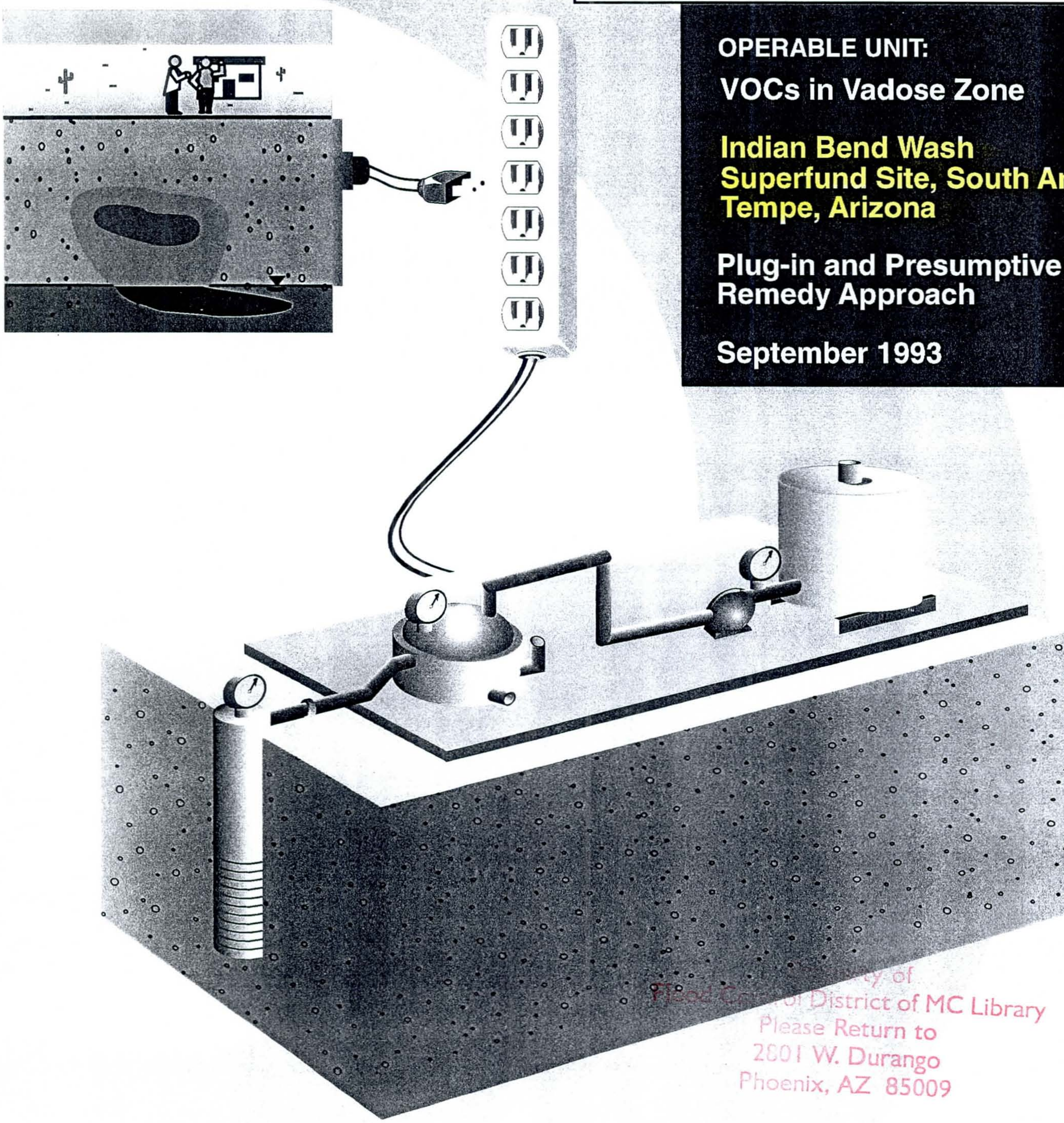
DICK PERREAULT

EPA

United States
Environmental
Protection
Agency

RECORD OF DECISION

Volume 1
Declaration, Decision Summary, Response Summary



OPERABLE UNIT:

VOCs in Vadose Zone

Indian Bend Wash Superfund Site, South Area Tempe, Arizona

Plug-in and Presumptive Remedy Approach

September 1993

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, Ca. 94105-3901

October 7, 1993

Mr. Dick Perreault
Flood Control District of Maricopa County
Land Management Division
3335 W. Durango
Phoenix, Arizona 85009

RE: Record of Decision ("ROD")
Operable Unit: VOC-in-Vadose Zone
Indian Bend Wash Superfund Site, South Area ("IBW-South")

Dear Mr. Perreault:

EPA is pleased to provide one black and white copy of the subject ROD, which was signed September 27, 1993. This documents selects EPA's remedy for VOCs in soils at individual subsites within IBW-South. The remedy uses soil vapor extraction technology, and the "Plug-in" and "Presumptive Remedy" approaches. As you are aware, EPA held public comment on this remedy June 14 - August 14, 1993, and held a public meeting in Tempe on July 7, 1993. The Administrative Record (including the ROD) can be found on microfilm at the Tempe and Scottsdale Public Libraries. In addition, these two libraries *and* the Phoenix Public Library each have a printed copy of the ROD.

This ROD contains color graphics. Official copies in the information repositories and in EPA's files are color copies; nonetheless, black-and-white copies are usable facsimiles.

Members of the public may request copies from EPA by sending a Freedom of Information Act (FOIA) request to Sharon Jang, Mail Code E-2, at the above address. The requester should indicate whether a color or black-and-white copy is desired. *Commercial* FOIA charges are *approximately* as follows: $100 for color copies, $30 for black-and-white copies. FOIA charges can be waived for certain requesters, in accordance with 40 C.F.R. §2.120.

Please inform me if your agency requires additional copies. If you have any questions pertaining to the ROD, do not hesitate to call me at (415) 744-2363.

Sincerely,

Jeffrey A. Dhont
Remedial Project Manager
Superfund Enforcement Branch

Printed on Recycled Paper

United States Environmental Protection Agency

RECORD OF DECISION

OPERABLE UNIT:

VOCs in Vadose Zone
Indian Bend Wash Superfund Site, South Area
Tempe, Arizona

Plug-in and Presumptive Remedy Approach

U.S. Environmental Protection Agency
Region IX
75 Hawthorne Street
San Francisco, California 94105

Volume 1 of 2

Declaration
Decision Summary
Response Summary

September 1993

CONTENTS–Volume 1 of 2

CONTENTS–Volume 1 of 2 (Continued)

CONTENTS–Volume 1 of 2 (Continued)

CONTENTS–Volume 1 of 2 (Continued)

CONTENTS–Volume 1 of 2 (Continued)

CONTENTS–Volume 1 of 2 (Continued)

I. DECLARATION

I. DECLARATION

1. Site Name and Location

This Record of Decision (ROD) is for the Indian Bend Wash Superfund Site, South Area. The Indian Bend Wash Superfund Site (IBW) is located in the cities of Scottsdale and Tempe, Maricopa County, Arizona, and includes a portion of the Salt River Pima-Maricopa Indian Community immediately east of Scottsdale and north of Tempe.

2. Statement of Basis and Purpose

This ROD presents the selected remedial action for volatile organic compounds (VOCs) in soils above the water table (the "vadose zone") at the Indian Bend Wash Superfund Site, South Area (IBW–South). VOCs in the vadose zone are an operable unit of IBW–South. The remedy is known as the "VOCs-in-Vadose-Zone Remedy." This ROD selects a remedy which includes both a remedial technology and a specialized process governing its application. The VOCs-in-Vadose-Zone Operable Unit remedy will be consistent with all other remedies to be selected for IBW–South. This document also identifies applicable or relevant and appropriate requirements (ARARs) and other criteria and requirements with which this remedy shall comply. EPA has chosen this VOCs-in-Vadose-Zone Remedy for IBW–South in accordance with the Comprehensive Environmental Response, Compensation and Liability Act, 42 U.S.C. §9601 et seq. as amended by the Superfund Amendments and Reauthorization Act of 1986, P.L. 99-499, 100 Stat. 1613 (1986) (CERCLA) and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan, 40 C.F.R. Part 300 (NCP). Data at IBW–South have been collected and analyzed in accordance with EPA-approved sampling and quality assurance plans. EPA considers site data to be of adequate quality to support the selection of the remedy presented in this ROD. The decision in this ROD is based on the Administrative Record for the VOCs-in-Vadose-Zone Remedy for IBW–South, the index for which is included as Volume 2 of this document.

The State of Arizona, acting by and through its Department of Environmental Quality, concurs with the remedy selected in this document.

3. Assessment of the Site

Releases of VOCs, common industrial solvents such as trichloroethylene (TCE), perchloroethylene (PCE), and 1,1,1-trichloroethane (1,1,1-TCA), from several individual facilities have contaminated the vadose zone and the groundwater at IBW–South. Actual or threatened releases from this site, if not addressed by implementing the response actions selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment.

4. Statement on Use of Innovative Approaches

IBW–South is complex and contains many subsites within the site. Based on the special circumstances presented by IBW–South, EPA has determined that the use of two innovative approaches to administering the site will greatly enhance the efficiency and effectiveness of this remedy. These are the "Presumptive Remedy" and the "Plug-in Approach."

The Presumptive Remedy allows EPA to presume that a remedial technology is appropriate in cases where voluminous treatability data indicate that it will be effective. Multiple alternatives are not evaluated specifically for this remedy, based on previous application of the same remedial technology in other similar situations.

The Plug-in Approach allows multiple, similar, but separate subsites (facilities or areas within the larger site) to make use of the same remedy at different times. Under this approach, EPA selects a standard remedy that applies to a given set of conditions rather than to a specific subsite. At the same time, EPA selects a process and set of criteria for determining where those conditions exist. Subsites are then fully characterized, at varying times, *after* the ROD. Based on the process pre-established by the ROD, EPA then makes subsite-specific determinations to "plug in" subsites to the remedy. The approach provides flexibility to address unforeseen circumstances, while allowing EPA to address the majority of similar subsites without re-selecting the same remedy at each one.

EPA believes these approaches are consistent with CERCLA, the NCP, and the mandate to protect human health and the environment.

5. Description of the Selected Remedy

IBW–South contains multiple, distinct facilities that are releasing or have released VOCs into soils. The releases from specific facilities (or small clusters of facilities) result in many contiguous zones of soil contamination (subsites) separated by large gaps of uncontaminated soils. Some of the released VOCs have passed through soils and have contaminated groundwater. Other released VOCs are still in the vadose zone (the soils above the water table) and can be sources of contamination to groundwater or ambient air in the future. The purpose of this remedy is to control and remove future sources of groundwater and air contamination by cleaning the vadose zone of VOCs at the multiple subsites where they have been released. This action will minimize the extent and expense of groundwater cleanup that may be necessary for IBW–South. This remedy does <u>not</u> address VOC contamination that has already reached the groundwater.

Based on site data and previous knowledge of SVE and this type of contamination, EPA has determined that **Soil Vapor Extraction** will be effective in removing VOCs from soils of the type found at IBW–South and at facilities with characteristics seen to date. Significant pre-existing treatability data support this conclusion, including data from IBW–North, the other study area of IBW. EPA has therefore selected Soil Vapor Extraction (SVE) as a **Presumptive Remedy**. Remedial alternatives other than SVE and No Action have not been evaluated. SVE, with air emissions treatment, will be applied to the soils at all subsites determined to have unacceptable levels of VOCs in the soils above the water table.

As stated in the last section, rather than study and select the same remedy multiple times at each facility, this remedy uses the **Plug-in Approach**. The remedy includes both the SVE technology and a process for determining at which subsites it must be applied. This process includes methods for confirming that a subsite has conditions amenable to SVE, and also for determining whether a subsite poses an unacceptable health risk. Subsites that have completed RI work need not wait for all the other subsites to complete RI work.

This remedy provides for several options for emission controls and efficiency enhancements to SVE, which can be selected as appropriate as each subsite plugs in to the remedy.

6. Statutory Determinations

The selected remedy for VOCs-in-Vadose-Zone at IBW–South:

- Is protective of human health and the environment for the VOCs-in-Vadose-Zone soils covered by this operable unit
- Complies with federal and state requirements that are legally applicable or relevant and appropriate to the remedial action
- Is cost-effective
- Utilizes permanent solutions and alternative treatment or resource recovery technologies to the maximum extent practicable
- Satisfies the statutory preference for remedies that employ treatment that reduces the toxicity, mobility, or volume of contaminants as a principal element

The remedy for this operable unit and other operable units at IBW–South will allow for unlimited use and unrestricted exposure at the completion of all remedial actions. Accordingly, the remedy is not subject to a statutory 5-year review. However, this is a long-term remedial action because complete cleanup will likely take more than five years to attain. Accordingly, by policy, EPA shall perform a review not less than every five years after the completion of the construction for all remedial actions at the site, and shall continue such reviews until EPA determines that hazardous substances have been reduced to levels protective of human health and the environment.

A remedial investigation/feasibility study is underway for the groundwater and a decision as to whether further remedial action is necessary will be made upon its completion. EPA will revisit the 5-year review status of the site when the groundwater remedy is selected, as necessary.

John C. Wise 9.27.93

John C. Wise
Acting Regional Administrator
EPA Region IX

Date

minimum temperature is 55°F. However, summer maximum temperatures routinely exceed 100 degrees, and occasionally exceed 110 degrees. The long-term average winds are from the west at 6 miles per hour. Precipitation averages 7 inches of rain per year, more than two-thirds of which falls in the summer and the winter. Winter rains are more gentle and of longer duration than summer rains, which usually occur as short, intense, localized thunderstorms. Pan evaporation, measured at the nearby Mesa Experimental Farm, averaged 108.66 inches per year between 1972 and 1986.

1.4. Topography

The surface topography of IBW–South is generally flat. The IBW–South area is broken by buttes of rock and surrounded by mountains at the edges of the valley. The surface ranges from 1,150 to 1,200 feet above mean sea level. Slopes generally do not exceed about 2 percent. Slopes of over 100 percent exist only at the banks of the Salt River.

1.5. Surface Water and Groundwater

The Salt River is the major surface-water body within IBW–South. The Salt River flows only about 10 percent of the time, but its flow is unpredictable in any given year. About 90 percent of the time the Salt River bed is dry within IBW–South. This is because of the impoundment of water far upstream from IBW–South. The Indian Bend Wash, a desert wash that has been converted to a series of urban ponds linked by channels, meets the Salt River at the northern boundary of the IBW–South study area.

There are four main aquifers under IBW–South: the upper, middle, and lower alluvial units, and a formation called the "red unit." The alluvial units are mainly alluvial deposits laid down by riverine action. Groundwater can usually be found at about 100 feet below land surface (bls), although during heavy and sustained river flow the water table has been observed to rise to about 55 feet bls. The bottom of the alluvial material in some areas of IBW-South is known to exceed 850 feet bls and may extend to more than 1,000 feet bls. There is a definitive geologic connection among aquifers. The three alluvial units represent an important aquifer resource to the people of Arizona, and wells within the IBW–South boundary likely would be used again if contamination were removed. More detail on surface water and groundwater characteristics is provided in Section 6, Summary of Site Characteristics.

1.6. Contaminants of Concern and Types of Sources

The contaminants of concern found in the affected wells in 1981 were volatile organic compounds, or VOCs. These remain the primary contaminants of concern today. VOCs are a type of solvent used by a variety of industries, especially electronics and circuitry manufacturing, to degrease and clean parts. They are also used heavily in dry cleaning.

IBW–South contains a number of separate industrial and business properties that have released contaminants into soils. These releases have occurred by a variety of modes: discharge of solvents or wastewater containing solvents through dry wells or into leach systems, direct discharge at land surface, leaking tanks or pipes, spills, and other means. VOC contamination has moved downward through the soils above the water table and reached groundwater. Once in the groundwater, it has spread away from its sources as the groundwater moves, and apparently has become a regional problem. In limited circumstances, VOCs in the soil may also move upward and reach the ambient air, although EPA has not observed such migration to date.

Primary VOCs of interest at IBW–South are trichloroethylene (TCE), 1,1,1-trichloroethane (1,1,1-TCA), 1,1- and 1,2-dichloroethylene (DCE), and tetrachloroethylene (perchloroethylene, or PCE). EPA also is monitoring for vinyl chloride, which is a breakdown product of the above compounds, and an array of non-VOC compounds.

The Salt River banks have been heavily mined and subsequently filled with landfill materials. Most of these materials are inert debris and municipal solid waste. EPA has identified some VOCs in landfill gas, however. The stabilization of the banks and the landfills, and flood protection remain of concern to local agencies.

EPA is also concerned about and is monitoring for heavy metals contamination, such as chromium or lead. These have not been detected at elevated levels in IBW-South groundwater, but the soils at some properties do contain metals, mostly from plating rinsate wastes, and some of the landfills at IBW–South have received metal foundry dusts. This ROD selects a remedy for VOC contaminants only, but EPA will continue to monitor metals contamination.

1.7. History of EPA Involvement

As EPA began its IBW investigation, the highest levels of VOC contamination were found in Scottsdale, and EPA initially focused resources there. EPA discovered that a facility owned by Motorola Government Electronics Group was a major source of this contamination. Subsequently, facilities owned by Seimens Corporation, Beckman Instruments, and other responsible parties also were identified as sources of the groundwater contamination in Scottsdale. EPA issued enforcement actions against these parties requiring characterization of the groundwater and soils over a wide area.

At the end of 1987, EPA informally split the overall IBW study area into two study areas for more efficient management. The two areas are called Indian Bend Wash North (IBW-North) and Indian Bend Wash South (IBW-South). This divided the original rectangular IBW study area just north of the Salt River. Figure II-3 shows the structure of the IBW project.

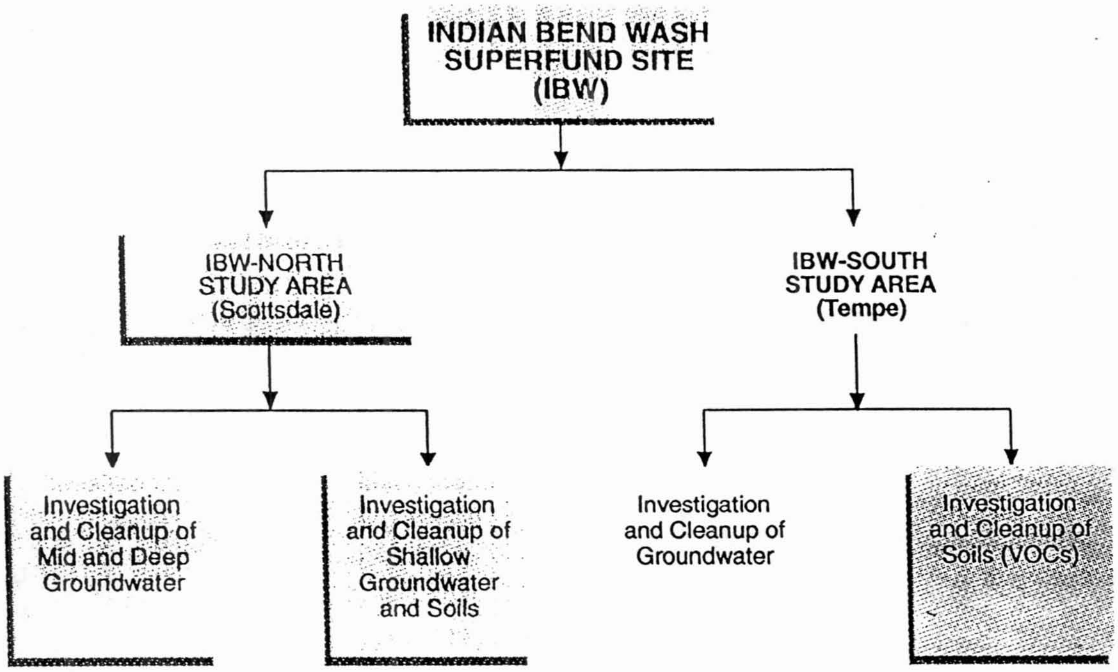


FIGURE II-3
STRUCTURE OF
IBW PROJECT

A partial remedy, called the "Scottsdale Operable Unit" has been selected for IBW–North. This remedy addressed the intermediate and deep groundwater of IBW–North only. The ROD for the Scottsdale Operable Unit was signed in September 1988 and called for pumping and treating the groundwater. EPA and responsible parties entered into a consent decree on April 28, 1992, to implement the remedial design and action for the Scottsdale Operable Unit. This decree called for the City of Scottsdale to accept the water after it had been fully treated to below health-based levels. In September 1991, EPA signed another IBW-North ROD that addressed the shallow groundwater and the VOCs in IBW–North soils. The soils remedy selected for IBW–North was soil vapor extraction (SVE). A consent decree to implement this remedy was entered with the Federal District Court on August 11, 1993.

EPA began turning more resources to investigating IBW–South in 1988. Available groundwater VOC concentrations were much lower in IBW–South, but these were still above drinking water standards. Insufficient data existed to determine the maximum contaminant concentrations in the study area.

Tempe currently receives its drinking water from the Salt River Project and not from wells within the IBW–South study area. Therefore, EPA does not believe that the public is currently exposed to the contaminated groundwater at IBW–South. EPA's primary focus is to protect the groundwater resource and to ensure that the contamination does not spread to drinking water wells outside IBW–South, which could threaten public health in the future. Those persons with concerns about possible past exposure to contaminated water should contact the Agency for Toxic Substances and Disease Registry (ATSDR); contacts are Bill Nelson and Gwen Eng, who can be reached at 415/744-2194 and 415/744-2193, respectively. ATSDR has staff available to answer health questions and in some cases may decide to conduct formal health studies in a community. EPA's responsibility is to study the physical problems and respond to present and future health risks.

