

CHAPTER 8

Other Issues

8-1. Introduction

Administrative items that warrant consideration in IAS include legal and regulatory, patent, and safety issues. These three issues are discussed herein. A working knowledge of legal and regulatory requirements associated with constructing and operating IAS systems is critical to ensure compliance with federal, state, and local requirements. Secondly, patents related to IAS have been issued, which may affect the use of certain aspects of IAS. Thirdly, because IAS systems require working with compressed gases and may involve discharging subsurface vapors, strict adherence to health and safety protocols is required.

8-2. Legal and Regulatory Issues

a. During the design process, it should be determined if there are any Federal, state or local standards, criteria, or requirements, including procedural or permitting requirements, that must be incorporated into the project. Normally, for projects conducted under CERCLA, and for projects on Federal property, permitting or other procedural requirements will not be applicable to work at or near the site; however, the substantive elements of the laws relating to any permits may need to be incorporated into the design. For the construction phase of the work, standard government contract clauses will require the contractor to obtain any construction related permits or approvals that are legally required. The Office of Counsel should be consulted to advise on any applicable requirements if there are questions or in the event of any disputes.

b. Other construction-related requirements include management and disposal of investigation-derived wastes (IDW) generated during construction and implementation. Federal laws and regulations under RCRA, CERCLA, and TSCA may apply, as well as state laws and regulations pertaining to local solid and hazardous waste receiving facilities.

c. Many states require drilling permits for well (and sometimes sample point) installations, and also written authorization or permits for air and groundwater discharge. It is critical that the discharge criteria be thoroughly researched during the conceptual design phase of a pilot- or full-scale IAS system. Specific construction requirements, such as the height of vent wells, may need to be heeded. Additionally, discharge requirements including sampling parameters and frequency must be considered. Treatment with vapor-phase granular activated carbon (GAC) for off-gas or liquid-phase GAC for groundwater, may be required to comply with discharge criteria. Alternately, a modified implementation plan, such as lowering the airflow rate, or shortening the duration of pilot tests, could eliminate the need for treatment. There may be standards, limitations, or coordination requirements arising under the *Clean Air Act* that may affect the emissions allowed from a system. If the work is conducted on a Federal installation,

the local installation environmental coordinator should be consulted to determine if the installation has any sort of permits or limitations regarding air emissions.

d. Proper procedures must be developed or documented for handling potentially hazardous materials required on site during IAS implementation. Materials required on site may include compressed gas cylinders, radioactive sources for neutron logging, and decontamination fluids such as methanol and nitric acid. USDOT shipping laws and regulations may apply for packaging and transport, and USEPA laws and regulations may apply to the management and disposal of spent materials. The site-specific situation must be evaluated to determine what, if any, requirements apply to the handling of materials, especially waste, during and at the completion of the project.

e. In addition to Federal, state, and local laws and regulations, relevant USACE guidance is available. Although USACE has not published specific air sparging guidance prior to this EM, EM-1110-1-4001 provides information covering many relevant topics that also apply to IAS.

8-3. Patent Issues

There are several patents that have been issued relative to technologies discussed in this EM. Readers are advised to consider the ramifications of these patents on their site activities. A first step toward this end is facilitated by a review of the summary of air sparging patents that follows. If closer scrutiny is required, a copy of the patent can be obtained promptly from the U.S. Patent and Trademark Office by mail for a minimal charge by calling (703) 305-4350, or from the U.S. Patent and Trademark Office web site*. **Contact Office of Counsel for further guidance on addressing this issue.** The following list of patents with associated summary descriptions is not intended to represent a complete patent search. It is organized from the most complex and encompassing patents to the straightforward single process- and media-specific categories that can generally be quickly evaluated. The SVVS[®] patents are discussed first and in considerably more detail, as many air sparging applications will either narrowly miss infringing on the patents or may require appropriate licensing for use of the technology. Note that the validity of any of the described patents has not been determined. The United States has authority to make use of any patented item or process in the course of any project, and cannot be refused use or enjoined from use of any patented item or process. Under the procedures of Title 28 United States Code 1498, a Federal agency may be required to pay reasonable compensation for the use of any patented item or process. This is normally done by negotiation or determination of a reasonable fee to obtain the right to use the patented item or process under a license agreement. Government contract clauses are prescribed for use in various types of contracts that may require the contractor to obtain any applicable licenses, and may in some cases require the contractor to indemnify the government in the event of a claim for compensation from a patent or license

* <http://www.uspto.gov>

holder. The Office of Counsel should be notified in the event of any questions or disputes related to patents.

a. Billings and Associates, Inc. Subsurface Volatilization and Ventilation System (SVVS)[®] (# 5,221,159; # 5,277,518; # 5,472,294). The SVVS[®] process is an integrated, in-situ technology that utilizes the benefits of air sparging, soil vapor extraction, and bioremediation to treat subsurface organic contamination in soil and groundwater. The patents' abstracts define the process.

