound*) needed in step II.") (emphasis added). Based upon these references, as well as the authorities cited under "Markush Group Chemical Terms," supra, the Court concludes that "water-soluble phosphate" is a "compound." The Court adopts the Government's proposed definition.

5. Dispersion Agent

The term "dispersion agent" is at issue in Claims 13 and 24 of the '608 patent. For example, Claim 13 provides that "wherein said process comprises an additional step of contacting said material with a dispersion agent." ('608 patent, col. 35, ll. 17-29). Claim 24 contains identical language. Id. at col. 36, ll. 1-3. The Government contends that "dispersion agent" means "[a] substance added to suspensions to separate the particles." (Mod. Joint Claim Const. Statement, '608 patent at 12). Sevenson contends that "dispersion agent" means "[a] material which facilitates the movement of one item within another." Id.

The terms "dispersion" and "dispersion agent" are used in the patents to provide examples where water, or another substance in place of water, can serve as a dispersion agent. See, e.g., '608 patent, col. 31, ll. 31-32 (Example 13), col. 6, ll. 11-13, and col. 7, ll. 63-65. However, the term "dispersion agent" is not defined in the patents or the prosecution histories. The Court therefore will look to dictionary evidence for assistance. See Vitronics, 90 F.3d at 1583. McGraw-Hill defines "disperser" as "material added to solid-in-liquid or liquid-in-liquid suspensions to separate the individual suspended particles." McGraw-Hill at 558. This definition is consistent with the Government's proposed definition, and is more precise than Sevenson's proposed definition. Accordingly, the Court concludes that "dispersion agent" means "a substance added to suspensions to separate the particles."

6. Aqueous Phosphate Compound

The term "aqueous phosphate compound" is at issue in Claim 28 of the '608 patent. Claim 28 provides that "wherein said second component is an aqueous phosphate compound." ('608 patent, col. 36, ll. 11-12). The Government contends that "aqueous phosphate compound" means "[a] phosphate compound made with water, wherein water is a compound with the chemical formula H_2O." (Mod. Joint Claim Const. Statement, '608 patent at 22). Sevenson asserts that "aqueous phosphate compound" means "[a] liquid material containing water comprising two or more elements or parts capable of supplying a source of phosphate anion, $(PO_4)^{3-}$, wherein water is a compound with the formula H_2O." Id.

As with the Markush group chemicals, addressed supra, the parties' only disagreement is whether "aqueous phosphate compound" is a "compound," as the Government contends, or a "material," as Sevenson contends.

The Court notes that the term itself is described as a "compound." The specifications support the conclusion that a person of ordinary skill in the art would likely understand "aqueous phosphate compound" to be a "compound," and not a "material." For example, the specification of the '608 patent describes "products like phosphoric acid (phosphoric), pyrophosphates, triple super phosphate, trisodium phosphates, potassium phosphates, ammonium phosphates, and/or *similar compounds* . . . ." ('608 patent, col. 8, ll. 17-20) (emphasis added). See also '608 patent, col. 23, ll. 53-57 (Example 6) ("The treatability studies are designed to optimize . . . the amount and concentration of phosphoric acid (*or other phosphate compound*) needed in step II . . . .") (emphasis added). Based upon these references, as well as the authorities cited under "Markush Group Chemical Terms," supra, the Court concludes that "aqueous phosphate compound" is a "compound." The Court adopts the Government's proposed definition.

G. Analysis of Remaining Terms in the '485 Patent[9]

1. Solution Form

The term "solution form" is at issue in Claims 1 and 15 of the '485 patent. For example, Claim 1 provides: "wherein said second component supplies at least one phosphate anion in solution form[.]" ('485 patent, col. 22, ll. 63-65). Claim 15 contains identical language. Id. at col. 23, ll. 28-29. The Government contends that "solution form" means "[a] homogeneous liquid mixture in which the components are uniformly distributed throughout the mixture." (Mod. Joint Claim Const. Statement, '485 patent at 11). Sevenson states that "solution form" means "[a] liquid containing dissolved materials." Id.