As the site study has progressed, EPA has investigated approximately 70 facilities. Each facility may have several potentially responsible parties (PRPs) associated with it. EPA has also established an expanding groundwater monitoring well network, which consists of EPA-installed and PRP-installed monitoring wells, and production wells which existed prior to EPA's investigation. More detail about the investigation approach is given in Section 3.

1.8. Lead Agency

EPA is the lead agency for the IBW–South Superfund project. The principal coordinating agency for the State is the Arizona Department of Environmental Quality (ADEQ). Funding is provided by a combination of sources, as PRPs are performing some work and the Superfund is funding other work. EPA coordinates with many other agencies in addition to ADEQ, including the Arizona Department of Water Resources, the City of Tempe, the U.S. Fish & Wildlife Service, the U.S. Corps of Engineers, and the Flood Control District of Maricopa County.

2. Statement on Innovative Approaches

This VOCs-in-Vadose-Zone remedy utilizes two specialized and innovative approaches to remedy selection at Superfund sites. The first is called the *Presumptive Remedy Approach*, and the other is called the *Plug-in Approach*. EPA's Feasibility Study, the risk assessment, and this ROD are all specially structured to interface with these approaches. EPA's response under these approaches will comply with CERCLA and the NCP, and also will allow EPA to address the complexity of IBW–South more efficiently.

The Presumptive Remedy Approach allows EPA to presumptively make use of a technology that has repeatedly been proven to be effective under identified site conditions. Description of this approach and justification for its use at IBW–South are given in Section 7, Justification for Presumptive Remedy, as well as in EPA's "Operable Unit Feasibility Study: VOCs in Vadose Zone, Indian Bend Wash Superfund Site, South Area" [Admin. Rec. No. 1599].

The Plug-in Approach is designed to address a site that has many similar, smaller subsites within it, by establishing a base remedy and then defining a process to allow the separate subsites to "plug in" to it. EPA has introduced the Plug-in Approach in order to more effectively address the multiple contaminant sources in the IBW-South study area. Because of this approach, this ROD differs slightly from a ROD for a traditional Superfund site, which often consists of only one contaminant source. For example, this Plug-in ROD calls for a remedy to apply any time a predefined set of conditions occurs within IBW-South. Therefore, the ROD does not discuss the remedy with respect to a single facility or location within IBW–South, as would a traditional ROD. Nonetheless, this ROD contains within it the entire process by which the VOCs-in-Vadose-Zone cleanup will be completed within IBW–South. The Plug-in Approach is justified and explained in detail in Section 8.

IBW–South covers a large area. Nationally, most Superfund sites are not this large. EPA informally calls this type of site an *areawide* site. IBW-South began merely as a zone within which groundwater contamination was known or suspected. EPA calls this zone the *study area*. There is no single locus of property serving as a source of all IBW-South contamination. Rather, contamination is emanating or has emanated from many individual facilities or properties over a wide area. Each small subsite is a separate source that must be investigated and may need to be cleaned up in its own right. However, compared to the total number of properties within IBW-South, those actually serving as contaminant sources are probably relatively few.

This adds a great deal of complexity to the way in which EPA must respond to the situation presented by IBW-South. For example, EPA's investigation of contamination has become a number of smaller investigations within a regional investigation. Whereas EPA may address a small Superfund site by means of steps taken in series, the process at IBW-South has been executed in several parallel phases. EPA's activities, including searching for responsible parties, investigating the contamination, selecting and designing cleanup options, and the use of the Presumptive Remedy and Plug-in Approaches, has been structured to address this "smaller-sites-within-a-big-site" situation.

3. Investigation Approach and Enforcement Activities

3.1. Investigation Approach

The Superfund process requires that the nature and extent of contamination be investigated sufficiently for a remedy to be selected. There are two sides to EPA's remedial investigation (RI) for IBW-South: a soil source investigation and a groundwater investigation. Investigation work proceeds at the same time on both sides. First, EPA investigates the contamination residing in soils above the water table at individual facilities, or *subsites*. This contaminated soil remains a source of future contamination of groundwater. The soil source investigation is subsite-specific; the soil investigation at each facility is usually undertaken separately. Figure II-4 is a conceptual illustration of soil source and groundwater contamination.

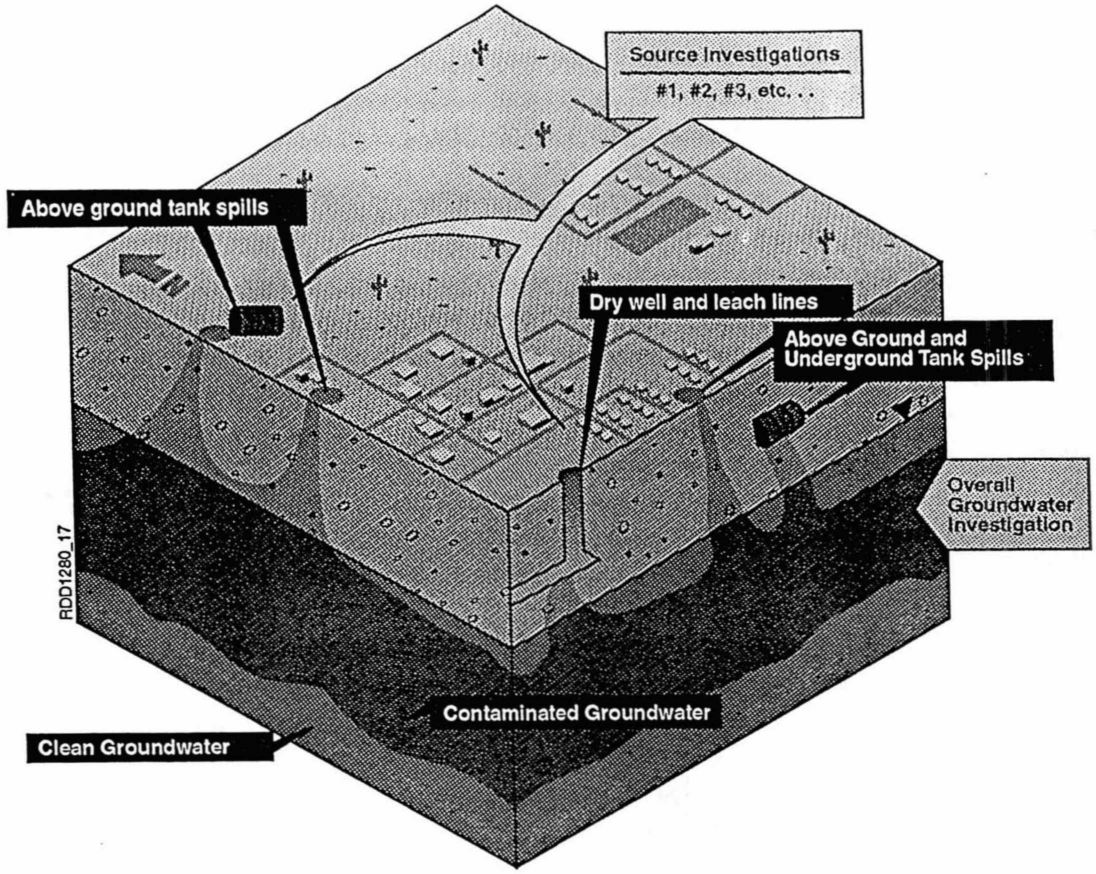


FIGURE II-4
SOIL SOURCES AND GROUNDWATER CONTAMINATION

Source investigations of soils at individual facilities generally consist of two components. First, EPA performs a Preliminary Property Investigation (PPI). The PPI allows EPA to determine that a facility warrants more investigation. If warranted, EPA issues an Administrative Order requiring PRPs to perform a Focused Remedial Investigation (Focused RI), which is much more comprehensive than a PPI. Under the Plug-in Approach in this remedy, these Focused RIs are completed <u>after</u> the ROD is in place.

The Focused RI is also designed to begin to gather information leading to eventual execution of the selected remedial alternative defined in Section 8.2 of this ROD. Each Focused RI results in a Focused RI Report, which is specific to a particular facility or property within IBW-South. Focused RI Reports may be written by PRPs, with EPA oversight, or EPA.

Focused RIs supply the information that allow the Plug-in Process in this ROD to determine whether the selected remedy will apply to any particular subsite.

Figure II-5 graphically depicts the screening of IBW–South subsites through the source investigation, resulting in a smaller number of subsite requiring Focused RIs.

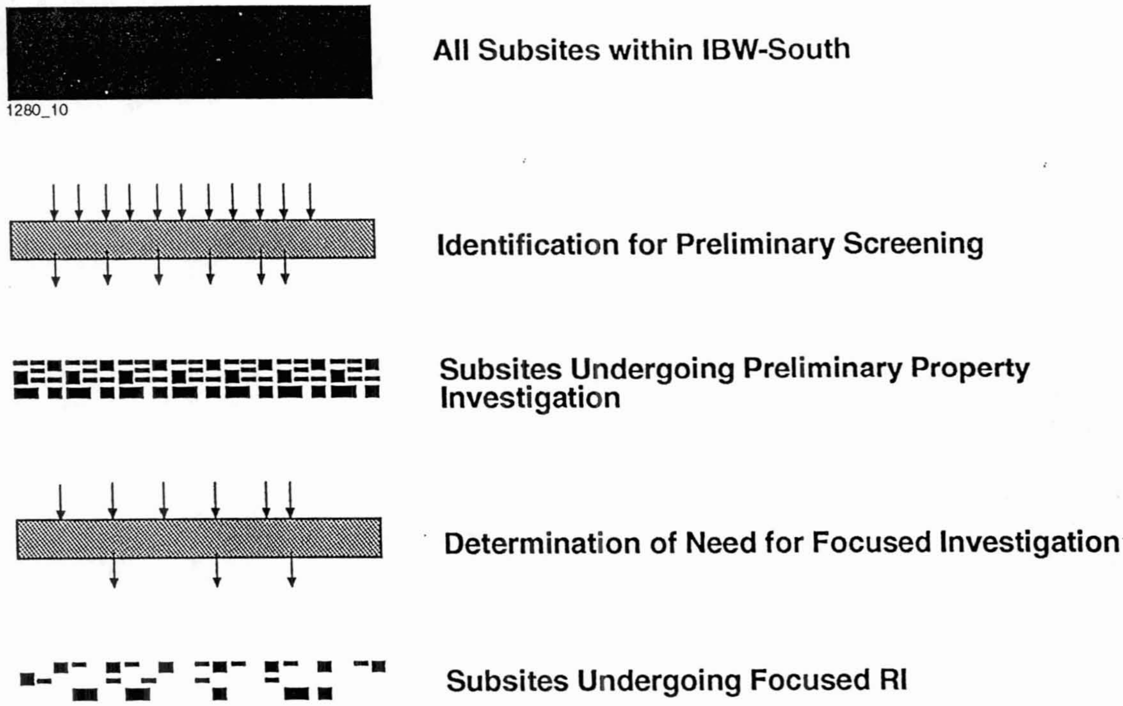


FIGURE II-5
SOURCE INVESTIGATION
SCREENING

While individual soil sources are being investigated, EPA is also investigating the regional groundwater contamination. This investigation is not specific to a particular facility, but covers all of IBW-South. EPA is performing the groundwater investigation using data acquired by sampling production and groundwater monitoring wells. Many monitoring wells are being installed by EPA; others are being installed by PRPs under administrative orders issued by EPA.

Typically, PRPs sample their own wells under EPA oversight and then transfer the groundwater data to EPA. Information on contaminant sources derived from PPIs and Focused RIs also guides EPA in its groundwater investigation. Currently, EPA regularly samples roughly 30 wells and is installing 32 additional groundwater monitoring wells at varying depths throughout IBW-South. These wells are scheduled to be installed by November of 1993.

EPA is synthesizing all RI information into a "living document" called the "Interim RI Report," or *IRI Report*. The IRI Report is updated periodically as EPA releases new RI information. This approach allows certain elements of the RI work to be presented while other RI work is still being completed. EPA released the first edition of the IRI in September of 1991. The second edition was released in June of 1993.

Each edition of the IRI Report is a compendium of EPA's groundwater investigation data and evaluation, all of the PPI Reports, and all of the Focused RI Reports, as of a cutoff date for that edition. The structure of the investigation and the resulting IRI Report contents are shown in Figure II-6.

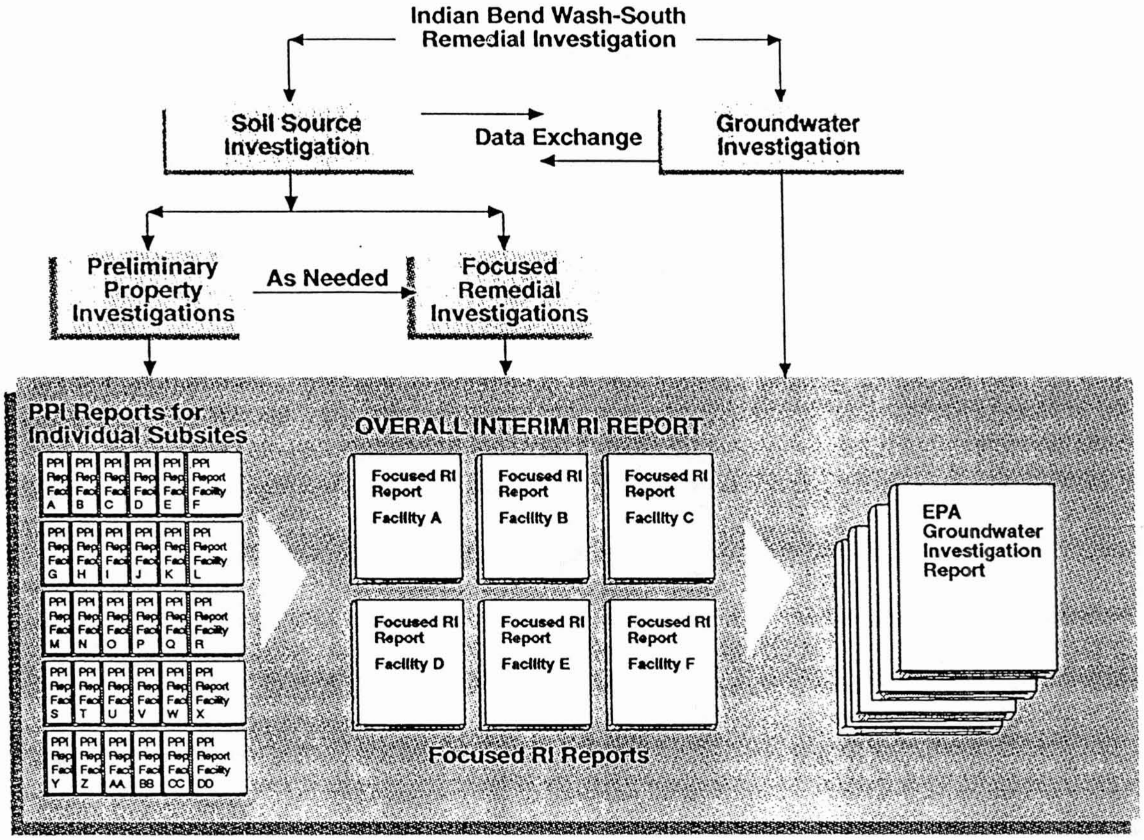


FIGURE II-6
REMEDIAL
INVESTIGATION
PROCESS

3.2. Enforcement Activities

EPA has information from its investigation for approximately 70 locations (each location supporting one or more facilities over time) as potential sources of VOC contamination. There may be one or more PRPs associated with any one facility. Only about 30 of these locations are still considered by EPA to be possible or known sources, barring new information. Some of the suspect facilities form contiguous clusters, but most of them are physically distinct, separated by distances ranging from blocks to a mile or more. Because most PRPs do not share a common zone of soil contamination for which they are responsible, and because the point to which investigation has proceeded at any given facility varies, a joint effort among PRPs for soils cleanup has not been forthcoming.

EPA has been performing the groundwater investigation. With regard to soils investigation, EPA has been screening properties based on responses to requests for information under CERCLA §104(e), civil investigative information, review of agency files and aerial photography, and in some but not all cases, screening samples for VOCs at individual properties. These activities, taken together, comprise the PRP search for IBW–South. Most of this information is contained within the PPI reports discussed above.

Once screening indicates a potential problem, a Focused RI is necessary (see Section 3.1). Those facilities conducting Focused RIs are subject to the Plug-in Process embodied in this ROD. The Focused RI provides the information required by the Plug-in Process embodied in this ROD to determine whether the selected remedial action is required at a facility or set of facilities (See Section 8).

EPA has issued Unilateral Administrative Orders under CERCLA §106 to PRPs in order to obtain Focused RIs. EPA chose not to use special notice procedures under CERCLA §122(e) because of the large number of individual actions required. So far, EPA has issued five Unilateral Administrative Orders for Focused RI work. As more Focused RIs become necessary, EPA may issue more orders, or may conduct work itself. The five orders issued to date are shown in Table II-1.

Table II-1
Unilateral Administrative Orders
for Focused RI Work at IBW–South (To Date)

Facility	Respondent(s)
DCE Circuits (former operator)	VAFCO Trust (Rudy Vafadari, et al.); Arden Properties
IMC Magnetics	IMC Magnetics, Arizona Division, Inc.
Unitog/Prestige Apparel	Unitog Rental Services, Inc.
Prestige Drapery	Prestige Cleaners, Inc.
Eldon Drapery	Leibovitz Enterprises Limited Partnership; Y&S, Inc.

EPA has issued information request letters pursuant to CERCLA §104(e) to more than 100 parties within IBW–South. These letters request information about practices of operation, waste handling and disposal; spills; the presence of tanks, dry wells, drains, leach lines and degreasers; and related matters.

In 1988 and 1990, EPA issued general notice letters to approximately 30 parties. In June 1993, just before this remedy was proposed, EPA issued a second general notice letter to about 65 parties informing them not only of potential liability but of the Plug-in Process and the importance of commenting on the remedy. EPA wanted to ensure that PRPs be informed of their opportunity to comment on the ROD even if EPA had not yet investigated their property. Some of the 65 parties who received this notice had also received the original general notice in 1988 or 1990.

The level of information that EPA has varies among the approximately 30 facility locations and 65 parties still considered to be possible sources of VOC releases based on current information. In some cases, EPA has definitive evidence indicating that a facility is a source. In other cases, EPA has only limited information about solvent use. Therefore, **it is important to note that not all of these facilities will ultimately be found to have released VOCs to soils.**

Figure II-7 shows all of the approximately 70 facility locations about which EPA has obtained information on and/or has investigated. As stated, only about 30 of these facilities are still considered potential source areas. EPA intends to screen out as many facilities as possible before subjecting the remainder to the Plug-in Process. The five facilities for which Administrative Orders require Focused RIs are marked in red on the figure. EPA may consider <u>more</u> facilities for the Plug-in Process than are shown on this list, should information indicate that they are a potential source of VOC contamination.

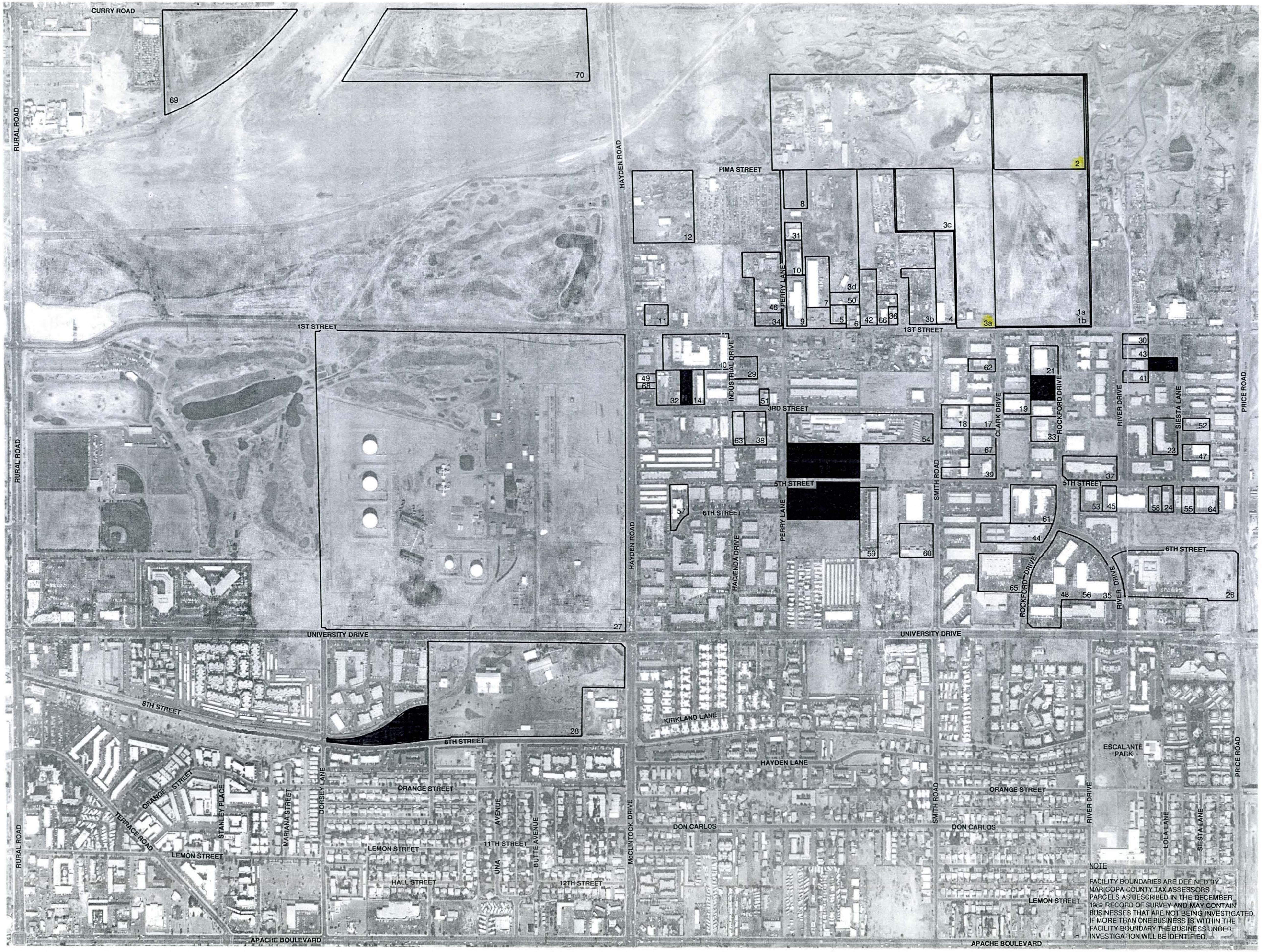
4. Scope and Role of this Decision Document within the Site Strategy

This remedy for IBW-South is a portion of the remedy for the overall IBW site, and addresses the VOCs-in-Vadose-Zone operable unit ("OU").