At least one injection well is drilled through the vadose zone to a depth below the water table defining the upper boundary of the aquifer. One or more extraction wells are established to a depth above the water table. Oxygenated gas is injected under pressure through the injection well(s) while a vacuum is applied to the extraction well(s). Contaminants are removed from the groundwater aquifer and from the vadose zone by a combination of physical, chemical, and biochemical processes. Additional specifications address simultaneous free product recovery, nutrient addition, and natural microbe fermenting and reintroduction.*

Recall, we have stipulated: “*Air Sparging* shall be defined to be the introduction of air, or other gases, in the saturated zone to remove contaminants by volatilization or bioremediation or to immobilize contaminants through chemical changes.” Thus, some of the physical steps for most IAS systems will necessarily be similar or identical to those specified for SVVS[®] implementation. The patents provide additional detail and insights about the SVVS[®] process, as follows:

This invention is an integrated delivery system to effectuate the advantageous characteristics of, primarily, bioremediation. This is because bioremediation causes 70% to 80% of the remediation success on a hydrocarbon contaminated site. For cost reasons, a delivery system must be capable of injecting air or other vapors capable of supplying oxygen for the enhanced bioremediation as well as nutrients for enhanced bioremediation. The same physical delivery system for injected air is used to gain the advantage of air stripping aspects of remediation. However, injection of air leads to relatively uncontrolled distribution of vapors moving up from below the water table through the vadose zone and possibly to exit points that were unsatisfactory to the populations living above the pollution. Therefore, a vacuum portion of the system controls the distribution of the vapor phase. The purpose is not primarily to remove volatiles by vacuum, but to control the entire vapor movement system containing portions of contamination and biological byproducts....†

The first SVVS[®] patent infringement case was settled in Federal District Court in 1994 with an Order of Dismissal that stipulated infringement. Several other environmental industry leaders and others have apparently concluded that their methods of employing air sparging do not infringe on SVVS[®] patents. Again, users are advised to consult the Office of Counsel for specific patent guidance. SVVS[®] license information is available from Mr. Jeffery Billings, Environmental Improvement Technologies, Inc., 12415 North 68th Place, Scottsdale, AZ 85254, (602) 596-0426.

b. 21st Century Environmental Remediation Technology Corporation; BioSparge (# 5,246,309). This is a closed-loop, in-situ system of gas injection wells combined with sur-

*United States Patents 5,277,518, 5,277,518, 5,472,294 Abstracts.

†United States Patent 5,277,518 page 13.

rounding low flow vapor extraction wells and a mobile surface treatment unit to provide injection, enhanced bioremediation, VOC capture and stripping without gas venting or emissions or groundwater withdrawal. Gas injection can be designed for heated and oxygenated gas to provide oxidation, volatilization, and nutrient addition (if necessary) to enhance bioremediation. License information is available from Mr. Robert V. Murton, 21st Century Environmental Remediation Technology Corporation, 6380 South Eastern Ave., Suite # 8, Las Vegas, NV 89119, (702) 798-1857.

c. Department of Energy; Two Sets of Horizontal Wells (# 4,832,122). This is an in-situ system for removing VOCs from a subsurface plume by injecting a fluid through a horizontal well into the saturated zone on one side of the contamination and collecting the fluid together with volatilized contaminants through a horizontal extraction well on the other side of the plume. The fluid may be air or other gas or a gas and liquid mixture. Though this patent includes the use of horizontal wells, it does describe the general concept of air sparging and pre-dates other air-sparging patents. This and other DOE patents may represent a strong basis for conducting air sparging on U.S. Government projects. Again, consult with Office of Counsel.