The parties agree that "solution form" refers to a liquid. While the term appears in the patent, and the patent provides examples of different phosphoric acid solutions, see, e.g., '485 patent, col. 7, ll. 52-65, col. 8, ll. 27-30, col. 8, ll. 46-48, and col. 11, ll. 16-17, "solution form" is not defined in the patents or the prosecution histories. The Court therefore will look to extrinsic evidence for assistance. See Vitronics, 90 F.3d at 1583. McGraw-Hill defines "solution" as "[a] single, homogeneous liquid . . . phase that is a mixture in which the components . . . are uniformly distributed throughout the mixture." McGraw-Hill at 1771. This definition is consistent with the Government's proposed definition, and is more precise

[9] The Court has addressed earlier the terms "lead-bearing material," "leachable lead," "treatment additive," "mixture," "aqueous phosphate reagent," and "second component," and adopts the construction of those terms for purposes of this patent.

than Sevenson's proposed definition. Accordingly, the Court concludes that "solution form" means "a homogeneous liquid mixture in which the components are uniformly distributed throughout the mixture."

2. One or More Reactive Sulfate Ion(s)

The term "one or more reactive sulfate ions" is at issue in Claims 22 and 30 of the '485 patent, and the term "sulfate ion" appears in Claim 17 of the '485 patent. Claim 22 provides, for example, "wherein said first component includes one or more reactive sulfate ions . . . ." ('485 patent, col. 24, ll. 19-20). The Government's proposed definition of "sulfate ion" is "[a] compound containing a sulfate ion, $(SO_4)^{2-}$." For "reactive sulfate ion," the Government contends that it means "[a] compound containing a reactive sulfate ion, $(SO_4)^{2-}$." (Mod. Joint Claim Const. Statement, '485 patent at 30). Sevenson contends that "one or more reactive sulfate ion(s)" means "[a]t least one sulfate ion, $(SO_4)^{2-}$, available for use in a reaction." Id.

The specification states that "sulfuric acid, or alum in liquid or powder form can also be used as *sources of sulfate ion* in certain solid wastes that contain sufficient calcium prior to treatment." ('485 patent, col. 6, ll. 54-57) (emphasis added). In addition, the specification states that "[a] first group of treatment chemicals for use in the processes of the present invention includes lime, gypsum, alum, halites, portland cement, and other similar products that can *supply sulfates*, halites, hydroxides, and/or silicates." ('485 patent, col. 4, ll. 46-49) (emphasis added). See also '485 patent, col. 6, ll. 24-27 ("[a] first group, 'group one', comprising a source of sulfate, hydroxide, chloride, fluoride, and/or silicates.").

In addition, the "Summary of the Invention" section of the '485 patent describes "mixing the solid waste with a *sulfate compound*, such as calcium sulfate dihydrate (gypsum powder) or sulfuric acid . . . ." ('485 patent, col. 3, ll. 4-6) (emphasis added). See also '485 patent, col. 22, ll. 40-42 (Example 6) ("The treatability studies are designed to optimize the amount and grade of gypsum powder (*or other sulfate compound*) needed during step I . . . .") (emphasis added). From these references, a person of ordinary skill in the art would likely understand the term "one or more reactive sulfate ions" to mean a compound, such as gypsum, alum, or portland cement, which is capable of supplying a sulfate ion.

Further, the claim language indicates that the sulfate ion must be reactive, which when viewed in the context of the patent as a whole, means that it must convert leachable metals into non-leachable form. The specifications also support this conclusion. Referring again to the "Summary of the Invention" section, the specification states that in the first step of the invention, the waste is mixed with a sulfate compound "having at least one sulfate ion for contacting waste particles and reacting with said leachable lead to produce a substantially insoluble lead composition." ('485 patent, col. 3, ll. 6-8). Likewise, the specification states

that "[t]he processes of the present invention provide reactions that convert leachable metals, especially lead, into a non-leachable form . . . ." ('485 patent, col. 3, ll. 56-58). To convert leachable metals into non-leachable form, more than a single molecule is required. Thus, when viewed in the context of the patent as a whole, a person of ordinary skill in the art would likely understand that "one or more reactive sulfate ion(s)" means "a compound containing a reactive sulfate ion, $(SO_4)^{2-}$." The Court adopts the Government's proposed definition.