The purpose of this remedy is to control and remove future sources of groundwater and air contamination by cleaning the vadose zone of VOCs at the multiple subsites where they have been released.

The remedial action selected by this document has the following specific response objectives:

- Adequately protect human health from the ingestion or inhalation of VOCs that migrate from the vadose zone to the groundwater
- Adequately protect human health from the inhalation of VOCs that migrate from the vadose zone to the atmosphere



LEGEND

A1 FIBERGLASS	36
ALLSTATE MINE SUPPLY, INC.	5
ALMAR INDUSTRIES	37
APS OCOTILLO POWER PLANT	27
ARIZONA BRONZE	32
ARIZONA CASTINGS, INC.	10
ARIZONA CIRCUITS	33
ARIZONA ELECTRICAL	38
ARIZONA INTEGRATED ELECTRONICS	39
ARIZONA JACOBSEN PLASTICS CO.	40
ARIZONA MOTORCYCLE SALVAGE, INC.	11
ARIZONA PNEUMATIC	41
BENJAMIN SUPPLY AND MANUFACTURING	42
BENNETT BROTHERS RECYCLING	3b
BIOMIN LABORATORIES	43
CERPROBE CORP.	44
CIRCUIT EXPRESS/MEGATRONICS/ECM	24
CIRCUIT TECHNOLOGY	29
DCE CIRCUITS	25
DESERT SPORTSWEAR	17
ELDON DRAPERY	13
FIRST STREET LANDFILL	1a
FORMER CRAVENS MARTIN DESIGN	23
FORMER MEGATRONICS @ 229 S.CLARK	19
FORMER QUARTZ ENGINEERING	21
GREAT WESTERN MINING	9
GS INDUSTRIES	45
HERSETH ENTERPRISES	46
IMC MAGNETICS @ MURPHY CLAN PROPERTY	16
IMC MAGNETICS	15
INTERLOCKING PAVING STONES/ B & M AUTO WRECKING	12
JONES MEDICAL LAB (JMI PHOENIX LAB INC.)	47
JORIGA ELECTRONICS	48
K&K TRANSMISSION	7
KACHINA LANDFILL	1b
KACHINA REDI-MIX	3c
LAMBERT & SON AUTOBODY	49
M&H ELECTRIC	50
M&M AIR CONDITIONING (BRODERICK REFRIGERATION)	51
MAPEI	18
MARDON INDUSTRIES	52
MARICOPA COUNTY LANDFILL	3d
MIRACHEM CORP.	53
OLD TEMPE LANDFILL	2
PALM HARBOR HOMES, INC.	54
PIMA PERRY PARTNERS	8
PINNACLE MANUFACTURING	55
PLASTIC INJECTION MOLDERS	56
PLEKO SOUTHWEST INC.	57
PRECISE MANUFACTURING	58
PRESTIGE DRAPERY SERVICE	22
REDI-STRIP OF PHOENIX	30
RELTEC CIRCUITS	59
ROADWAY EXPRESS, INC.	60
ROCKFORD CORP.	61
ROWAN PROPERTY	6
RRCA LANDFILL	3a
RURAL METRO CORP.	4
SALT RIVER MARINE	34
SCHMID TOOL AND MOLD	62
SERVICE AND SALES, INC.	63
SILVER STREAK, INC.	14
SOUTHWEST MOLD/SOUTHWEST THERMOPLASTICS	64
SRP-75 LANDFILL	69
SRP-78 LANDFILL (HAYDEN ROAD)	70
SUPERLITE BLOCK	28
SYSTEM SPECIALISTS	35
TECH MEDICAL, A DIV. OF TECH PLASTICS, INC.	65
TEMPE TRANSMISSION EXCHANGE	66
UNITOG/PRESTIGE APPAREL	20
VARIAN	26
WHITRONICS	31
XYTEC CORP.	67
ZEMUN INDUSTRIES	68

N

400 0 400 800 FEET

FACILITIES ORDERED BY EPA TO CONDUCT FOCUSED REMEDIAL INVESTIGATIONS, TO DATE

FIGURE II-7
FACILITIES UNDER INVESTIGATION
INDIAN BEND WASH - SOUTH ROD

- Control the sources of continuing groundwater contamination to minimize loss of the groundwater resource and reduce the degree of groundwater cleanup that may be required

While a major objective of this remedy is to prevent soil contamination from reaching groundwater in the future, it does not address contamination that has already reached the groundwater, nor ensure by itself that groundwater contaminant levels are protective of human health. EPA will issue a separate ROD to address the final cleanup for the groundwater for IBW–South. This VOCs-in-Vadose-Zone remedy addresses a final cleanup for the continuing sources of VOCs in soils, but is only an interim remedy for groundwater.

In conjunction with the groundwater remedy, this remedy will serve to address the principal threats posed by contamination at IBW–South. It does not address non-VOC contaminants that may be in soils, such as metals. Where necessary, EPA will use removal actions or select other remedies for such contaminants, or modify this remedy to address them with an amendment or an explanation of significant differences ("ESD"). This remedy will apply to certain types of landfill materials. This is discussed in Section 8.5.

5. Highlights of Commununity Participation

Because the IBW–South and IBW–North study areas are part of one overall IBW site, EPA has joined community relations planning and execution for both areas. The Community Relations Program therefore addresses the IBW community as a whole, although a given factsheet or meeting usually pertains specifically to only one study area.

EPA currently maintains IBW–South information repositories at the EPA Region IX Office in San Francisco, and at the Scottsdale, Tempe, and Phoenix Public Libraries. The EPA Region IX Office and the Tempe and Scottsdale Public Libraries maintain copies of the Administrative Record file on microfilm, while the Phoenix Public Library maintains a collection of selected key documents, including the Interim Remedial Investigation (IRI), the Feasibility Study, the Proposed Plan, and this Record of Decision. In addition, the Arizona Department of Environmental Quality maintains an information repository, with various key documents, in its Phoenix Office. EPA also maintains a computerized mailing list database for all of Indian Bend Wash. This list currently contains more than 1,700 addresses. In addition to continually updating the mailing list, EPA sent a factsheet in December of 1990 to approximately 35,000 addresses in the area of the Indian Bend Wash Superfund site in an effort to expand the list. This factsheet (and all EPA factsheets) provided a return coupon and telephone numbers that one could use to be placed on the mailing list.

EPA also operates a toll-free information message line (800/231-3075) to enable interested community members to call EPA with questions or concerns about Indian Bend Wash Superfund site activities. The message line is publicized through newspaper notices and the mailing list. EPA has been responding to numerous inquiries about the effects of potential Superfund liability upon residential and small business property located within or near the study area boundaries. Some of these concerns are addressed in the Response Summary of this Record of Decision.

Table II-2 presents a chronological list of other community relations activities that EPA has conducted for IBW–South in order to comply with the public participation requirements of CERCLA §113(k)(2)(B) and CERCLA §117. Activities that were specific to IBW–North only are *excluded* from this list.

Table II-2
IBW–South Community Participation Highlights

Page 1 of 2

September 1984	Released a community relations plan based upon interviews with Phoenix, Scottsdale, and Tempe residents and State and local officials.
1984-1988	*During this period, community relations activities addressed all interested persons in the IBW community, but information transfer centered on IBW–North.*
December 1990	Distributed a factsheet to all persons on the mailing list providing information on IBW–South and groundwater monitoring and soils investigations.
Throughout 1991	Distributed a flyer to residents near EPA's well drilling activities throughout the study area, which explained the reason for, and nature and context of the well drilling.
May 1991	Distributed a flyer and held a public meeting to update the community on the findings of the remedial investigation, the type of contamination and movements of groundwater, the potential sources, and EPA's remedial and enforcement strategies; addressed community questions and concerns.
January 1992	Updated the 1984 community relations plan to reflect new site communication strategies and information from residents, officials, and other members of the community.
September 1992	Distributed a factsheet providing information about investigation activities and Administrative Orders that had been issued, and also announcing a public comment period on a Contingency Plan for Removal of Landfill Materials, which ADOT was proposing as part of its work under its agreement with EPA. Held a 30-day public comment period on this issue.
December 1992	Issued a flyer to residents in a surrounding neighborhood of the former DCE Circuits facility where EPA was beginning field work as part of a Focused Remedial Investigation. Flyer explained the reason for, and nature and context of the activities and gave contact names.
April 1993	Distributed a factsheet updating the community on activities at IBW–South, including more Administrative Orders, groundwater, and an initial description of the Plug-in Approach to be used in the upcoming VOCs-in-Vadose-Zone remedy.

Table II-2
IBW–South Community Participation Highlights

May 1993	Issued a flyer to residents affected by EPA's well drilling activities informing them of the reason for, and nature and context of the activities.
June 7, 1993	Distributed the Proposed Plan Factsheet for the VOCs-in-Vadose-Zone remedy to all persons on the mailing list, to local officials, the State, and to libraries, announcing EPA's proposal, the comment period, the scheduled public meeting and open house session, and the availability of the Administrative Record file.
June 7, 1993	Mailed Administrative Record file, on microfilm, to Scottsdale and Tempe Public Libraries. Hard copies of the IRI Report, the Feasibility Study, and the Proposed Plan were sent to these libraries and the Phoenix Public Library.
June 9, 1993	Published a notice in the Tempe Tribune and the Arizona Republic announcing the start of the public comment period, the scheduled public meeting and open house session, and the availability of the Administrative Record file for the VOCs-in-Vadose-Zone remedy.
June 9, 1993	Issued press releases to the Scottsdale, Tempe, and Phoenix media about the proposed VOCs-in-Vadose-Zone remedy, the scheduled public comment period and open house session, and the availability of the Administrative Record file.
June 14, 1993	Began a 30-day public comment period on EPA's proposed remedy for VOCs in the Vadose Zone at IBW–South.
June 28, 1993	Held a meeting at the home of the leader of a Phoenix citizens group to which several citizens groups were invited, to present EPA's proposal for VOCs-in-Vadose-Zone remedy and to answer questions and concerns.
June 29, 1993	Held a meeting at the Holiday Inn in Tempe for all Potentially Responsible Parties, to present EPA's proposal for VOCs-in-Vadose-Zone remedy and to answer questions and concerns.
July 7, 1993	Held a formal public meeting at Gililland Jr. High School in Tempe, from 7-10 PM, to present EPA's proposed remedy for VOCs in the Vadose Zone, answer questions, and to receive written and oral public comments; all proceedings were recorded and the transcript made part of the Administrative Record file.
July 8, 1993	Held an open house session at Gililland Jr. High School in Tempe to present EPA's proposed remedy for VOCs in the Vadose Zone, answer questions, and receive written comments; EPA was present between the hours of 1:00 to 5:00 p.m. and 7:00 to 9:00 p.m. to provide one-on-one responses to questions of the public.
July 26, 1993	Mailed a flyer to the mailing list and published newspaper announcements in the Tempe Tribune and the Arizona Republic extending the public comment period 31 days to August 14, 1993, in response to a written request for an extension.

6. Summary of Site Characteristics

6.1. Fate/Transport of Contaminants of Concern

Industrial facilities at IBW–South have used the VOCs trichloroethylene (TCE), perchloroethylene (PCE), and 1,1,1-trichloroethane (1,1,1-TCA), typically as solvents. These compounds, along with 1,1-dichloroethylene (1,1-DCE) and cis- and trans-1,2-dichloroethylene (1,2-DCE), have been detected in groundwater from monitoring and supply wells. Vinyl chloride has so far been detected only at relatively low levels in the landfills. DCE and vinyl chloride may be present from direct release, and it is also possible that these components are present as breakdown products of TCE or 1,1,1-TCA. EPA is monitoring for other VOCs that have been used at facilities within IBW–South, such as chlorobenzene, ethylbenzene, benzene, toluene, xylene, and chloroform.

Heavy metals, including lead, chromium, nickel, copper, and cadmium, have been used by many of the plating shops in the area and are present in some facility soils, as evidenced by EPA's first Focused RI. However, metals have not been found in groundwater at elevated levels, based on wells installed to date. EPA will be installing more groundwater monitoring wells and will continue to monitor for metals.

VOCs in the soil matrix are distributed to the various phases in accordance with physical properties of the contaminant (specifically vapor pressure, solubility, and Henry's Law constant), as well as properties of the soil (e.g., moisture content, clay mineral fraction, and organic matter content). The VOCs rapidly achieve an equilibrium condition among these various phases. Figure II-8 is a graphic representation of soil particles with sorbed contaminants surrounded by gaseous-phase and dissolved contaminants.

The following means may be influencing the transport of contaminants at IBW–South:

- Leaching of contaminants from source areas by infiltration and percolation of precipitation, wastewater, or irrigation water to the water table

- Movement of relatively pure product (e.g., pure TCE) from a source to the water table to form a dense non-aqueous phase liquid (DNAPL) source

- Soil gas contamination of groundwater by infiltration of water, which dissolves the gas phase contaminants, which percolate to the water table

- Soil gas migrating within the soil vapor and diffusing into the groundwater

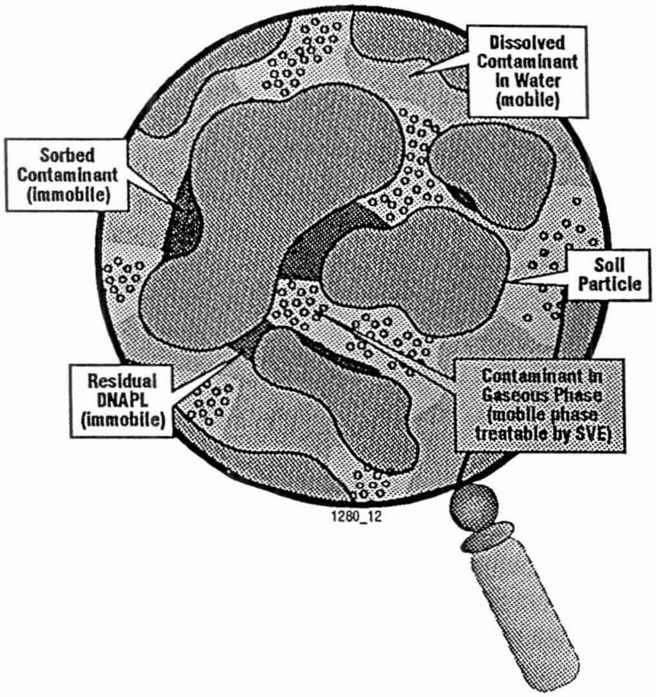


FIGURE II-8
DISTRIBUTION OF VOCs
IN THE SOIL MATRIX

All of these mechanisms may exert some influence on contaminants within IBW–South. Movement of relatively pure product would result in the highest levels and, potentially, long-term releases into the groundwater as the pure VOC slowly dissolves. Investigations to date have not confirmed the presence of any DNAPL in IBW–South soils, but its presence is possible. Available data indicate that a significant fraction of the VOCs in the vadose zone is present as soil vapor.

Because TCE can be used as an indicator of the fate characteristics of most of the VOCs of concern, it is further discussed here.

With TCE's relatively high vapor pressure, volatilization is the most significant removal mechanism when TCE is released into surface soils. When released into the atmosphere, TCE is readily photo-oxidized, ultimately to hydrochloric acid (HCl), carbon dioxide (CO_2), and carbon monoxide (CO). While these breakdown products are undesirable as components of photochemical smog, the long-distance transport and accumulation of TCE itself in the atmosphere has generally not been of concern because its half-life in air is approximately 3.7 days.

Reported soil adsorption coefficients for TCE indicate high mobility in soils and low potential adsorption. Therefore, TCE leaches readily to groundwater. Once TCE reaches groundwater, volatilization ceases to be a significant process, and biodegradation is slow. Therefore, TCE is expected to persist for many years in the groundwater.

6.2. Soils

Soil properties and conditions governing the movement of air through soils and subsequent volatilization of VOCs from unsaturated soils include soil porosity, temperature, convective currents, and barometric changes.

IBW-South lies in an arid climate. The unsaturated soils in IBW-South are generally alluvial deposits with low clay content, laid down by rivers and water runoff over millions of years. There is generally little organic matter in the soil. These factors mean that VOCs do not tend to adhere to the soil and therefore migrate readily.

There is extreme difficulty in obtaining a representative soil sample (as opposed to a soil *gas* sample) for VOC compounds in the IBW-South environment, due to four primary factors:

1. Aeration (and therefore loss) of VOCs from the sample during split-spoon retrieval

2. Aeration of VOCs from the sample during handling in the field

3. Aeration of VOCs from the sample during laboratory preparation

4. High variability in analyses at relatively low concentrations

For these reasons, *soil gas* samples for VOCs can show high levels of contaminant, while *soil* samples for VOCs show little or no contaminant.

At chemical equilibrium, a significant fraction of VOCs in IBW–South soils is found in the gas in the soil, the soil vapor phase.. While there also may be a significant fraction sorbed to soil particles or dissolved in soil moisture, these other fractions will readily move into the vapor phase if the VOC vapor concentration is decreased. This makes the vapor phase an efficient focus for evaluating and removing VOCs in the subsurface at IBW-South.

Based on these facts, EPA's approach to characterizing and remediating soil at IBW-South relies heavily on soil gas sampling for VOCs, rather than soil sampling. In general, surface soil gas sampling results in a contour map of VOC contaminants at about a 5-foot depth. From this map, soil vapor monitoring wells are installed. These wells can be sampled at multiple depths, allowing for a depth profile of VOC contamination. Even low concentrations at the surface can be indicative of high concentrations at depth.

VOC contaminants have been confirmed in IBW-South soils at various individual facilities. Surface soil gas samples taken in 1988 and 1990 indicated concentrations up to 2,500 micrograms per liter (µg/l) of TCE and 1,500 µg/l of PCE, as well as concentrations of 1,1,1-TCA, benzene, ethylbenzene, 1,1-DCE, and 1,2-DCE at various facilities. As part of recent Focused RIs, surface soil gas concentrations of over 12,000 µg/l of PCE have been detected at the Unitog facility, and several hundred µg/l of TCE at the IMC Magnetics facility. Even surface soil gas levels on the order of 10 µg/l may be indicative of much higher concentrations at depth. Soil vapor monitoring wells at the former DCE Circuits facility have now produced TCE concentrations in excess of 9,500 µg/l. The IRI Report contains the results of soil gas data that EPA has used to initially evaluate subsites, as well as summaries of data from non-EPA investigations.

6.3. Groundwater and Hydrogeology

While this is not a ROD for a groundwater remedy, a limited description of groundwater characteristics is provided here to emphasize the migration that may occur if VOCs migrate from the soils and enter groundwater, and the relation of groundwater to vadose zone soils.

At IBW–South, VOCs that leave the vadose zone soils and enter groundwater have high potential of migrating rapidly from their original source, both laterally and with depth and in complex directions. Much more detail on groundwater can be found in the IRI Report [Admin. Rec. No. 1597].

The hydrogeology and hydrodynamics at IBW-South are extremely complex. Generally, there are four major geologic units under the site, three of which are composed of alluvial materials. These have been labeled the Upper Alluvial Unit (UAU), Middle Alluvial Unit (MAU), and Lower Alluvial Unit (LAU). The LAU is not present at all locations under the study area. The fourth major geologic unit under the site, labeled the Red Unit, underlies all formations in the area.

Alluvial material extends to as much as 1,000 feet bls before bedrock is encountered; however, there are some areas under IBW-South where bedrock is encountered within the first 300 feet bls. Figure II-9 illustrates the stratigraphy with approximate corresponding depths at IBW-South.