d. IEG™ Technologies Corporation; UVB (# 5,116,163). The Unterdruck-Verdampfer-Brunnen (UVB) is an in-situ technology to remove VOCs from groundwater through a single well with two hydraulically separated screened intervals installed within a single permeable zone. A blower creates a vacuum that simultaneously draws water into the well at the lower screened portion (to be discharged at the upper screen creating a circulation pattern) and ambient air through an inner pipe discharged at the base of the wellbore, causing air bubbles to form that air strip VOCs as they rise through the water column. License information is available from Dr. Eric Klingel, IEG Technologies Corporation, 5015D West W.T. Harris Boulevard, Charlotte, NC 28269, (704) 599-4818.

e. EG&G Environmental. NoVOCs™ In-Well Stripping Groundwater Remediation Technology (# 5,180,503, # 5,389,267). This system, very similar to UVB, is an in-situ technology to remove VOCs from groundwater through a single well with two hydraulically separated screened intervals installed within a single permeable zone. Pressurized air is injected into the well below the static water table, aerating water within the well. The aerated water is less dense than water outside the well, creating a pressure gradient that draws water into the well through the lower screen. The VOCs volatilize into bubbles that encounter a packer where the VOCs in vapor form are released and removed with a vacuum blower for above-ground treatment. Air-lifted water within the well is usually discharged from the upper screen above the static water table to flush the capillary fringe. License information is available from Mr. Wayne J. DiBartola, EG&G Environmental, Foster Plaza 6, Suite 400, 881 Andersen Drive, Pittsburgh, PA 15220, (412) 920-5401.

f. Wasatch Environmental, Inc.; Density-Driven Convection (# 5,425,598). This system, also very similar to UVB, is an in-situ technology to remove VOCs from groundwater through a single well with two hydraulically separated screened intervals installed within a single perme-

able zone. Water inside the wellbore is aerated directly by injecting air at the base of the wellbore, which causes air bubbles to form, which air-strip VOCs as they rise through the water column and push aerated water upward through the wellbore and out the upper screened interval, simultaneously drawing water from the contaminated area around the lower screened interval. License information is available from Mr. Leslie H. Pennington, Wasatch Environmental, Inc., 2240 West California Ave., Salt Lake City, UT 84104, (801) 972-8400.

g. *Department of Energy; Chlorinated Hydrocarbon Bioremediation (# 5,384,048)*. This is an in-situ system for the bioremediation of chlorinated hydrocarbons in soil and groundwater by injection of a nutrient fluid and an oxygenated fluid with extraction so that both are drawn across the contaminated plume. The successful demonstration and patent utilize methane as the nutrient fluid and air as the oxygenated fluid. License information is available from Mr. Robert Marchick, Assistant General Counsel for Patents, U.S. Department of Energy, Washington, D.C. 20585, (202) 586-4792.

h. *Department of Energy; Phosphate-Accelerated Bioremediation (# 5,480,549)*. This is a system for delivering vapor-phase nutrients, particularly triethyl or tributyl phosphate, to contaminated soil and groundwater to enhance in-situ bioremediation of contaminants. License information is available from Mr. Robert Marchick, Assistant General Counsel for Patents, U.S. Department of Energy, Washington, D.C. 20585, (202) 586-4792.

i. *Integrated Environmental Solutions, Inc. Rapid Purging (# 5,509,760)*. This is a decontamination method that claims to put maximum remediation stress on a contaminated area of soil and groundwater, using positive pressure to push an uncontaminated gas throughout the contaminated area/volume and strip contaminants from it, and relying on a close spacing of air entry points.

j. *Matrix Environmental Technologies; Oxygen Sparging (#5,874,001)*. This is a method and apparatus for in-situ removal of biodegradable contaminants from groundwater or soil or both by injecting oxygen gas into groundwater containing a biodegradable contaminant in a volume low enough to avoid migration or volatilization of the contaminant but high enough to enhance the rate of biodegradation of the contaminant.

8-4. Safety

The users of this EM shall refer to and comply with all applicable Federal regulations (OSHA) and USACE regulations including ER 385-1-92 in addressing all safety and health concerns, during all phases of IAS development, including pre-design investigations, design, construction, and operation and maintenance. Specifically, the designers shall comply with the requirements of ER 385-1-92 when developing the Health and Safety Design Analysis, which is subsequently used to draft Safety, Health and Emergency Response contract specifications for IAS construction based on UFGS 01351.