3. Monobasic Calcium Phosphate

The term "monobasic calcium phosphate" is at issue in Claims 25, 29, and 33 of the '485 patent. For example, Claim 25 provides that "wherein said phosphate supplying reagent is phosphoric acid, trisodium phosphate, potassium phosphate, mono basic calcium phosphate, or dibasic calcium phosphate." ('485 patent, col. 24, ll. 37-40). The Government contends that "monobasic calcium phosphate" means "a compound with the chemical formula $CaH_4(PO_4)•H_2O$." (Mod. Joint Claim Const. Statement, '485 patent at 37). Sevenson states that "monobasic calcium phosphate" means "a material comprising $CaH_4(PO_4)•H_2O$." Id. As with the Markush group chemicals, addressed supra, the parties' only disagreement is whether "monobasic calcium phosphate" is a "compound," as the Government contends, or a "material," as Sevenson contends.

The specification for the '485 patent describes "products like phosphoric acid (phosphoric), pyrophosphates, triple super phosphate, trisodium phosphates, potassium phosphates, ammonium phosphates, and/or *similar compounds* . . . ." ('485 patent, col. 6, ll. 29-33) (emphasis added). See also '485 patent, col. 22, ll. 40-44 (Example 6) ("The treatability studies are designed to optimize . . . the amount and concentration of phosphoric acid (*or their phosphate compound*) needed in step II . . . .") (emphasis added). Based upon these references, as well as the authorities cited under "Markush Group Chemical Terms," supra, the Court concludes that "monobasic calcium phosphate" is a "compound." The Court adopts the Government's proposed definition.

4. Dibasic Calcium Phosphate

The term "dibasic calcium phosphate" is at issue in Claims 25, 29, and 33 of the '485 patent. For example, Claim 25 provides that "wherein said phosphate supplying reagent is phosphoric acid, trisodium phosphate, potassium phosphate, mono basic calcium phosphate, or dibasic calcium phosphate." ('485 patent, col. 24, ll. 37-40). The Government contends that "dibasic calcium phosphate" means "a compound with the chemical formula $CaHPO_4•2H_2O$." (Mod. Joint Claim Const. Statement, '485 patent at 37). Sevenson states that "dibasic calcium phosphate" means "a material comprising $CaHPO_4•2H_2O$." Id. As with the Markush group chemicals, addressed supra, the parties' only disagreement is

whether "dibasic calcium phosphate" is a "compound," as the Government contends, or a "material," as Sevenson contends.

The specification for the '485 patent describes "products like phosphoric acid (phosphoric), pyrophosphates, triple super phosphate, trisodium phosphates, potassium phosphates, ammonium phosphates, and/or *similar compounds*." ('485 patent, col. 6, ll. 29-33) (emphasis added). See also '485 patent, col. 22, ll. 40-44 (Example 6) ("The treatability studies are designed to optimize . . . the amount and concentration of phosphoric acid (*or other phosphate compound*) needed in step II.") (emphasis added). Based upon these references, as well as the authorities cited under "Markush Group Chemical Terms," supra, the Court concludes that "dibasic calcium phosphate" is a "compound." The Court adopts the Government's proposed definition.

5. Combination

The term "combination" is at issue in Claims 28 and 30 of the '485 patent. Claim 28 provides for "a combination of sulfuric acid and a phosphate supplying reagent[.]" ('485 patent, col. 24, ll. 51-52). Claim 30 provides for contacting soils or solid waste materials "with a combination of a sulfate reagent which includes one or more reactive sulfate ions and a phosphate supplying reagent[.]" Id. at col 24, l. 67 to col. 25, l. 2. The Government contends that "combination" means "sulfuric acid plus phosphate supplying reagent, mixed together." (Mod. Joint Claim Const. Statement, '485 patent at 41). Sevenson states that "combination" means "a result or product of bringing two or more entities into close relationship." Id.