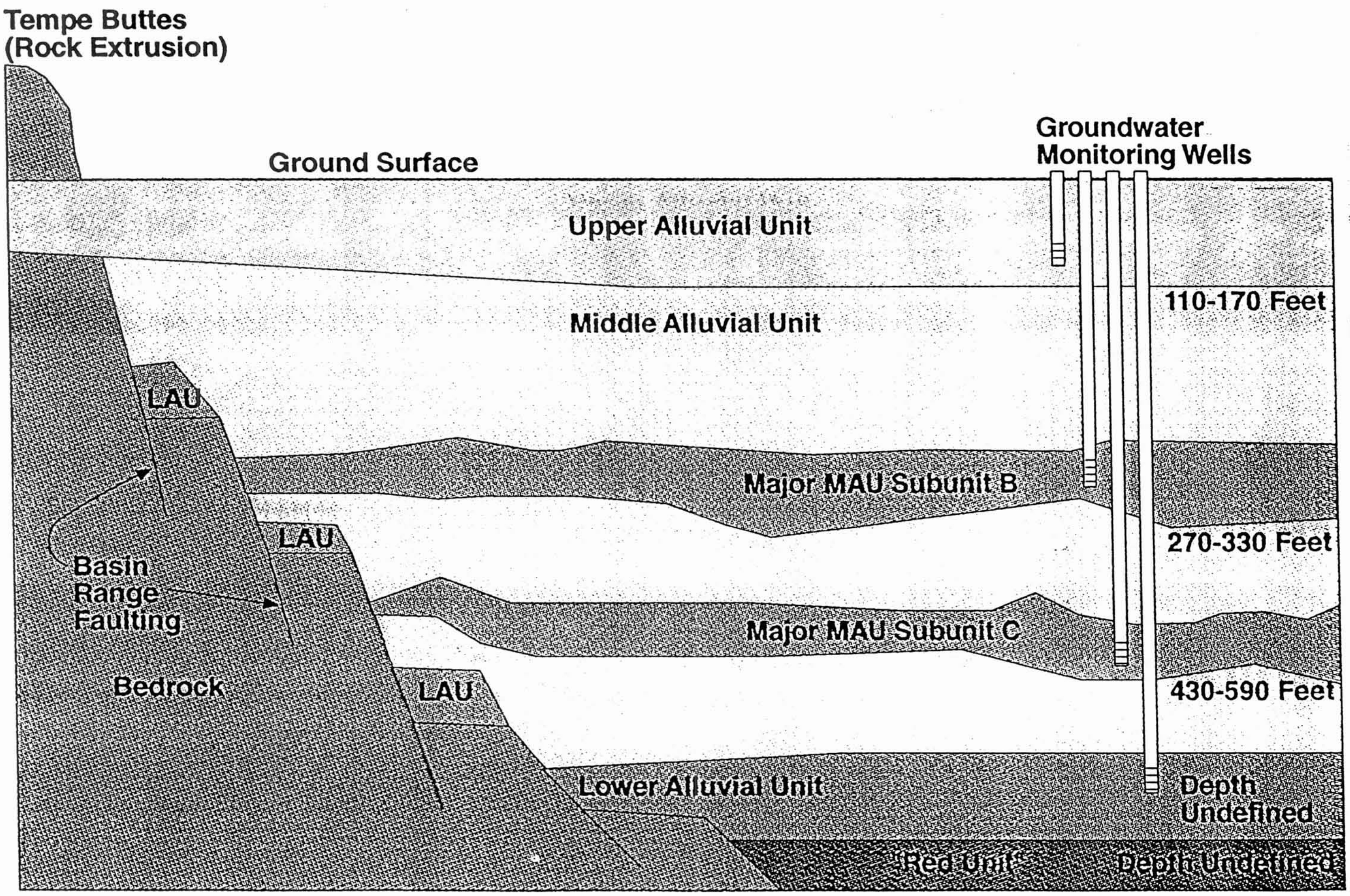


FIGURE II-9
CONCEPTUAL GEOLOGIC
CROSS SECTION

While the stratigraphies of the three alluvial units are somewhat different, available data indicate strong interconnection among the three units, with substantial vertical gradients. No significant barrier to the vertical flow of water exists among the three units.

Transmissivities in IBW-South are extremely high, resulting in estimated groundwater particle velocities as high as 25 feet per day during high recharge (river flow). During low recharge (dry river conditions) the particle velocities may still be as high as 2 to 5 feet per day. It is therefore possible, though not confirmed, that contaminants from IBW-South sources have extended miles from their original point of entry to the groundwater.

The Salt River, which is ephemeral, is a powerful agent of groundwater recharge in the UAU. When the river is flowing heavily, EPA has recorded groundwater levels rising by as much as 45 feet. The river flows about 10 percent of the time averaged over all time, but may not flow at all in any given year.

Because the water table rises and falls dramatically with temporal variations in river flow, contamination in the vadose zone at depth can enter groundwater when the water table rises to meet it, as shown in Figure II-10. When the water table falls again, some of the VOCs will have dissolved and will recede with the groundwater. Groundwater concentrations also tend to fluctuate as the thickness, and therefore the volume of the UAU changes.

Groundwater flow direction in the UAU is extremely complex, varying both temporally and laterally. During no river flow, the UAU gradient varies from south-southeast to south-southwest depending on one's location. With river flow episodes, all gradients shift eastward by 10 to 25 degrees, and then slowly return to normal.

These factors imply that a particle of contamination, once reaching groundwater, follows a tortuous path that is dependent on changes in recharge rates.

The flow direction in the MAU is less well-characterized, but appears to be to the northeast. This is virtually anti-inclined to the gradients in the UAU. Thus, contamination may start out in the soils at a subsite, enter the UAU moving in one direction, gradually sink to the MAU, and return at greater depth in the direction from which it originally came.

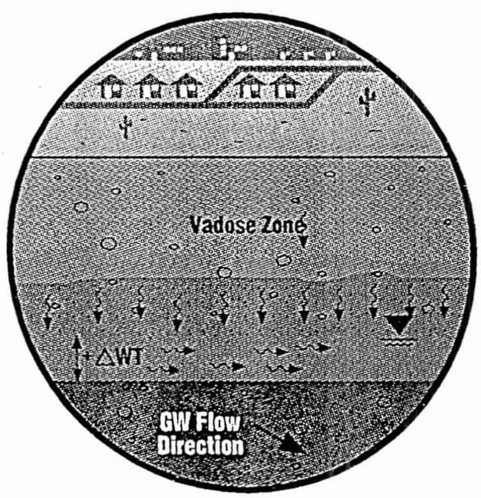


FIGURE II-10
CONTAMINANTS ENTERING GROUNDWATER AS A RESULT OF CHANGES IN GROUNDWATER LEVEL

7. Justification for Presumptive Remedy

As stated, EPA is using two innovative approaches in tandem in this remedy, the Presumptive Remedy Approach and the Plug-in Approach. These two concepts work well together at IBW-South, but are nonetheless independent. This section justifies the Presumptive Remedy Approach for VOCs in the Vadose Zone at IBW-South.

7.1. Presumptive Remedy Approach

When EPA began administering the Superfund program in 1980, very few technologies were available for cleaning up uncontrolled releases of hazardous substances, and little data were available on their effectiveness. With the passage of time, an industry was spawned to develop, test, and implement these technologies, and as more sites were addressed, a much wider range of technologies has become available. Additionally, there are now data, called *treatability data*, indicating conditions under which different technologies are effective.

Even with this new information and capability, it remains necessary at most sites nationwide to consider a full range of technical options in an FS Report, before selecting one of them in the ROD. However, EPA has recognized that there are certain situations in which the conditions at a site are so well suited to a particular technology that the use of that technology can be presumed to work (the *Presumed Remedy).* The Presumptive Remedy Approach is considered when there is a remedial technology or process option that has repeatedly been shown to work in the range of conditions present at a site; and there are no apparent conditions at the site that are markedly different from the conditions under which the technology has previously been tested or used. When the Presumptive Remedy Approach is used by EPA, the FS Report and the ROD do not evaluate a full range of varied options. Rather, only the Presumed Remedy and the No-Action Alternative are evaluated and compared. The FS and ROD describe why it is appropriate to presume that the alternative will be effective.

By presuming one alternative, EPA does not imply that there are no other alternatives that might be effective in cleaning up the contamination at IBW–South. Rather, EPA concludes that the effectiveness of the Presumed Remedial Alternative will be fully acceptable without making a comparison to other alternatives.

Soil vapor extraction (SVE) is the technology presumed to be effective for VOCs in the IBW–South soils. In this ROD, SVE will sometimes be referred to as the *Presumed Remedial Alternative.*

SVE is presumed, in part, because it has been selected as the remedial action for similar sites with similar contamination problems. In Maricopa County alone, there are approximately 70 SVE projects either in the process of being permitted or currently operating.

Two remedial investigation/feasibility study (RI/FS) programs previously have been completed by EPA for sites located near the IBW–South study area. Both FSs evaluated several remedial alternatives; they did not use a Presumptive Remedy Approach. These sites have vadose zone soil conditions and contamination problems similar to those observed at IBW-South. EPA therefore did not believe that it would be necessary or cost-effective to re-analyze the same alternatives at IBW-South. A brief description of these sites follows in paragraphs 7.3 and 7.4.

7.2. Conditions at IBW–South Amenable to SVE

Soils in the vadose zone at IBW-South typically consist of moderately permeable sands, silts, and gravels, with cobbles and thin clay beds. The vadose zone consists especially of loose alluvial deposits with a large cobble fraction. The soils typically have low organic carbon content. Significant clay layers, as well as other phases such as oil, have not been observed. These soil types, in general, are conducive to effective SVE removal of VOCs.

Shallow soil gas sampling at a variety of locations at IBW-South has indicated that soil gas contaminants at most subsites are the type that can be remediated by SVE.

Excavation and removal of contaminated soils at IBW–South are restricted because many contaminated areas are located under buildings and roadways. Capping the contaminated areas decreases upward migration to limit exposure risks; however, it does not remove the potential for migration of VOCs from the unsaturated zone to groundwater. In addition, because some VOCs have been found at IBW–South at depths of up to 100 feet, the availability of many other treatment remedies, especially ex situ ones, is limited. While EPA has not thoroughly evaluated these other remedies, these factors lend further support for EPA's decision to presume a technique that has been proven effective in all these conditions.

SVE can remove VOC contaminants from beneath buildings and roadways with minimal disturbance to structures and is proven to be effective with a minimum of disruption to urban environments. The SVE remedy removes the VOCs from the vadose zone, thereby reducing their potential threat to groundwater and public health. Also, SVE can effectively treat VOCs at the depths to groundwater expected at IBW-South.

SVE has been proven as an inexpensive technology relative to excavating soil or treating soil by chemical or thermal means. It is therefore appropriate to presume that SVE will be cost-effective as well as technically effective. This should be true even after accounting for the potential use of SVE enhancements.

SVE is particularly suited to IBW–South not only because it is effective in removing and treating VOCs in soils of the type at IBW–South, but also because its capabilities are quite broad. Under the Plug-in Approach, EPA must select a technology to address many distinct subsites, which are not yet fully characterized. Therefore, it makes sense to select a versatile (robust) technology that is relatively insensitive to unexpected variations from one subsite to the next. This is true of SVE.

7.3. SVE Remedy at IBW-North Study Area

The IBW-North study area is part of the same Superfund site as IBW–South. The study area is located immediately adjacent to IBW-South, north of the Salt River, and has vadose zone characteristics similar to those observed at IBW–South. In September 1991, EPA issued a ROD for IBW–North that selected SVE as the remedial action to remediate VOC-contaminated soils [IBW-North Admin. Rec. Nos. 2055 through 2057].

The primary contaminants of concern for the IBW–North Superfund site are similar to those in the IBW–South site, as many of the same types of industries are located in both areas. Primary contaminants requiring removal by the SVE treatment selected for IBW-North included TCE, PCE, 1,1,1-TCA, DCE, 1,2,-DCE, cis- and trans- isomers, and chloroform. Similar to conditions at IBW-South, a large fraction of VOCs in the vadose zone in IBW-North was found to be present as soil vapor with high mobility in soils and low potential adsorption. Because of the close proximity of IBW-North to IBW–South, the climate, topography, urban setting, soil, groundwater characteristics, and stratigraphy are very similar.

EPA selected SVE to remediate the VOCs in the vadose zone at IBW-North after complete analysis and comparisons with other remedial technologies such as excavation, soil washing, and capping. EPA's full analysis was performed in accordance with the nine evaluation criteria set forth in EPA's *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA*, 1988, as cited in the Feasibility Study, Admin. Rec. No. 1599.

7.4. SVE Remedy at Phoenix-Goodyear Airport ("PGA") Superfund Site

The PGA site is located approximately 20 miles to the west of IBW-South, within the Salt River Valley. The vadose zone lithology at PGA is similar to that observed at IBW-South. A pilot study was conducted at PGA in 1988 using an SVE system. Results of this pilot study demonstrated that SVE would be an effective solution for removing VOCs from vadose zone soils that have lithology similar to IBW-South. In September 1989, EPA signed a ROD for PGA selecting SVE as the remedial action [Admin. Rec. No. 1603].

The primary VOC contaminants of concern for the PGA vadose zone included TCE, PCE, 1,1,-DCE, chloroform, and carbon tetrachloride, which are the same or similar contaminants to those at IBW–South.

The climate and soil stratigraphy at PGA are also similar to those of IBW–South, with long, hot summers, and short, mild winters. The alluvial deposits of the western Salt River Valley consist of an Upper Alluvial Unit, Middle Fine-Grained Unit, and a Lower Conglomerate Unit, whose stratigraphy and water migration are similar to IBW-South.

The remedy selection process for PGA soils, like that for IBW–North, also evaluated a full suite of remedial action alternatives using the nine standard criteria for Superfund remedy comparison.

8. Description of Selected Remedy

The remedy selected for VOCs in the vadose zone at IBW–South is to use SVE to remove and treat VOCs in soils at those subsites that "plug in" to the remedy. The process for determining which subsites must plug in to the remedy is called the "Plug-in Process," and is hereby incorporated as part of the remedy. The Plug-in Process shall be applied once for *each* subsite at which a Focused RI is performed. The term "subsite" and the details of the Plug-in Process are defined below.

For all SVE systems that are required, air emission control (offgas treatment) shall be included. One of three types of emission controls defined below shall be applied at any subsite which plugs in. EPA shall identify which of the three emission controls will be used at any particular subsite as part of the remedial design for that subsite. All controls shall meet the Applicable or Relevant and Appropriate Requirements ("ARARs") or other requirements specified in this document.

For any SVE system, certain SVE enhancements shall be considered available as part of this remedy. Decisions on the use of and choice among these enhancements shall be part of the remedial design of each SVE system. The available enhancements are specified and described below.

8.1. The Plug-in Process: Basic Framework and Requirements

This section discusses the concept, justification, and terminology of the Plug-in Approach. The detailed specification of the process is provided in Section 8.3, after discussion of the selected remedial technology in Section 8.2.

8.1.1. Definition of "Subsite"

IBW–South contains zones of VOCs in soils separated by large zones of uncontaminated soil. Generally speaking, VOC-contaminated soil zones correspond to facility locations: certain facilities have released VOCs into soils. However, VOCs may have strayed from one facility onto neighboring facilities, or several adjoining facilities may have released contamination so that a single zone of VOC-contaminated soils spans a cluster of facilities. EPA shall consider one contiguous zone of VOC soil contamination, and the associated facilities and properties, as a "subsite." A subsite is a candidate for plug-in, the unit on which EPA will apply the Plug-in Process to determine whether a cleanup is necessary. A subsite defines one VOC contamination problem to which one SVE cleanup system would be applied, where determined necessary.

8.1.2. The Plug-In Approach in Concept

The Plug-in Approach is a way of structuring a remedy for complex Superfund sites such as IBW-South. The approach can be used when a Superfund site contains multiple areas or "subsites" that are similar physically and share similar contaminants. Each subsite has contamination that must be addressed.

This Plug-in Remedy identifies SVE as a standard remedial action, and then defines a process that will be used to determine *where* the remedial action shall be applied. The ROD does not select a remedial action for a *specific* subsite. Rather, it selects a remedial action to apply to any subsite exhibiting certain conditions. The ROD defines what these conditions are and selects a process for determining whether they exist.

The Plug-in Remedy is selected prior to fully characterizing the subsites. Subsites will be characterized concurrently or at different times. If the conditions at a subsite match predefined conditions, the subsite will "plug in" to the remedial action and be subject to its requirements. Each subsite has a separate Plug-in Decision. This ROD fully contains the basis and process to be used for all Plug-in Decisions. Therefore, following the prescribed process in the ROD completes the remedy for any particular subsite. The Plug-in Remedy contains a "blueprint" directing decisions as to its own application.

By separating selection of SVE, the cleanup technology, from a decision about its application at a particular subsite, EPA can verify that the cleanup technology is appropriate for a subsite after all sampling data about it have been collected. At the same time, EPA does not have to evaluate and select a separate remedy for each subsite.

After plugging in to the remedy, remedial design and action can begin at a subsite. Subsites not matching the conditions and criteria are not plugged in, but still can be addressed, if necessary, by other remedies, removal actions, or through modifications to the remedy. Because unexpected conditions or situations may occur during Focused RI work at a subsite, the Plug-in Approach is designed to be flexible enough to adjust to these conditions.

VOCs in soils at all subsites will be addressed by this single Operable Unit ROD. Remedial action will occur at some subsites while investigation work continues at other subsites. Thus, sitewide, remedial investigation and remedial action actually occur *concurrently* (see Figure II-16).

8.1.3. Plug-In vs. Traditional Superfund Remedy–Justification for Using Plug-In at IBW-South

Traditionally, the Superfund remedy selection process is site-specific. Each site is considered a unique problem that is first investigated and a remedy selected after considering a range of potential solutions. Usually, EPA characterizes the nature and extent of contamination with a remedial investigation (RI), then evaluates and compares several remedial alternatives in a Feasibility Study (FS), proposes one of those alternatives to the public in a Proposed Plan, receives public comment on that alternative, and then selects an alternative in a ROD. After the ROD, the exact technical specifications and construction detail of the remedy are developed during remedial design, and finally, the cleanup takes place in a remedial action phase. The part of this process starting with the FS and ending with the ROD is called *remedy selection.*

In traditional remedy selection, several alternatives are matched, or evaluated, for a single site. Site characterization is usually substantially complete before any final decision is made on remedy selection. This is important because, should a remedy be based on inadequate data, unknown characteristics of the site may render a selected remedy ineffective.

Multiple-source sites, such as IBW–South, present a number of challenges with regard to remedy selection. In the case of VOCs in soils at IBW–South, the problem is not in finding a technical alternative to treat VOCs; as discussed, SVE has been demonstrated to work at similar sites. Rather, the difficulty lies in administering many similar, yet distinct subsites. The soils at IBW-South are very similar from one location to the next, being laid down by the same alluvial activity and existing in the same arid environment. The VOC contaminants are generally chlorinated solvents, the behavior of which is fairly predictable in these soils. EPA expects that VOCs in this type of soil would tend to move readily into the soil vapor. There are proven remedial technologies, broadly suited to a wide range of conditions (i.e., robust), which remove the VOC vapor from soils.

Until Focused RI work is completed at a subsite, EPA cannot know whether that subsite even <u>needs</u> a remedy. However, as more has become known about IBW-South, it has become apparent that wherever a remedy <u>is</u> necessary, it is likely to be the <u>same</u> remedy. Therefore, before Focused RI work is completed at subsites, the remedial action for VOCs in soils can be presumed at <u>most</u> subsites.

Therefore, the traditional approach makes little sense in the case of IBW–South. The traditional approach would select a separate remedy for each particular subsite. If EPA performed a separate remedy selection for each subsite, the likely result would be a large number of virtually identical FS Reports and RODs. This would be an inefficient use of resources.

In contrast, the Plug-in Approach selects a remedy for a given range of conditions. Assuming these conditions will exist most of the time, one needs only assess whether a particular subsite meets these conditions. Provided it does, it can "plug in," and there is no need to perform a separate remedy selection. Instead of matching several remedies to a single subsite, the Plug-in Approach matches several subsites to a single remedy. Figure II-11 illustrates this concept.

The Plug-in Approach retains all the basic components of the traditional Superfund process, but rearranges and optimizes the order in which they are executed to minimize redundancy. Just as in the traditional Superfund process, a final decision on remedy selection for any <u>one</u> subsite is not in place until <u>after</u> Focused RI work is complete at that subsite.

The Plug-in Approach carries many benefits. First, it allows remedial action to begin without redundant remedy selection processes. Taken over all subsites at IBW–South, this is expected to save a significant amount of time and resources, both for EPA and for PRPs. Second, it allows focused investigation at each subsite to occur at its own pace. The Plug-in Remedy is available as soon as each subsite's investigation is completed. Because Focused RI work and remedial action can occur at the same time, subsites that have completed Focused RI work and have plugged in can begin remedial design and remedial action immediately, and are not held back by other subsites that are still performing a Focused RI.

Third, rather than treating each subsite in a vacuum, the Plug-in Approach focuses the collection of data at subsites on the most-likely remedial alternative. Thus, there are less data to collect in remedial design, and actual remedial action (cleanup itself) can begin sooner. In all, the Plug-in Approach minimizes waste, time, and resource use, and begins remedial action sooner.

8.1.4. Plug-In Process Components and Terminology

The Plug-in Process is *fully* detailed in Section 8.3. However, its terms and components are *first* defined in this section. Figure II-12 identifies elements established by this ROD, in conjunction with the Feasibility Study and the IRI Report. The figure also graphically depicts how these components, once in place, serve to ensure that only appropriate subsites are plugged-in to the remedy.

The Existing Site Profile

> The observed "similar conditions" that SVE, the Presumed Remedial Alternative, will have to address.

The selected remedial action in a Plug-in Remedy must be able to address the vast majority of subsites if the Plug-in Approach is to be efficient. The range of common conditions among subsites that has been observed at IBW-South is collectively called the *existing site profile*.

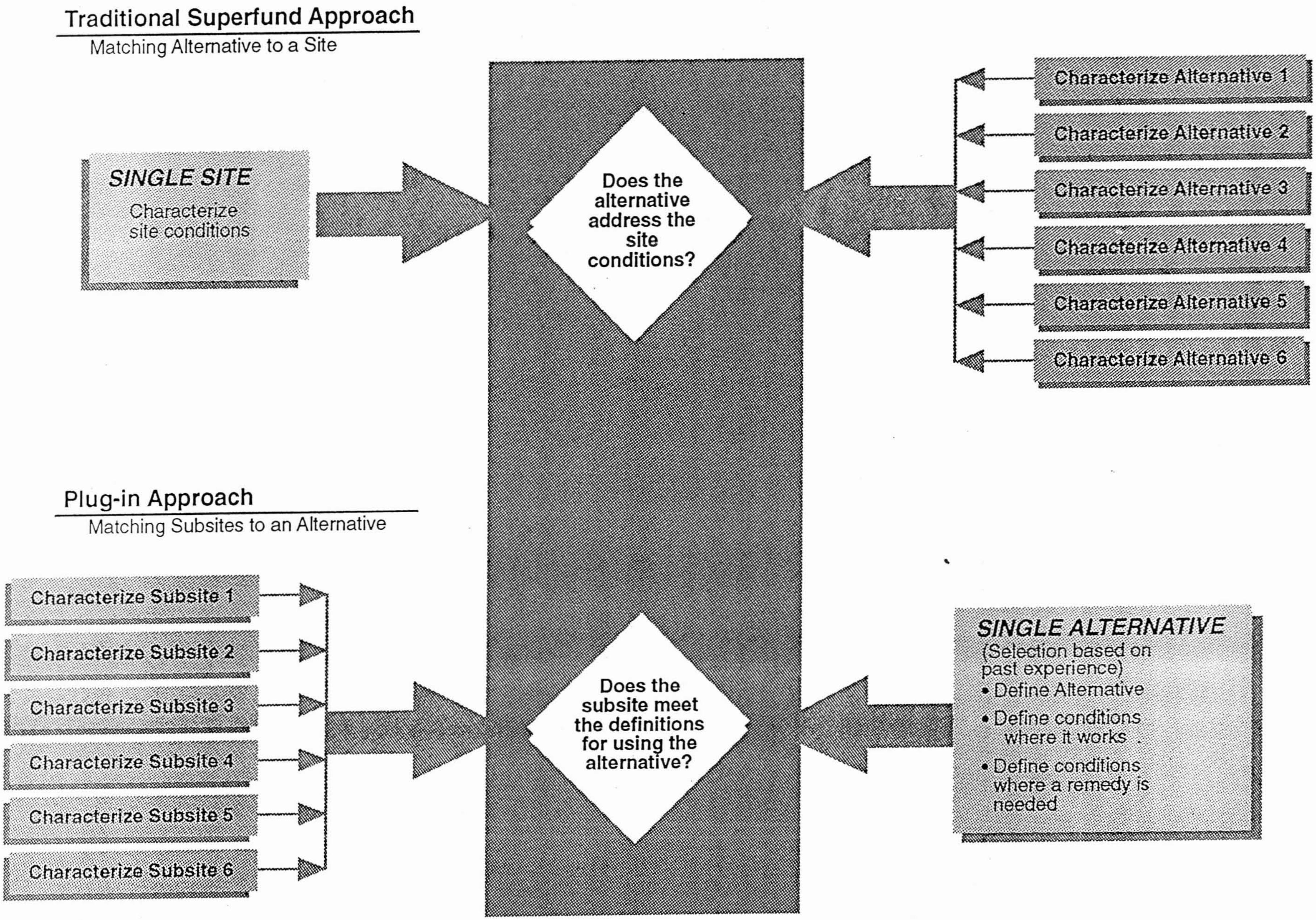


FIGURE II-11
COMPARISON OF TRADITIONAL VS PLUG-IN APPROACHES
INDIAN BEND WASH - SOUTH STUDY AREA

1280_14

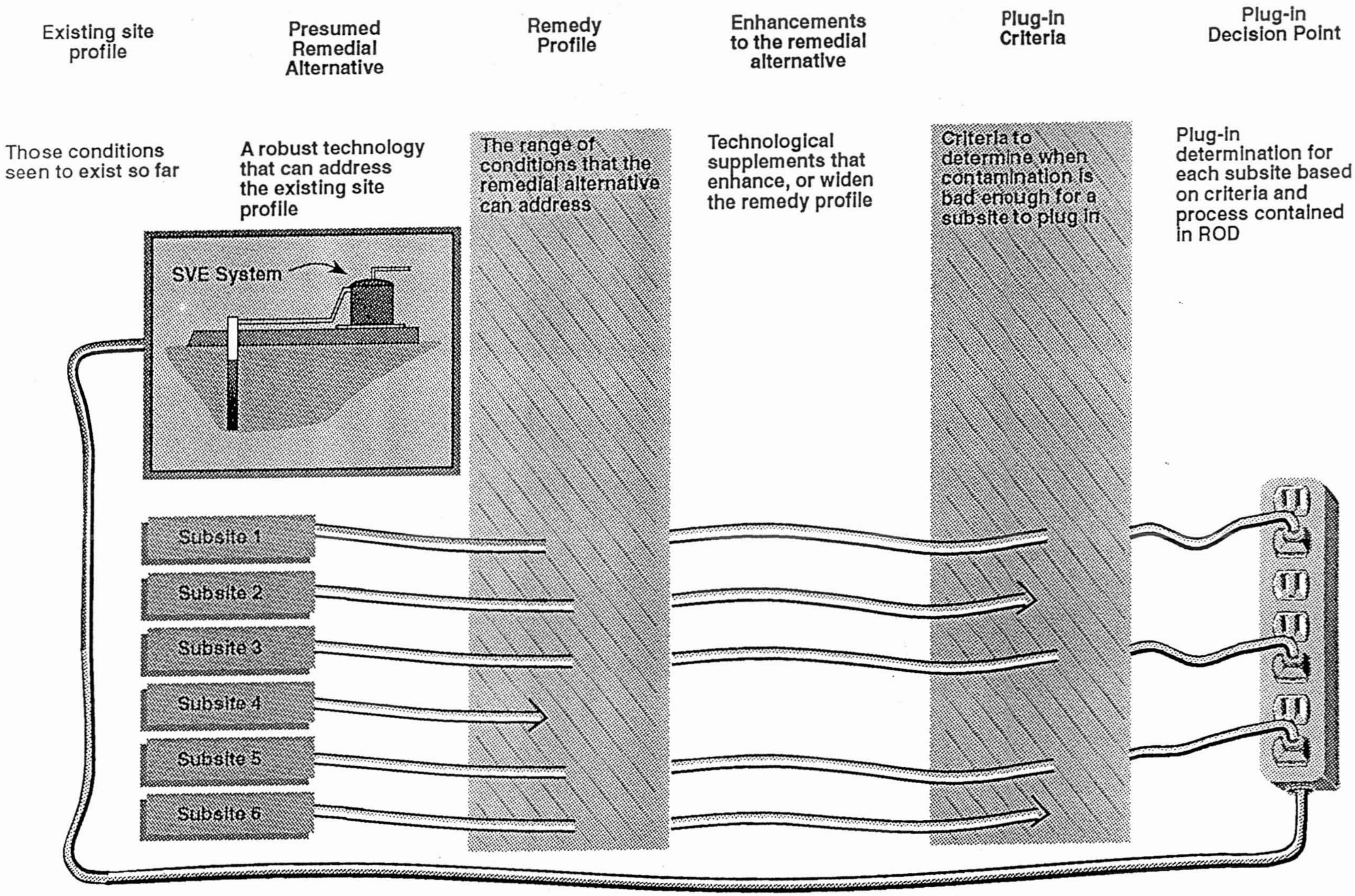


FIGURE II-12
PLUG-IN PROCESS COMPONENTS AND TERMINOLOGY
INDIAN BEND WASH - SOUTH ROD

1280_04

The existing site profile is defined in terms of various physical and contaminant parameters that might have an impact on the effectiveness of a remedial alternative. For example, for SVE, the air permeability of the soil and the volatility of the contaminants strongly impact its effectiveness. The existing site profile for IBW-South is defined by the IRI Report {Admin. Rec. No. 1597] and Chapter 1 and 2 of the Feasibility Study [Admin. Rec. No. 1599]. It is also summarized in this document under Section 6, Summary of Site Characteristics. Figure II-13 shows a conceptual illustration of the existing site profile.

FIGURE II-13
EXISTING SITE PROFILE

The Presumed Remedial Alternative

> The remedial action to be taken for VOCs in the vadose zone if a subsite is plugged in.

The Presumed Remedial Alternative is the action that will be taken at all subsites that meet the *Remedy Profile* and the *Plug-in Criteria* (defined below). The Presumed Remedial Alternative is selected to meet all identified applicable or relevant and appropriate requirements (ARARs). SVE is the Presumed Remedial Alternative for this remedy. SVE is described and its applicable specifications are stated in Section 8.2.

The Remedy Profile

> The range of conditions that SVE, the Presumed Remedial Alternative, is able to address.

The range of conditions that the Presumed Remedial Alternative can address is called the *Remedy Profile*. After a subsite completes its Focused RI, the first test of whether it can be plugged in to the remedy is whether it exhibits conditions within the Remedy Profile. Like the existing site profile, the Remedy Profile is defined in terms of physical and contaminant parameters that may have an impact on the effectiveness of the Presumed Remedial Alternative.

Figure II-14 shows a conceptual illustration of the Remedy Profile. The context of the Remedy Profile in the Plug-in Remedy is shown in Figure II-12. SVE is selected as the Presumed Remedial Alternative because it can be expected to address those conditions seen to date (the existing site profile). SVE may be capable of addressing conditions even beyond those seen to date. Therefore, this ROD establishes reasonable boundaries on what

SVE can address. This is important because, should a subsite exhibit characteristics outside these boundaries, SVE may not be effective at that subsite, and that subsite should not be plugged in.

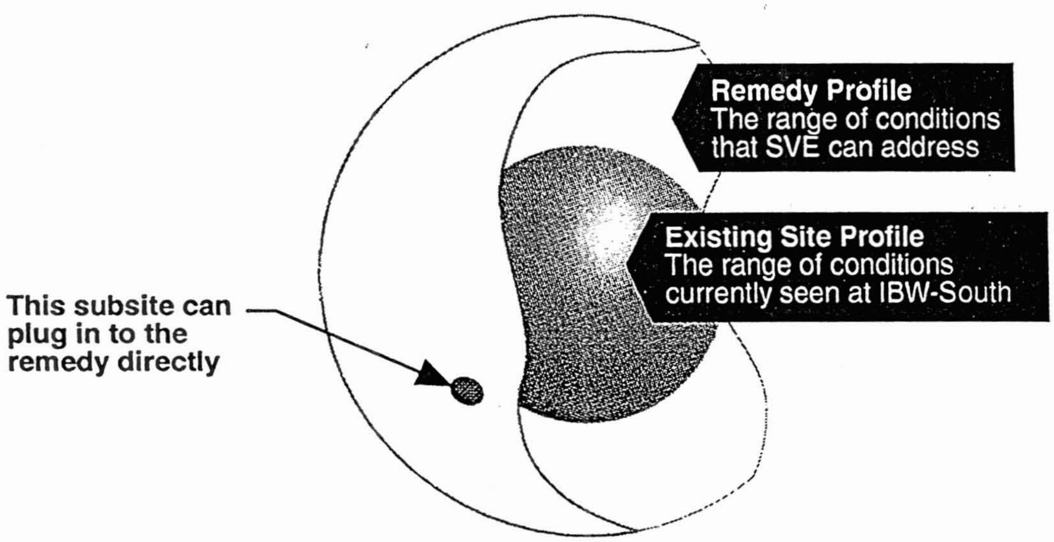


FIGURE II-14
REMEDY PROFILE

If a subsite exhibits conditions outside the Remedy Profile, EPA will assess whether the Remedy Profile can be enlarged by use of a technical enhancement. Certain technical enhancement options are incorporated in this remedy and are discussed below. If a subsite cannot be brought within the Remedy Profile by use of an enhancement, that subsite cannot directly plug in. In such a case, there are several possibilities which are discussed in Section 8.3.2.

As an example, the SVE remedial alternative addresses VOCs because they move easily into the soil vapor phase and can be subsequently removed by the SVE system. Should a subsite contain only metals in the soil, however, SVE would be useless as a remedy to address those metals. Metals are not volatile and would be unaffected by the removal of soil gas. The Remedy Profile is defined by certain parameters such that a subsite with metals only would fall outside the Remedy Profile. The Remedy Profile is specified in Section 8.3.4.

Enhancements to the Presumed Remedial Alternative

> Technological enhancements to SVE that may be necessary to widen the Remedy Profile or allow SVE to operate more efficiently.

Certain technical enhancements shall be considered available as part of this remedy. The available enhancements are listed in Section 8.2.5. At some subsites, it is conceivable that some of these enhancements may be necessary in one of three situations: (1) to widen the enhanced Remedy Profile so that SVE will apply, (2) to make SVE more efficient even if it would otherwise apply, or (3) to meet an ARAR. Situation (2) is considered the most likely at IBW–South. In such a situation, SVE would be effective in cleaning the vadose zone, but it may take a longer time due to an unforeseen condition, such as an unusual soil type. In such a case, the use of the enhancement may substantially reduce the treatment time and increase its efficiency. Decisions on the use of enhancements shall be made as part of remedial design after a subsite is plugged in.

Figure II-15 is a conceptual illustration of an enhanced Remedy Profile where the Remedy Profile has been widened by the addition of technical enhancements.

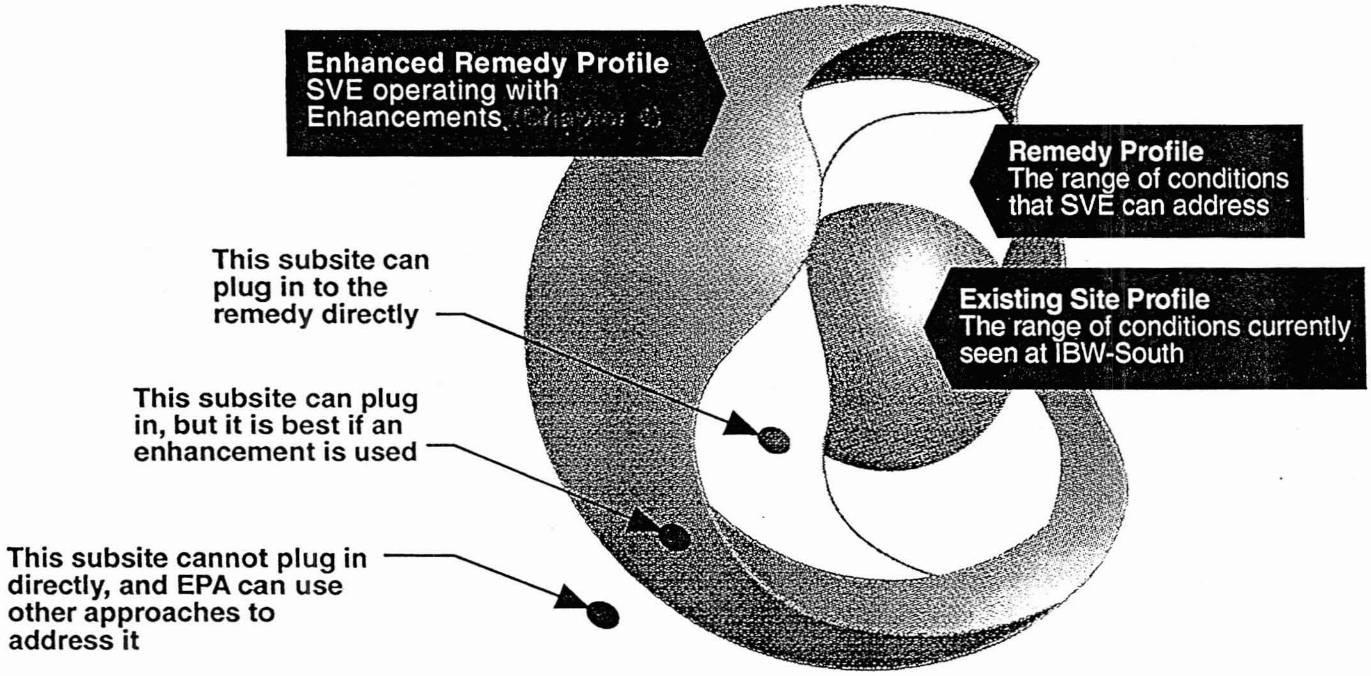


FIGURE II-15
ENHANCED REMEDY PROFILE

The Plug-In Criteria

> The criteria determining whether *contamination* is serious enough to require that a cleanup for VOCs in soils be implemented.

Even if conditions at a particular subsite are amenable to SVE (within the Remedy Profile), there still may not be enough contamination there to make SVE necessary. There must therefore be criteria based on potential health threats that serve as the standard for EPA to determine whether an action is necessary. EPA can plug in those subsites that exceed any of the Plug-in Criteria. Those not exceeding the Plug-in Criteria do not need a VOCs-in-Vadose-Zone remedy and EPA will not plug in such subsites to the remedy.

Most of the IBW–South Plug-in Criteria are specific to the various pathways by which persons may be exposed to VOC contaminants in the soils from a subsite, either currently or in the future. These pathways are identified and evaluated in the Risk Assessment in Appendix A of the Feasibility Study, and are discussed in this document in Section 8.4. The Plug-in Process and risk assessment for IBW–South allow EPA to compare the risk from VOCs in soils at any given subsite against this fixed set of Plug-in Criteria. The Plug-in Criteria and the process for using them are established by Section 8.3 and are also discussed by Chapter 5 and Appendix A of the Feasibility Study [Admin. Rec. No. 1599].

As an example, VOCs may leak downward and enter groundwater, which may then be withdrawn and consumed. Or, VOCs may volatilize upward and be inhaled near the ground surface. The Plug-in Criteria, in effect, set separate limits on the levels of VOCs that may reach the groundwater and levels of VOCs that may volatilize upward into the air, due to any single subsite. If either of these types of limits is exceeded, a remedial action is necessary, and EPA would plug in the subsite and require the Presumed Remedial Alternative, SVE. If neither of the limits is exceeded, there is no unacceptable health threat posed by the VOCs in the soil, and implementation of the Presumed Remedial Alternative is not necessary.

The Plug-in Decision Point

> **After** the ROD, when sampling work is completed at a single subsite, a decision is made whether to plug in the subsite (require the remedial action).

This remedy selects a remedial action that will apply whenever certain conditions exist at IBW–South. There are two conditions that a subsite must meet before being plugged in (See Figure II-16). First, the subsite must exhibit conditions falling within the Remedy Profile, and second, the subsite must exhibit contamination exceeding one or more of the Plug-in Criteria. At the Plug-in Decision Point, a determination is made as to whether to plug in one subsite and require the selected SVE action. This decision is made according to the process set in advance by this ROD. There will be one Plug-in Decision Point for each facility that proceeds through the Plug-in Process. It is a Plug-in Decision as sanctioned by this ROD that causes SVE to be required at any particular subsite. Note that the Plug-in Decision Point occurs at different times for different subsites. See Figure II-16.

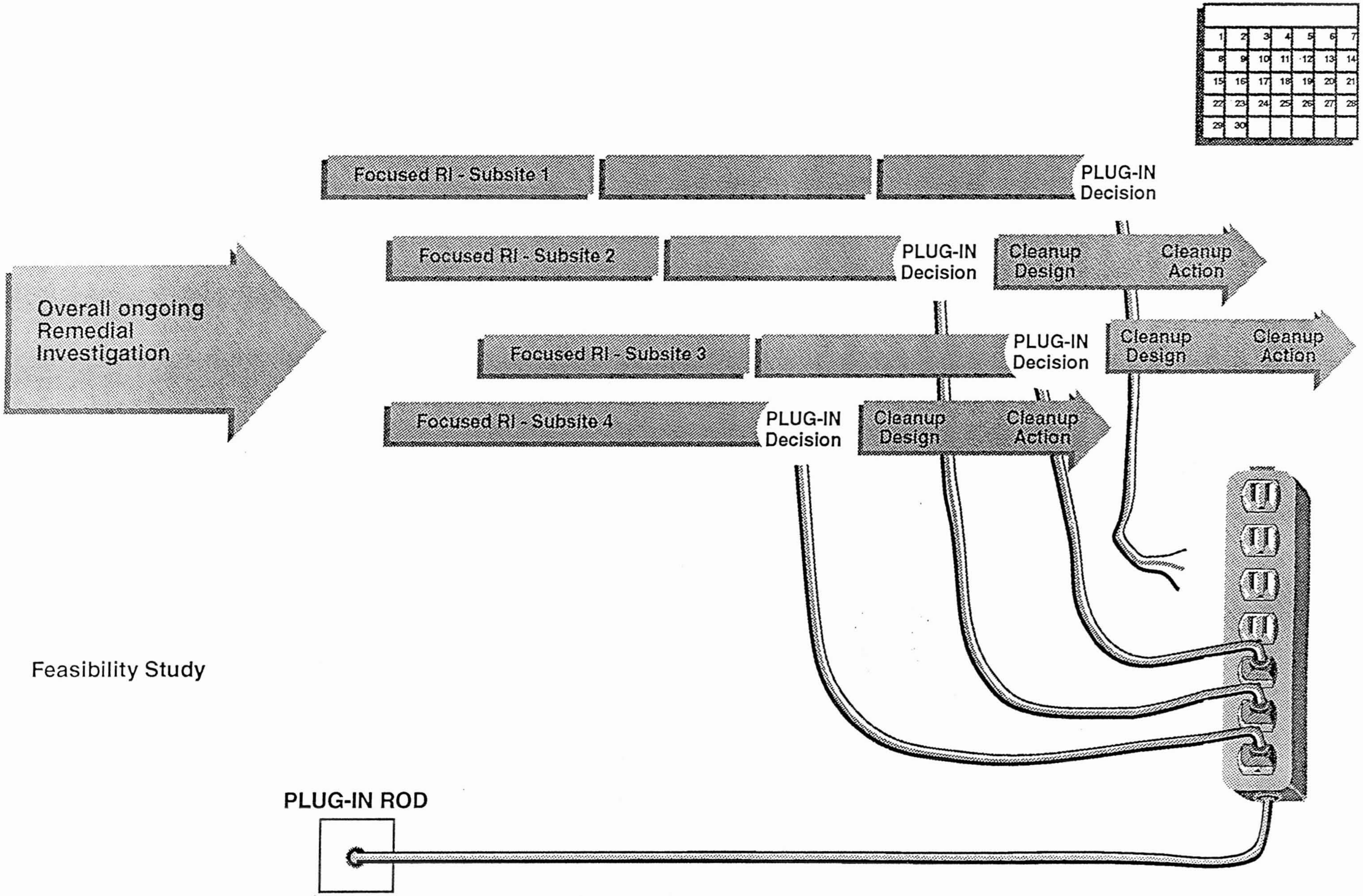


FIGURE II-16
TIMING OF EVENTS WITHIN THE PLUG-IN PROCESS
INDIAN BEND WASH - SOUTH ROD

1245_05

8.2. The Selected Remedial Technology

Because this is a Presumptive Remedy, the Feasibility Study only compared SVE with the No-Action Alternative. Comparison with No-Action is required by the NCP, and the No-Action Alternative provides a basis of comparison for SVE. EPA has determined that SVE is preferable to No Action as a remedy for VOCs in the vadose zone at IBW–South. This section provides a description of the SVE alternative, a summary of the comparison with the No-Action Alternative under the nine standard criteria, and a description of available emission control (air treatment) options, SVE enhancement options, and Performance Standards for their use. The nine criteria serve as a basis for defining why SVE should be an effective remedy at IBW-South. The Feasibility Study analysis compared the consequences of taking no action versus using SVE at subsites *that have been determined to meet the Plug-in Criteria* and therefore pose an acceptable health threat. Subsites not meeting the Plug-in Criteria are, in effect, screened out by the Plug-in Process, and therefore no remedial action is necessary at those subsites, by definition.