The language of Claims 28 and 30 is not identical, and the Government's proposed definition accounts only for the language in Claim 28. The Government does not account for the slightly different language in Claim 30. The Court concludes that Sevenson's definition of "combination," "a result or product of bringing two or more entities into close relationship," is the most reasonable under the circumstances because it can be applied to both claims at issue. The Government's proposed definition of "combination" does not accomplish this objective.

6. Sulfate Reagent

The term "sulfate reagent" is at issue in Claims 30, 31, and 34-36 of the '485 patent. For example, Claim 30 provides for contacting soils or solid waste materials with "a sulfate reagent which includes one or more reactive ions." ('485 patent, col. 24, ll. 66-67 to col. 25, l. 1). The Government contends that "sulfate reagent" means "a separate and distinct compound capable of supplying a sulfate ion, $(SO_4)^{2-}$, that participates in a chemical reaction." (Mod. Joint Claim Const. Statement, '485 patent at 45). Sevenson asserts that

"sulfate reagent" means "a material capable of supplying a source of sulfate ion(s) $(SO_4)^{2-}$." Id. The parties disagree on whether "sulfate reagent" is a "separate and distinct compound," as the Government contends, or a "material," as Sevenson contends.

The claim language itself does not specifically indicate whether the sulfate reagent is "a separate and distinct compound" or "a material." However, the specification, including the drawings, provide the necessary guidance. For example, the "Summary of Invention" section of the specifications indicates that "[a] *first group of treatment chemicals* for use in the processes of the present invention includes lime, gypsum, alum, halites, portland cement, and other similar products that can supply sulfates, halites, hydroxides, and/or silicates." ('485 patent, ll. 46-49) (emphasis added). In addition, the same section describes "mixing the solid waste with a *sulfate compound*, such as calcium sulfate dihydrate (gypsum powder) or sulfuric acid." ('485 patent, col. 3, ll. 4-6) (emphasis added). Similarly, the "Description of the Preferred Embodiment" section of the specification states that "*[a] first group, 'group one,'* comprises a source of sulfate, hydroxide, chloride, fluoride, and/or silicates." ('485 patent, col. 6, ll. 24-25) (emphasis added); see also '485 patent, col. 22, ll. 40-44) (Example 6) ("The treatability studies are designed to optimize the amount and grade of gypsum powder (*or other sulfate compound*) needed during step 1.") (emphasis added). The references in the specifications to "a first group" and "group one" treatment chemicals are in contrast to the references throughout the specifications to "a second group" and "group two" treatment chemicals. See, e.g., '485 patent, col. 4, ll. 50-55, col. 6, ll. 28-34. The repeated contrast between groups one and two in these patents signifies the "separate and distinct" nature of all of the chemical components, including the sulfate reagent. As noted, the specifications also indicate that each Markush group member is a "compound."

The drawings accompanying the patent show separate and distinct groups of treatment chemicals. See Fig. 1, 2a, 2b, supra. Where a visual representation is used to "flesh out words," the drawings are an important part of the specification to consider when performing claim construction analysis. See Autogiro, 181 Ct. Cl. at 60, 384 F.2d at 395-96. Consistent with the language in the specifications, the drawings depict the "group one" and "group two" treatment chemicals as separate and distinct compounds that participate in the patented method. See Fig. 1, 2a, and 2b, supra.

Finally, Sevenson's proposed definition incorporates the word "material," which is used in each of the five patents at issue to refer to the material being treated by the patented process. Therefore, Sevenson's proposed definition would introduce some confusion and uncertainty into the claim construction analysis of these patents. Based upon all of the intrinsic evidence, the Court finds that "sulfate reagent" means "a separate and distinct compound capable of supplying a sulfate ion, $(SO_4)^{2-}$, that participates in a chemical reaction." This construction is true to the claim language and most naturally aligns with the patent's description of the invention.

Conclusion

The Court has interpreted in this Opinion and Order the disputed terms of the '982, '367, '123, '608, and '485 patents. Counsel for the parties are requested to submit a joint status report to the Court on or before April 12, 2007 providing a proposed schedule for further proceedings.

IT IS SO ORDERED.

s/Thomas C. Wheeler
THOMAS C. WHEELER
Judge