8.2.1. Description of the Selected Soil Vapor Extraction Alternative

SVE is a means of physically removing VOCs from contaminated soil. This is accomplished by inducing airflow through soils containing VOCs and collecting the contaminated soil gas through an extraction well. The withdrawn contaminated soil gas can be treated at the ground surface, after which the treated air is released to the atmosphere. Conceptually, an SVE system is analogous to vacuuming the subsurface soil.

A typical SVE system consists of one or more extraction wells, connected by manifold to a vacuum blower and other associated air-processing equipment. This equipment would include valves for flow control, an air-water separator to remove excess moisture, monitoring gauges (e.g., flow meters, pressure meters, temperature probes), a mechanical blower (such as a regenerative or positive displacement type) and an air treatment system (such as carbon adsorption, catalytic oxidation, thermal destruction, or regenerative sorbent).

A typical SVE system is shown in Figure II-17, and SVE components are shown in Figure II-18.

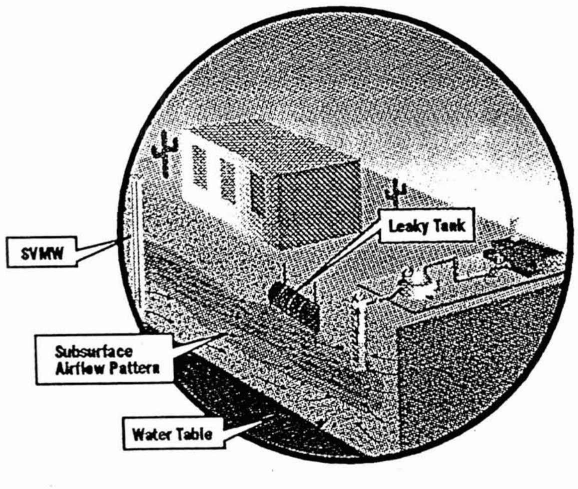


FIGURE II-17
APPLICATION OF AN SVE SYSTEM TO REMEDIATE VADOSE ZONE CONTAMINATION

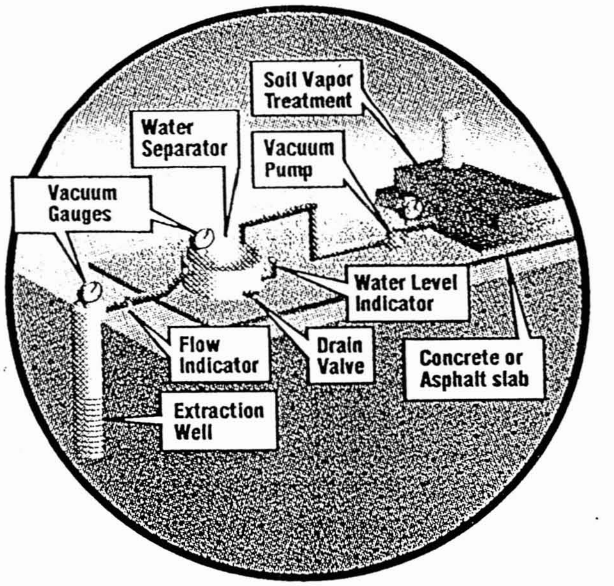


FIGURE II-18
SOIL VAPOR EXTRACTION
SYSTEM COMPONENTS

The fundamental subsurface component of SVE consists of one or more extraction wells placed in the contamination zone. A consistent vacuum is pulled on these wells in order to remove VOC contaminants. These wells need to be placed to effectively induce subsurface airflow through zones of VOC contamination; the optimum placement and distribution of a multiple well system is typically designed using a predictive flow model. Figure II-19 shows the various components and dimensions of a typical SVE well.

The other primary subsurface component of SVE systems is the network of soil vapor monitoring wells (SVMWs) that is used to evaluate the SVE system performance. SVMWs are used to measure and verify propagation of vacuum in the subsurface. This information is then used to estimate or predict the zone through which airflow is occurring.

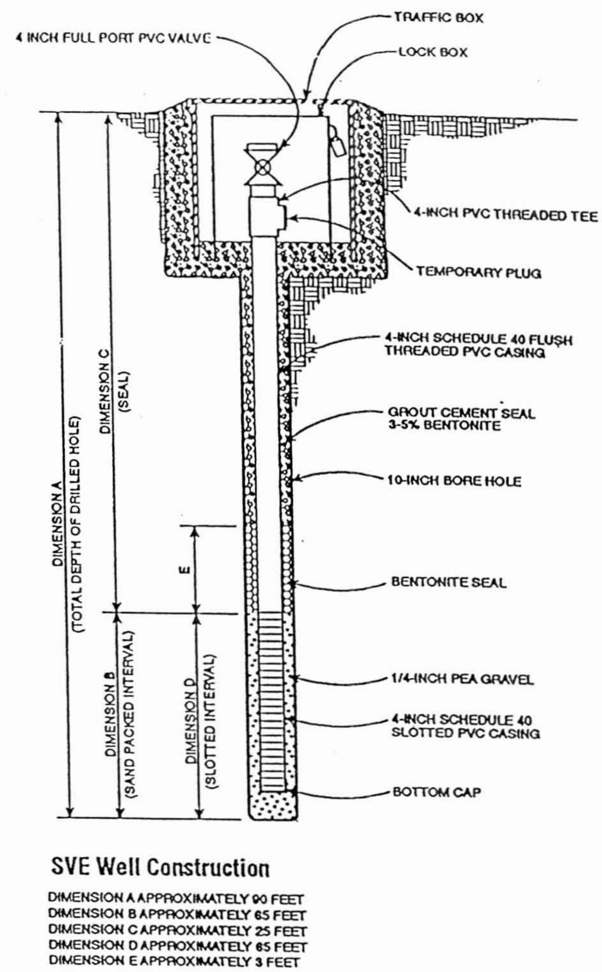


FIGURE II-19
COMPONENTS AND DIMENSIONS
OF A TYPICAL SVE WELL

SVMWs are also used to collect periodic soil gas samples, which are used as proxies for soil concentration data samples to assess the rate at which soil decontamination is occurring.

These data, together with the monitoring of the concentrations of contaminants in the blower discharge, are commonly used to predict the remaining time necessary for SVE system operation.

Both extraction wells and SVMWs can be completed below grade or slightly above grade. Piping connecting extraction wells to the "plant" (pumps, blowers, valves, water separator, and treatment system) can then be installed either above or below grade. The amount of space required for the SVE system is minimal, although the plant may occupy it for an extended period of time.

SVE usually can be installed with only minor disruption to urban buildings or facilities, as compared to other measures such as soil washing or excavation of contaminated soil. Figure II-20 shows the various components and dimensions of a typical SVMW.

SVE decontaminates soil by extracting the contaminated soil gas, which is at equilibrium with the other contaminated phases (See Figure II-8), resulting in its replacement with uncontaminated air. This shifts the equilibrium and causes the contamination in sorbed, dissolved, and free phases to tend to move into the vapor phase. In this way, VOCs are transferred from the other phases into the vapor phase and are progressively removed by the SVE system. The paths that contaminants follow during transfer from one phase to another are analogized in Figure II-21.

Chapter 3, Section 3.1.2.2, of the Feasibility Study [Admin. Rec. No. 1599] provides a detailed discussion of the various parameters that affect SVE efficiency, the amount of air that must be withdrawn to achieve cleanups, and the conditions under which enhancements to SVE may be necessary.

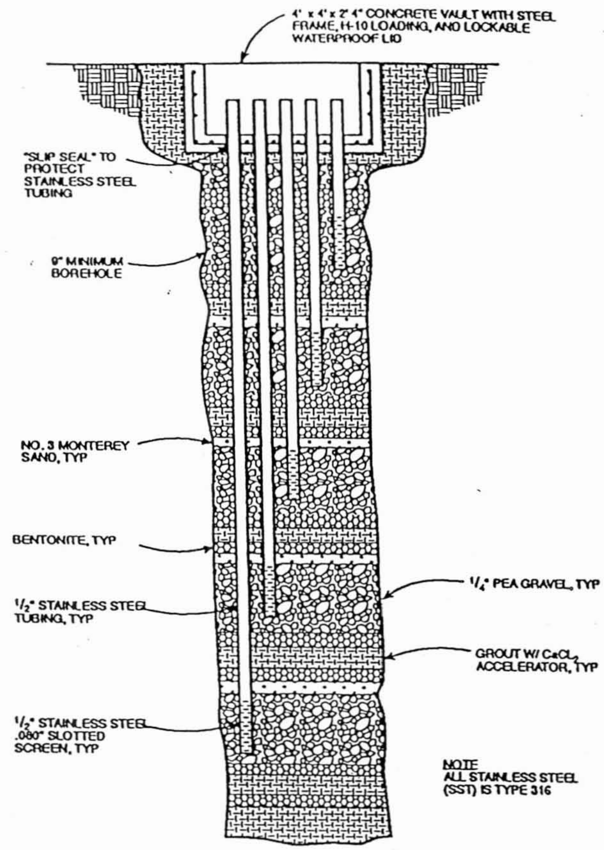


FIGURE II-20
COMPONENTS AND DIMENSIONS OF A TYPICAL SVMW

Also included is a discussion of typical values of the parameters at IBW–South. These data in the Feasibility Study support EPA's decision to use SVE under the conditions observed at IBW–South.

Air flow rates ranging from 1 to 100 standard cubic feet per minute (cfm) per foot of well screen are expected from SVE systems operating at IBW–South. A minimum of 500 to 1,000 pore volume exchanges of air is assumed to be needed,

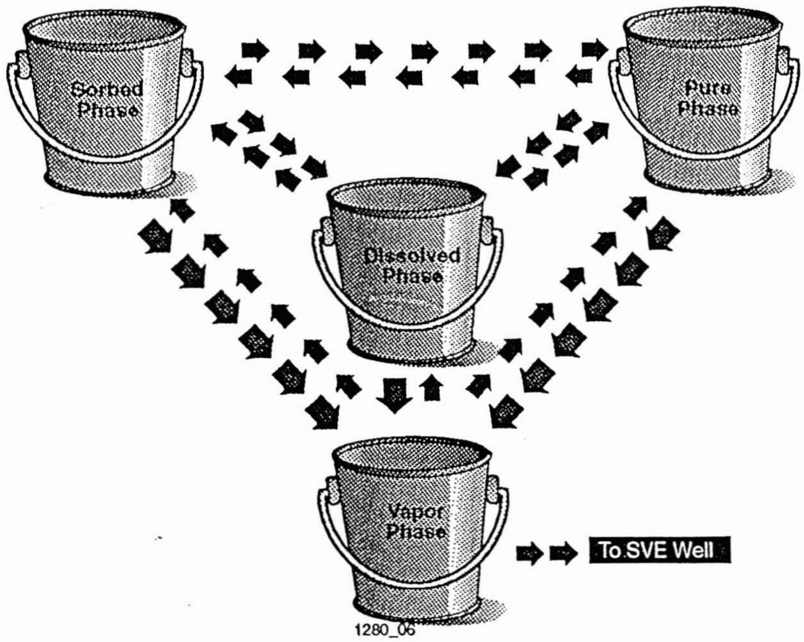


FIGURE II-21
TRANSFER OF CONTAMINANTS BETWEEN DIFFERENT PHASES IN THE SOIL MATRIX

and cleanup times are expected to take an average of 1 to 2 years and as many as 5 years. In cases where a period of more than 5 years is projected to be required for cleanup, EPA will consider the use of enhancements to the SVE remedy to increase its effectiveness.

8.2.2. Description of the No-Action Basis of Comparison

Selecting the No-Action Alternative would mean that nothing would be done to address the current VOC contamination in the vadose zone at IBW-South. Under the No-Action Alternative, any VOC contaminants in the vadose zone would remain in place and would be allowed to continue to migrate in the subsurface.

Specifically, the contaminants might become entrained in infiltrating rainwater and percolate downward to groundwater, or groundwater may rise to meet the contaminants; vapor phase contaminants in the vadose zone would also tend to migrate in all directions in response to a concentration gradient.

These VOC contaminants would also pose a potential exposure risk in excess of the risk-based Plug-in Criteria (see Section 8.3.5) should future excavation activity penetrate the VOC-contaminated areas.

8.2.3. *Nine-Criteria Comparison with No-Action and SVE*

Overall Protection of Human Health and the Environment

The No-Action Alternative would not be protective of human health and the environment. By definition, subsites exceeding Plug-in Criteria for which no action was taken would pose a cancer and non-cancer risk to human health in excess of levels in the Plug-in Criteria (specified in Section 8.3.5) and therefore pose an unacceptable threat to human health and the environment. Under the No-Action Alternative, contaminated soil and soil gas would be left in place with continued groundwater impacts caused by the downward migration of VOCs and the potential for human exposures should excavation into contaminated soil occur. The presence of these soils as continuing sources of potential groundwater contamination could also compromise any groundwater remedy that EPA might propose in the future.

Figure II-22 graphically compares threats to human health and the environment under both the No-Action Alternative and the SVE Alternative.

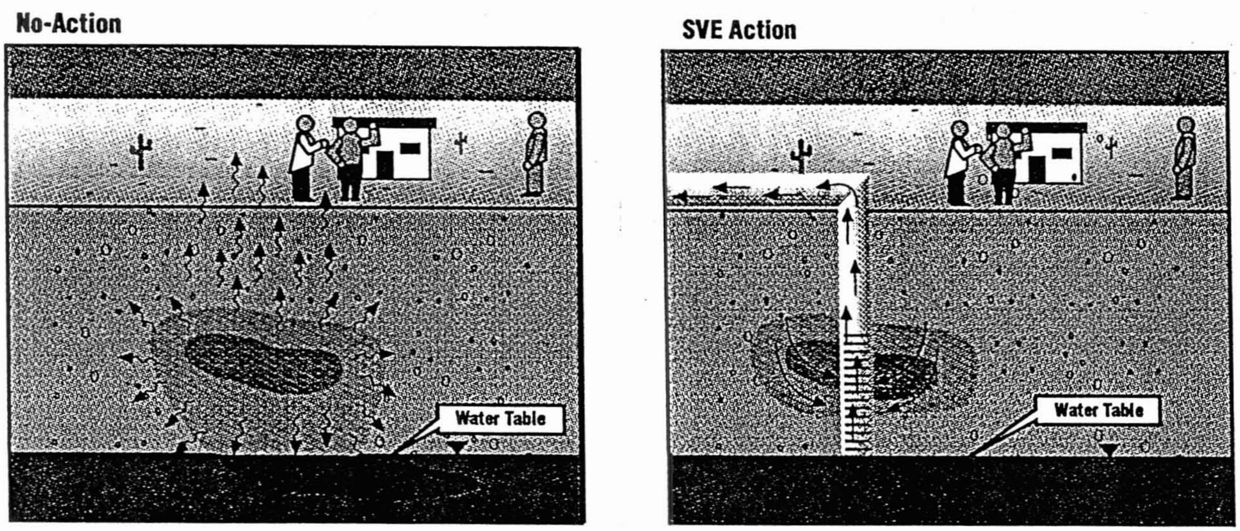


FIGURE II-22
OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT–NO-ACTION AND THE SVE ALTERNATIVE

The SVE Alternative will offer overall protection of human health and the environment because the threatening contaminants will be removed from the vadose zone and either destroyed or captured onto sorbents. Some low-level VOC emissions could occur during remediation; therefore, onsite monitoring will be conducted to check for unacceptable VOC emission levels.

By reducing the amount of VOCs remaining in the vadose zone, SVE will reduce significantly the cancer and non-cancer risk to human health and also the potential for future negative impacts to groundwater and ambient air. During operation, an SVE system will overcome the natural migration mechanisms that lead to groundwater and ambient air contamination, lending additional protection to human health and the environment during operation.

Table II-3
Overall Protection of Human Health and the Environment–Summary

	Soil Vapor Extraction	No Action
Alternative protects human health	✓	
Alternative protects the environment	✓	

Compliance with ARARs

Because the ARARs for this remedy are primarily action-specific, rather than chemical-specific (see Appendix A), the No-Action Alternative may not violate ARARs directly. However, the No-Action Alternative might render a potential groundwater remedy unable to meet ARARs, as VOC contamination sources would continue. The SVE alternative will meet chemical-, action-, and location-specific ARARs. SVE systems for IBW-South will be designed to comply with all ARARs identified by EPA. Appendix A discusses ARARs for this operable unit.

Table II-4
Compliance with ARARs–Summary

	SVE	No Action
Alternative can comply with chemical-specific ARARs	✓	
Alternative can comply with action-specific ARARs	✓	Not Applicable
Alternative can comply with location-specific ARARs	✓	Not Applicable
Alternative can comply with other regulatory criteria	✓	

Long-Term Effectiveness and Permanence

The No-Action Alternative would not alter the human health risks posed by contamination at a particular source area. No controls would be used on the contamination residing in the vadose zone. While dispersion and degradation of contaminants would occur naturally, the ability to accurately estimate these mechanisms is weak, and it cannot be assumed that degradation would take place before the contaminants reached groundwater wells or before humans were exposed to them.

The SVE system will remove the contaminants from the vadose zone to levels that comply with ARARs and health-based criteria. SVMWs will be used to monitor the amount of VOCs remaining in the vadose zone during treatment.

The SVE system will continue to operate until the mass of VOCs in the vadose zone has been reduced below the Performance Standards in this ROD. The SVE technology will be able to meet these standards for subsites that match the Remedy Profile. SVE enhancements such as steam or hot air injection may be required for subsite conditions outside the Remedy Profile. Onsite monitoring will be conducted to check for low-level VOC emissions.

Pilot-study data from the PGA Superfund site indicate that SVE will adequately remove VOCs from vadose zone soils similar to those at IBW-South. SVMWs will be required to monitor effectiveness of SVE during remediation.

When the SVE action is completed, any remaining soil contaminants should be at levels that no longer pose a threat to human health or the environment. The removal of VOCs will be permanent.

O&M activities required for the SVE Alternative include:

- Monitoring of the offgas for low-level VOC emissions
- Monitoring of SVMWs
- Monitoring system components to check for failures and to identify the need for replacement equipment (components of this system are readily replaceable if necessary)

Table II-5
Long-Term Effectiveness and Permanence–Summary

	Soil Vapor Extraction	No Action
Treatment residuals will be rendered harmless	✓	
Long-term controls are adequate and reliable to monitor residual untreated VOCs in the vadose zone	✓	
In situ residual contamination will be reduced to levels protective of human health and the environment	✓	

Reduction of Toxicity, Mobility, or Volume through Treatment

The No-Action Alternative would not reduce toxicity, mobility, or volume through treatment. No treatment activities are associated with the No-Action Alternative.

Reduction of toxicity, mobility, and volume of contaminants by use of an SVE system is graphically depicted in Figure II-23.

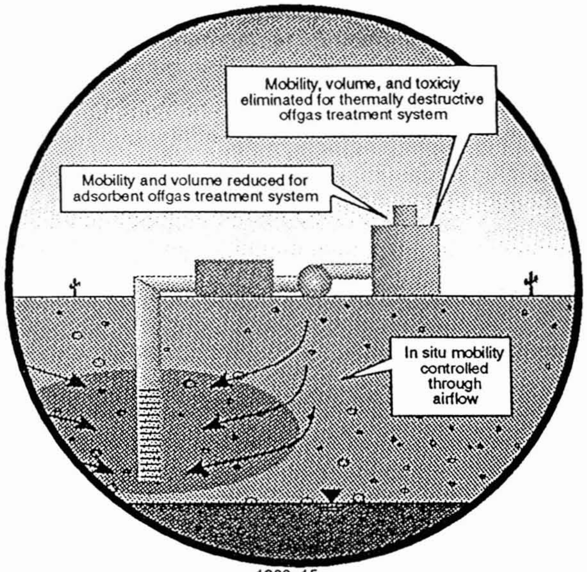


**FIGURE II-23
REDUCTION OF TOXICITY, MOBILITY, OR VOLUME–
THE SVE ALTERNATIVE**

SVE will physically remove the VOCs from the vadose zone. A variety of different offgas treatment options could be used to remove the VOCs from the airstream. Offgas treatment options specified in Section 8.2.4 include adsorptive treatment (such as vapor-phase activated carbon), thermal destruction, and catalytic oxidation. The selection of an appropriate offgas treatment method occurs in remedial design and will be based on data from specific subsites (see Section 8.2.4).

The Reduction of Toxicity, Mobility, or Volume criterion must be evaluated for two separate questions: First, are there reductions with respect to the contaminant that actually remains in the ground? Second, are there reductions with respect to the contaminant that has been removed from the ground and is now present in some form at the ground surface?

Toxicity

Toxicity of any VOCs left in the ground after SVE would be the same, strictly speaking. However, there would no longer be exposure pathways to humans due to groundwater or soil gas itself. Therefore, the potential for toxic effects *is* reduced. The toxicity of the VOCs after removal would depend on the offgas treatment selected. Where adsorption-based systems are used, the toxicity of the adsorbed VOCs is not reduced, should anyone be directly exposed to the adsorbent. Such exposure is unlikely, and because the adsorbent would be removed from the site, the only humans at risk would be workers handling the adsorbent, and they would have received training to handle it safely.

Where catalytic oxidation or thermal destruction is used, the toxicity of the VOCs is removed permanently, as they are destroyed by the process.

The type of treatment residuals generated by an SVE system depends on the selected offgas treatment method. Vapor-phase activated carbon offgas treatment would generate spent carbon, requiring either regeneration or disposal. A method such as thermal destruction or catalytic oxidation that included a scrubber unit to neutralize HCl would produce scrubber water with high total dissolved solids and pH. These residuals are far less toxic than the original VOCs. The air-water separator may also produce wastewater containing VOCs. The quantity of treatment residuals would be assessed for each subsite after sufficient RI data have been obtained to estimate the quantities of VOCs in the vadose zone. EPA has selected Performance Standards for treatment-derived wastewater in Section 8.3.7.

The statutory preference for treatment at Superfund sites is best met by the catalytic oxidation and thermal destruction offgas treatment options, as these permanently destroy the waste. However, the preference is also significantly served by SVE with an adsorption offgas treatment system, such as vapor-phase activated carbon.

Mobility

SVE will strongly reduce contaminant mobility in the ground by containing the spread of the contaminant both vertically and laterally, and eventually removing it altogether. This will prevent most of the VOCs from reaching the water table. Groundwater moves very quickly at IBW-South, and VOCs become much more mobile after reaching the water table.

The mobility of the contaminants after removal will also be reduced with the SVE Alternative. All offgas treatments will either trap or destroy the VOC contaminants, rendering them immobile. The small percentage of VOC contaminants that pass emission controls, which are 95 percent or more effective will become more mobile in the atmosphere.

Volume (and Mass)

By physically removing contaminants from the ground, SVE will significantly reduce the mass and volume of overall contaminants remaining in the ground at IBW-South. The mass and volume of VOCs that will be removed depends on the areal and vertical extent of contamination at the subsite in question. Information from Focused RIs at individual subsites can be used to estimate the amounts of material that will be treated by SVE at each subsite that meets the Plug-in Criteria.

Figure II-24 graphically depicts the reduction of volume of contaminants by SVE systems over time.

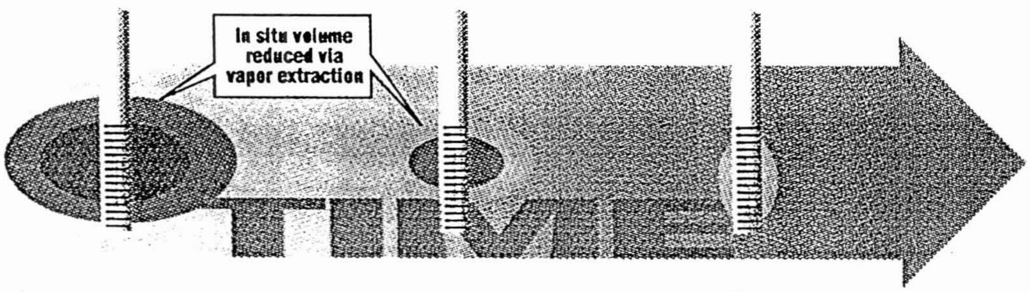


FIGURE II-24
REDUCTION OF CONTAMINANT
VOLUME OVER TIME–
THE SVE ALTERNATIVE

The actual final volume of the contaminants themselves, after removal from the ground, will depend on the offgas treatment used. This remedy contains use of offgas treatment in all cases. With offgas treatment systems based on adsorption, such as vapor-phase carbon, the contaminant on the adsorbent still retains its original mass and has a certain volume. However, this volume is dramatically reduced because the contaminants have been concentrated onto the adsorbent. This makes the contaminants more manageable and, potentially, more reusable.

With catalytic oxidation or thermal treatment, the contaminants are destroyed, so the mass and volume are virtually eliminated. Destruction efficiencies of 95 to 99 percent can be achieved by these offgas treatment options.

Table II-6
Reduction of Toxicity, Mobility, or Volume through Treatment–Summary

	SVE with Carbon or Regenerative Sorbent Offgas Treatment	SVE with Thermally Destructive Offgas Treatment	No Action
Toxicity of VOCs above ground is reduced		✓	
Toxicity of VOCs below ground is reduced	✓	✓	
Mobility of VOCs above ground is reduced	✓	✓	
Mobility of VOCs below ground is reduced	✓	✓	
Volume of VOCs above ground is reduced	✓	✓	
Volume of VOCs below ground is reduced	✓	✓	
Treatment process is irreversible		✓	Not Applicable

Short-Term Effectiveness

Since no remedial action occurs for the No-Action Alternative, no short-term effects would occur that differ from the current condition. No-Action would provide no disruption to the community or to property owners, and in the short-term, public exposures to VOCs would be minimal.

Implementation of the SVE Alternative will entail construction-related risks during drilling of vapor extraction and monitoring wells. However, with appropriate and readily available monitoring and protective equipment, safety risks associated with installation and operation of SVE systems at IBW-South should not be any greater than those associated with similar drilling activities at uncontaminated sites. The ground is not opened to the atmosphere with an SVE system, other than to drill boreholes for monitoring wells. There is little potential for public exposure to the contaminants in the short-term. Standard worker safety plans, in accordance with Occupational Safety and Health Act ("OSHA") regulations at 29 CFR Section 1910.120, shall be followed for all drilling activities.

Some environmental impact may occur during construction activities for the SVE Alternative, including noise and vibrations during drilling and disruptions of streets and sidewalks during the laying of manifold piping. Some noise may also be generated during SVE system operation, but should be sufficiently muffled to avoid becoming a public nuisance.

It is difficult to predict the time required to meet remedial response objectives with the SVE Alternative for any particular subsite. Extraction rate is a function of site-specific characteristics such as quantity and nature of VOC contamination, air permeability, and depth to groundwater. On the basis of extraction rates cited by other SVE remediation projects, the SVE Alternative at IBW-South is expected to remove the bulk of the vadose zone contaminant mass in a time frame on the order of several years. VOCs begin to be removed as soon as pumping begins.

There are potential short-term risks associated with the various offgas treatment options. With catalytic oxidation and thermal destruction, there is a small chance that these systems would fail, resulting in an untreated discharge of soil gas to the atmosphere. However, the risk associated with this is small for three reasons. First, at any given time there is only a small mass of soil gas in the system, so there is no potential for a large, uncontrolled release of VOCs. Second, any such discharge would be of short duration, as the system would be shut down. Third, the contaminant concentration in the airstream is relatively low to begin with; it would likely meet air quality regulations even without treatment.

The other short-term risk from these offgas treatment systems is the very small amount of VOCs that are not treated. This amount is not expected to exceed 5 percent of the influent concentration and should average less than 1 percent. EPA does not believe this will cause any adverse health effects. All discharges will meet ARARs and Performance Standards selected in this ROD to ensure protectiveness during remedial implementation.

With adsorption offgas systems, there is essentially no short-term risk associated with handling the spent carbon and, potentially, no short-term risk with the VOCs at their final destination (a RCRA landfill, regeneration facility, or in the case of an accident, on the ground).

About 40 gallons per week of wastewater may be generated from the air/water separator during SVE system operation. This wastewater will be tested, and if found to be hazardous, will be handled in a manner compliant with all ARARs. Section 8.3.7 specifies concentration levels at which water from the air/water separator must be handled as a hazardous waste.

If a scrubber is necessary to neutralize excess hydrochloric acid with an offgas treatment using catalytic or thermal oxidation, then water with high total dissolved solids and high pH may result. Such water would be handled in accordance with all ARARs. If found to be a

RCRA characteristic waste, the water would be treated to remove the characteristics, or properly removed from the site as a hazardous waste.

If water from either process is sampled and found to be non-hazardous, it may be discharged to the ground surface or evaporated, as appropriate. No such water will be injected into the ground via wells or discharged into surface waters.

Table II-7
Short-Term Effectiveness–Summary

	SVE with Offgas Treatment	No Action
Protection of community during implementation of Remedial Action	✓	
Protection of workers during implementation of Remedial Action	✓	
Ability to comply with air quality standards	✓	
Environmental impacts during construction in compliance with regulations	✓	Not Applicable
Remedial response objectives achievable within an acceptable timeframe	✓	

Implementability

The No-Action Alternative implies no action is implemented.

The activities required for installing an SVE remediation system include drilling the necessary extraction and monitoring wells, laying out the manifold piping, and plumbing the piping into the selected offgas treatment unit. Construction and operation of an SVE system are readily achievable in the IBW-South environment. The Arizona Department of Environmental Quality ("ADEQ") estimates that approximately 70 SVE projects in Maricopa County are currently in the process of being permitted or are operating. Nationwide, EPA has selected 83 SVE remedial actions for Superfund sites that are in the pre-design, design, or operational phase. In some instances, problems siting equipment in optimal locations are likely and expected; however, equipment placement should generally be possible and in most cases, be implementable with a minimum of disruption to surrounding activities.

SVE has proven to be effective at remediating VOC-contaminated soils at many other sites [Hutzler, N. J., et al., 1991, as cited in the FS, Admin. Rec. No. 1599]. The equipment required for an SVE system is well-proven and reliable. It is also replaceable should a failure occur.

Additional remediation may be required at subsites that have metals or other non-VOC contaminants in the vadose zone. Additional remediation may also be necessary at subsites where the underlying groundwater is highly contaminated with VOCs. If VOC levels in groundwater are high, the VOCs can migrate upward from the water table and recontaminate the vadose zone. The SVE system, once having achieved cleanup standards and the other requirements of this ROD for VOCs in the vadose zone, may be dismantled and removed from the site so that it will not interfere with other potential remedial actions.

Monitoring can be used to measure the effectiveness of the SVE remedy through two mechanisms:

- Monitoring of SVMWs to provide an estimate of the amount of residual mass of VOCs remaining in the vadose zone

- Monitoring of the offgas to provide a measure of the mass of VOCs that have been removed from the vadose zone

Pertinent regulatory interests outside of EPA include air discharge (Maricopa County and ADEQ), installation of extraction and monitoring wells (Arizona Department of Water Resources), and right-of-way and traffic (City of Tempe). Onsite remedial actions are exempt from administrative permit requirements by CERCLA §121(e).

Offsite treatment is not required for the SVE remedial action since treatment occurs onsite. Facilities with adequate storage capacity and necessary disposal services are available to support the implementation of SVE at IBW–South.

Cost

There would be no direct cost associated with the No-Action Alternative. There may, however, be indirect costs associated with loss of the groundwater resource. These costs were not quantified by the Feasibility Study for this Operable Unit.

Feasibility cost estimates are projected on the basis of the total costs of a remedial alternative for the duration of the alternative. These estimates have an expected accuracy of approximately +50 to -30 percent.

Catalytic oxidation was selected as the representative offgas treatment option for performing the cost estimate because reasonable cost estimates can be provided, calculated from an assumed extraction flow rate and time of operation.

In contrast, reasonable cost estimating for a vapor-phase activated carbon offgas treatment system requires subsite-specific remedial investigation data on the types and total mass of VOCs in the vadose zone. RI data are currently inadequate to provide accurate cost estimates for vapor-phase activated carbon offgas treatment at any particular subsite. However, an estimate using vapor-phase carbon to treat chlorinated solvents in soils at IBW–North was prepared in 1991 [U.S. EPA, 1991, *Public Comment Draft North Indian Bend Wash RI/FS Report*, IBW–North Admin. Rec. Nos. 1874 to 1878]. For a two-well SVE system operated for 2 full years, the estimated 1993 present worth cost was approximately $720,000, assuming a 5 percent discount rate for the years 1991 to 1993.

Subsites with relatively low extracted vapor concentrations that can economically use vapor-phase activated carbon may have substantially lower remediation costs than those presented below. Figures II-25 and II-26 represent present-worth and annualized cost estimates, respectively, for a single SVE system with one, three, or five extraction wells. The effect of adding enhancements is shown in the Table II-8. Use of enhancements is described in Section 8.2.5, and more detail on cost is presented in the Feasibility Study.

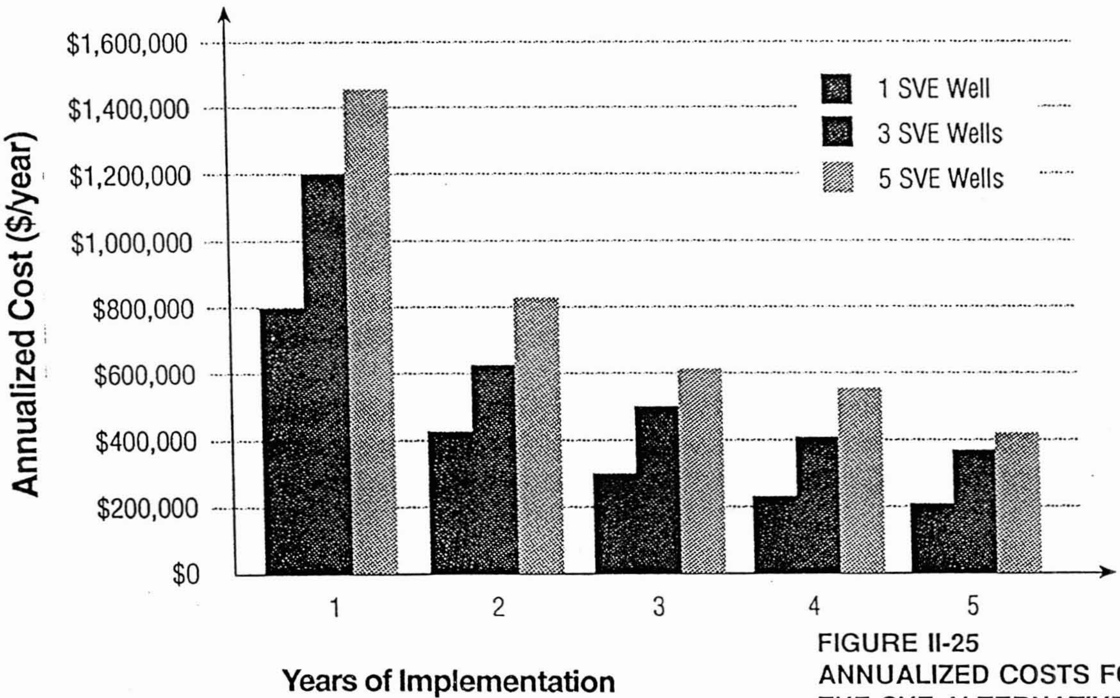


FIGURE II-25
ANNUALIZED COSTS FOR THE SVE ALTERNATIVE

Table II-8
Cost Estimate of Various SVE Enhancements

Enhancement	Cost of Enhancement
Hot air injection	1.5 to 2.5 times non-enhanced SVE system cost
Steam injection	1.5 to 2.5 times non-enhanced SVE system cost
High vacuum SVE system	1 to 1.5 times non-enhanced SVE system cost
Horizontal extraction wells	1 to 1.5 times non-enhanced SVE system cost
SVE system with ground surface sealing	1 to 1.5 times non-enhanced SVE system cost
Bioventing	0.5 to 1 times non-enhanced SVE system cost

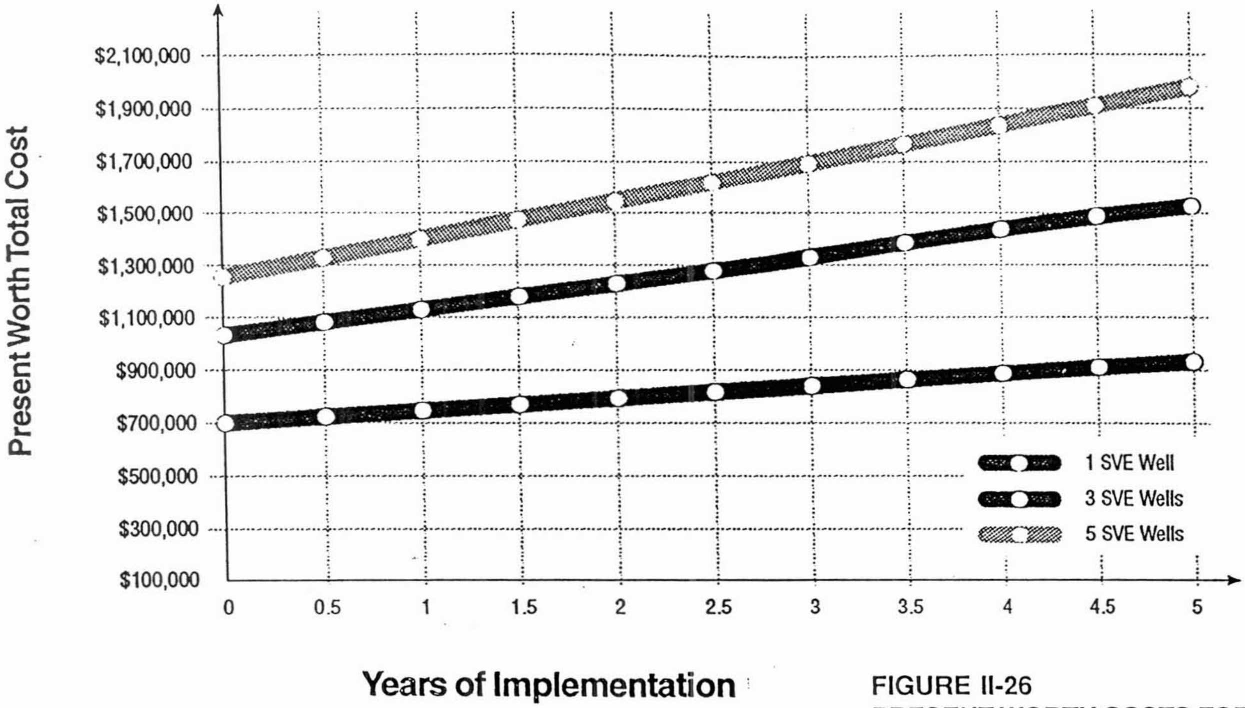


FIGURE II-26
PRESENT WORTH COSTS FOR THE SVE ALTERNATIVE

State Acceptance

The State of Arizona concurs with the use of the SVE alternative for VOCs in the vadose zone at IBW–South above health-based limits, and with the use of the Plug-in Approach, as selected by this ROD. The State prefers the use of SVE over the No-Action Alternative.

Community Acceptance

The community's response to EPA's proposed remedy, and EPA's response to public comments and concerns, are in the Response Summary, in Part III of this ROD. Those responding to EPA's proposal and attending public meetings accepted the Plug-in Concept and the use of the SVE technology, in general. Concerns centered on who will be held liable for contamination and the amounts of liability. Also of concern was the indirect effect of the Superfund site on financing and real estate. These issues are addressed in the Response Summary. EPA received no comments requesting that EPA select the No-Action Alternative.

8.2.4. Emission Control (Offgas Treatment) Design Options and Requirements

The "offgas" is the air that is removed from the ground by an SVE system. During remedial action, this air contains the VOCs extracted from the soil, the subject of this Operable Unit. EPA's proposed remedy included three options for emission controls, or treatment of this offgas, and stipulated that any of the options may be used at any particular facility.

All SVE systems operated as part of this remedy will contain continuous emission controls. EPA has selected use of emission controls for several reasons:

- The greater Phoenix area is a non-attainment area for ozone under the Clean Air Act, and several of the VOCs in question are precursors to ozone in the atmosphere, thus adding to photochemical smog problems.

- Because a Plug-in Approach is being used, there could be several SVE systems operating concurrently, thus raising the issue of cumulative impacts if the VOCs were directly discharged without treatment.

- The SVE systems will be operating in an area with relatively high VOC solvent use.

Offgas treatment selection for any given subsite shall be made during remedial design for that subsite, but shall be chosen from among three available options. Offgas treatments among these options shall be considered part of this selected remedy. If offgas treatments other than those specified by this ROD are necessary, then EPA will amend the ROD or issue an explanation of significant differences ("ESD"), as appropriate. EPA will declare the likely offgas treatment for a given subsite at the time that the subsite plugs in to the remedial action.

The selection of an appropriate offgas treatment method at any particular subsite will be made on the basis of subsite-specific remedial design data. The specific offgas treatments discussed in Chapter 3, Section 3.1.3, of the Feasibility Study [Admin. Rec. No. 1599] are hereby selected as the available offgas treatment design options for this remedy. These include:

- **Adsorptive Treatment.** This treatment option includes the use of vapor-phase activated carbon or other sorbents. Offgas treatment by vapor-phase activated carbon is well-proven for VOC-contaminated air. Carbon treatment is accomplished by placing vessels containing activated carbon in the vented airstream. Other proven methods of adsorptive offgas treatment include the use of proprietary sorbents that are regenerated onsite.

  These treatments work by adsorbing the VOCs from the offgas. Organic molecules are selectively adsorbed to the surface pores of the carbon or sorbent granules, and contaminant is transferred from the air to the sorbent. This technique is commonly used to remove organic vapors from air.

  Carbon treatment requires periodic carbon replacement as the carbon surfaces become saturated with VOCs. The saturated or "spent" carbon then requires transport to a licensed regeneration facility or to a treatment, storage, or disposal facility approved by RCRA (meets the requirements of the Resource Conservation and Recovery Act). Operation and maintenance ("O&M") costs for carbon treatment can become prohibitive for soil gas concentrations in excess of 1 part per million by volume (ppmv). Some non-carbon regenerable sorbents can be regenerated without disposal, leaving pure VOCs only for recycling and disposal.

- **Catalytic Oxidation and Thermal Oxidation.** Thermal treatment and catalytic oxidation are alternative methods that destroy the VOCs in the offgas. The two methods are similar in that heat is used to reduce VOCs to complete products of combustion. However, in catalytic oxidation, a catalyst causes VOC destruction to occur 10 times more quickly and at temperatures approximately 50 percent lower than required for thermal destruction. These technologies will reduce chlorinated VOCs to carbon dioxide, water, and hydrochloric acid (HCl). A caustic scrubber would be required at the outlet of the treatment unit to neutralize the HCl.

  Unlike adsorbent systems, thermal treatment and catalytic oxidation literally destroy the VOC contaminants. Such systems would produce offgas of essentially carbon dioxide and water vapor. VOC contaminants that may remain in the offgas would be below standard air discharge limits for facilities. Such offgas may have lower VOC levels than the surrounding ambient air.

  Thermal destruction may be the most economical for extracted vapor concentrations in excess of 2,500 ppmv. Catalytic oxidation may be the most economical for extracted vapor concentrations ranging from 600 to 2,500 ppmv. Proprietary sorbents and onsite regeneration may be economically feasible at any concentration encountered in SVE and should be considered on a case-by-case basis for specific subsites.

Any of these offgas treatments can be designed for a minimum 95 percent removal efficiency, and can be safely and economically implemented and operated.

Figure II-27 shows the concentration levels at which the various treatments would be considered most effective and economical. This is intended as a guideline only. EPA will decide which option to use in a given case based on the rate of extraction required, the location of buildings and other constraints, and other design considerations and data.

Performance Standards for Emissions Controls

As described in Appendix A (ARARs), EPA has considered the following Maricopa County Air Pollution Control Division rules in establishing performance standards for emission controls. These rules are *not* ARARs for this remedy. However, these rules were used in setting air emission Performance Standards for the IBW-South site based on the potential impacts of the soil vapor extraction systems that likely will be in operation at the site.

- Rule 210–Lists requirements for major sources of air emissions, defined by Rule 210, §212 as capable of emitting 100 tons per year or more of any air pollutant subject to regulation under the Clean Air Act.

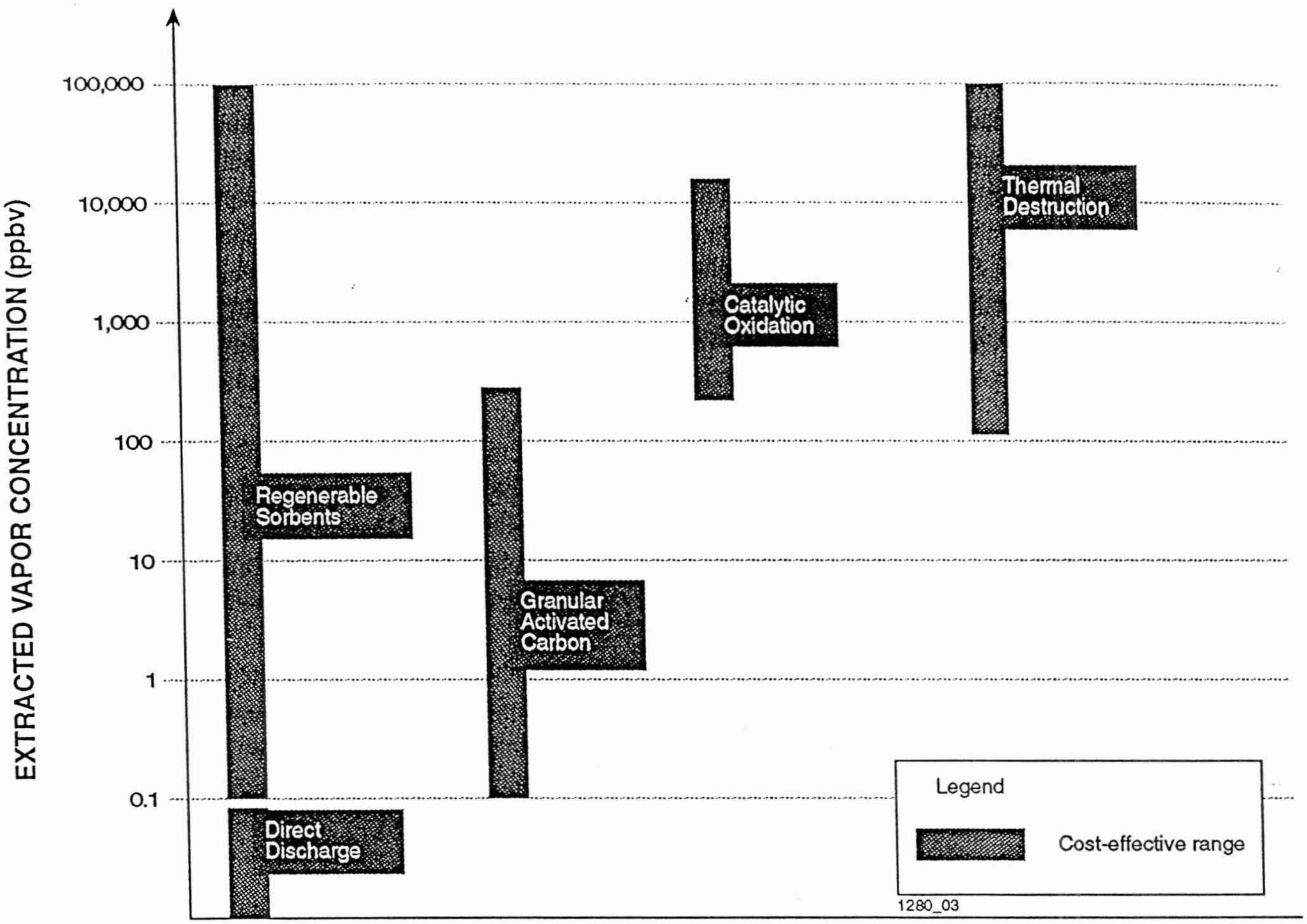


FIGURE II-27
EFFECTIVENESS OF OFFGAS TREATMENT OPTIONS WITH VARIOUS CONCENTRATIONS OF EXTRACTED VAPOR

Rule 210, §304 requires a new stationary source which emits up to 150 pounds/day or 25 tons/year of VOCs to apply reasonably available control technology ("RACT"). RACT is defined in §220 as the lowest emission limitation that a particular source is capable of achieving by the application of control technology that is reasonably available considering technological and economic feasibility.

- Rule 210, §303 provides that sources emitting more than 150 pounds per day are required to use <u>best</u> available control technology ("BACT").

- The January 1991 MCAPCD Guidelines for Remediation of Contaminated Soil provide that up to 3 pounds per day of total emissions from soil remediation projects are allowable if no air pollution controls are being used. If air pollution controls are being used, the controls must have an overall efficiency of at least 90 percent.

- Rule 330, §301–Prohibits discharge of more than 15 pounds of VOCs into the atmosphere in any one day from any device involving heat.

- Rule 330, §302–If heat is not involved, VOC emissions are limited to no more than 40 pounds per day.

- Rule 330, §304–If either of the limitations set forth in §301 or §302 is exceeded, the emissions must be reduced by incineration with a 90 percent oxidation rate to carbon dioxide, adsorption with an 85 percent capture rate, or other similarly effective process. This section also states efficiency requirements for the emissions reduction process.

EPA believes that the emission control options for this remedy would meet both RACT and BACT requirements (although emissions from SVE systems are not expected ever to exceed the 150-pounds-per-day threshold for BACT). As stated above, emissions controls will be applied to *all* SVE systems. The following additional performance standards shall apply to emission controls:

- Emission controls for offgas treatment shall attain a minimum 90 percent efficiency rate (either by removal or oxidation to CO_2 and H_2O)

- Routine monitoring of the offgas shall be performed during the remedial action, to ensure that no ARARs or performance standards are being violated.

- If the emission controls should fail, the SVE system will be shut down until the emission controls are again effective.

8.2.5. SVE Enhancements–Design Options and Performance Standards

SVE enhancements are specific technological supplements that allow SVE to remove contaminants more efficiently. Enhancements are not separate remedies, but design options for the SVE remedy. Based on data seen to date, EPA does not believe that enhancements will be necessary for most subsites at IBW–South. However, this remedy contains a list of seven enhancement options that shall be available as part of this remedy. If an enhancement is to be used at a particular subsite, it shall be determined as part of the remedial design of the SVE system for that subsite. At the time of plug-in, EPA will declare in the public notice of the plug-in (see Section 8.3.3) whether enhancements are expected, and which enhancements are most likely. If enhancements or modifications other than the seven options listed in this section are necessary, EPA will amend the ROD or issue an explanation of significant differences ("ESD") to address such changes.

SVE enhancements may be required for specific subsites at IBW-South to accomplish either of two objectives:

1. To expand the range of conditions over which SVE is effective (i.e., expansion of the SVE Remedy Profile) at subsites that exhibit conditions near, but not within the Remedy Profile. This may allow a larger variety of subsites to plug in and allow SVE to be implemented where it would otherwise not be possible. For example, part of a subsite may contain a significant layer of clay with low air permeability. An SVE enhancement could be used to bring the VOCs out of the clay more efficiently.

2. To optimize SVE system operation (improve the efficiency and performance) of SVE systems at subsites exhibiting conditions that do fall within the Remedy Profile. While SVE can remediate such subsites, it may take too long to do so. Performance improvements would provide increased rate of contaminant removal or decreased remediation cost.

EPA will consider the use of an enhancement as part of a subsite remedial design plan when:

1. EPA projects that the cleanup time for a subsite or part of a subsite will be greater than 5 years, or

2. One or more of the following physical conditions are present:

    - Contaminants are present with vapor pressures less than 1 mm Hg at 20° C.

    - Contaminants are present with Henry's Law constants less than 100 atmosphere per mole-fraction.

    - Soil intrinsic permeability is less than 1 x 10^{-3} darcies, either over all depth, or in any significant stratigraphic layer which holds VOCs.

    - Soil water saturation exceeds 60 percent.

    - Depth to groundwater is less than 5 feet.

3. The use of an enhancement is necessary in order to meet an ARAR or other requirement specified by this ROD.

However, where use of an enhancement would lessen the cost of overall remediation, then even where the above conditions do not exist, an enhancement may be considered. EPA does not anticipate that SVE enhancements will be necessary in most cases at IBW–South. When they are used, it is expected that in most cases it will be with the objective of increasing the rate of VOC withdrawal, thereby shortening overall cleanup times. In such cases, SVE may be effective with or without the enhancement, but it is more economically and environmentally feasible to run the enhanced SVE system for a shorter time, rather than unenhanced SVE for a longer time.

At a limited number of subsites, enhancements may be needed to allow SVE to work at all; these subsites would fall outside the Remedy Profile without an enhancement.

Most SVE enhancements will have an effect on the projected cost of an SVE system. This effect is generalized in Section 8.2.3 and in Chapter 3 of the Feasibility Study. The thermal enhancements are most expensive, while the physical and operational enhancements are the least expensive. Ground surface sealing, for instance, may add little cost compared to the cost of a basic SVE system, if the subsite is small. The degree to which an enhancement will affect cost will depend on whether the enhancement is part of the original design of the SVE system, or is added after the system is in place; also whether it effects operation and maintenance costs, or only implies an initial capital outlay. Costs may be offset by savings derived from a shorter cleanup timeframe that is achieved with the enhancement. EPA believes that it is appropriate to presume SVE is a cost-effective remedy at IBW-South, even after accounting for the potential use of enhancements.

Figure II-28 lists available SVE enhancements for IBW-South. Table II-9 summarizes the description of the enhancements and general guidelines for which enhancements are indicated under which conditions. The conditions used are Remedy Profile parameters and limits. A more detailed discussion of enhancements and the technical situations for their use is presented in Chapter 4 of the Feasibility Study.

SVE Enhancements

Physical
- High Vacuum SVE
- Horizontal SVE Wells
- Ground Surface Sealing

Thermal
- Hot Air Injection
- Steam Injection

Biological
- Bioventing

Operational
- Pulsed System Operation

FIGURE II-28
AVAILABLE SVE ENHANCEMENTS
AT IBW–SOUTH

8.3. Plug-In Process Specification

8.3.1. Overview

As previously discussed, this remedy contains both a remedial technology, selected in Section 8.2, and a process for determining whether a subsite must execute it. This section defines the process that shall be used to determine which subsites shall plug in to the SVE remedy. This section also specifies the cleanup performance standards for subsites that are plugged in.

Table II-9
Description of Enhancements

Enhancement	Description	Indications
Hot air injection (THERMAL)	Hot air injection wells are used in tandem with extraction wells to increase the tendency of subsurface VOCs to volatilize into the vapor phase. Increases vapor pressure and Henry's constant of VOC contaminant, and therefore rate of removal of VOCs. Removes excess soil moisture, increases rate of VOC diffusion.	VOC vapor pressure < 1 mm Hg @ 20° C, or VOC Henry's Law Constant < 100 atm/mole-fraction, or soil intrinsic permeability < $1x10^{-3}$ darcies, percent soil water saturation > 60%.
Steam injection (THERMAL)	Hot air injection wells are used in tandem with extraction wells to increase the tendency of subsurface VOCs to volatilize into the vapor phase. Increases vapor pressure and Henry's constant of VOC contaminant, and therefore rate of removal of VOCs. Increases rate of VOC diffusion.	VOC vapor pressure < 1 mm Hg @ 20° C, or VOC Henry's Law Constant < 100 atm/mole-fraction, or soil intrinsic permeability < $1x10^{-3}$ darcies.
High vacuum SVE system (PHYSICAL)	High vacuums are applied through zones of low air permeability to increase the removal of contaminants. Increases air permeability of the soil.	Percent soil water saturation > 60%, depth to groundwater less than 5 feet, soil intrinsic permeability < $x10^{-3}$ darcies.
Horizontal extraction wells (PHYSICAL)	Horizontal wells are installed to access zones of subsurface contamination not accessible by conventional SVE wells.	Depth to groundwater less than 5 feet, low-permeability zones running laterally, zones inaccessible to normal SVE wells.
SVE system with ground surface sealing (PHYSICAL)	Ground surface is sealed to increase the lateral influence of SVE wells and to prevent excessive air leakage from the atmosphere which reduces SVE efficiency.	Depth to groundwater less than 5 feet.
Bioventing (BIOLOGICAL)	SVE wells are operated at low flow that allows biological activity to break down biodegradable contaminants. Increases oxygen content of soils.	VOC vapor pressure < 1 mm Hg @ 20° C, or VOC Henry's Law Constant < 100 atm/mole-fraction,
Pulsed System Operation (OPERATIONAL)	SVE wells are operated intermittently in accordance with a schedule. Shifts partitioning equilibrium. Allows more VOC to diffuse out of zones of lower permeability. Minimizes "rebound" at end of cleanup. Increases total VOC recovery.	VOC vapor pressure < 1 mm Hg @ 20° C, optimization of SVE system needed.

Those subsites that EPA screens from further consideration *prior* to requiring a Focused RI are not considered to be subject to a Plug-in Determination. The specific sampling, modeling efforts, and risk estimations described in Section 8.3 of this ROD will not be performed for such subsites. Therefore, no determination will be made as to whether such subsites exceed the Plug-in Criteria. However, by screening out such subsites without requiring a Focused RI, EPA will have determined that insufficient evidence exists to consider them as contaminant sources.

The decision tree (Section 8.3.8) is the blueprint for Plug-in Decisions. The tree incorporates the elements of the process specified in Section 8.3.

8.3.2. Options at the Plug-In Decision Point

The possible options at the Plug-in Decision Point are shown in Figure II-29. Most cases are expected to move through the "plug-in directly" route.

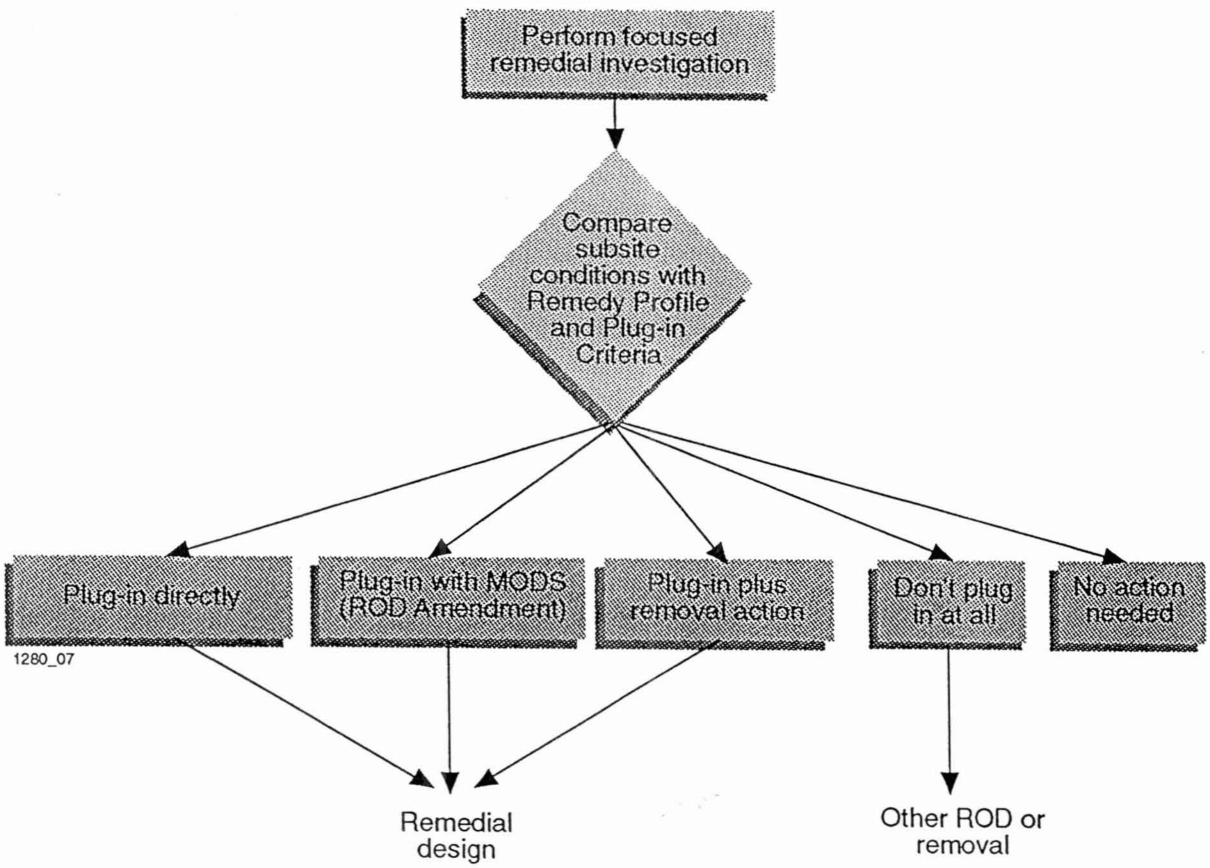


FIGURE II-29
EVENTS FOR A TYPICAL SUBSITE

The Presumed Remedial Alternative is designed so that it will apply to a majority of subsites. Nonetheless, EPA has several options to address subsites that exceed the Plug-in Criteria, but have contaminants other than VOCs, or exhibit other characteristics outside the Remedy Profile. In such a case, the subsite cannot be plugged in to the remedy directly, because the Presumed Remedial Alternative, SVE, will be at least partially inappropriate. In such instances, EPA may decide to select a remedy for that subsite by another means. Options would include taking removal actions in conjunction with plugging the subsite into the remedy, amending or otherwise modifying the remedy to address special situations at the subsite, or selecting an entirely separate remedy. Such remedies would be subject to all requirements of CERCLA and the NCP.

8.3.3. How Plug-in of a Subsite Will Be Administered

For any subsite passing through a Focused RI, EPA will make the results of the Focused RI available to the public. EPA will prepare a document showing the results of the Plug-in Process specified in this section for the subsite. This will include the comparison of the data from the subsite with the Remedy Profile and Plug-in Criteria. In this document, EPA will make a determination as to whether the subsite plugs in. The determination will be published regardless of whether the subsite plugs in.

EPA will summarize, and give notice of the availability of the Focused RI and EPA's Plug-in Determination in a factsheet, which will be distributed to EPA's Community Relations mailing list and to the local libraries. For each subsite that EPA determines *will* plug in to the remedy, EPA will hold a 30-day public comment period. Prior notice of the comment period will be given in the factsheet. During this comment period, *EPA will only address comments on*: (1) whether the Plug-in Process as determined by this ROD was followed in making the Plug-in Determination, and (2) whether subsite-specific data were used in an appropriate fashion. Neither the Plug-in Process itself, nor the use of the SVE technology, will be re-opened for public comment during such periods.

It is this ROD <u>in conjunction with</u> a subsite-specific Plug-in Decision made in accordance with the process in this ROD, that constitutes a final decision for VOCs in soils at a particular subsite.

8.3.4. Specification of the Remedy Profile

Table II-10 specifies the unenhanced Remedy Profile for IBW–South.

Table II-10 Remedy Profile Parameters for Soil Vapor Extraction	
Remedy Profile Parameter	**Remedy Profile Boundaries and Range of Inclusion**
Soil Permeability of the Vadose Zone	Greater than 1 x 10^{-3} darcies
Percent Saturation	Less than 60 percent
Depth to Groundwater	Greater than 5 feet
Henry's Law Constant of Contaminant	Greater than 100 atm/mole fraction
Vapor Pressure of Contaminant	Greater than 1.0 mm Hg @ 20°C

8.3.5. Specification of the Plug-in Criteria

This remedy addresses VOCs in soils as future sources of groundwater and air contamination. The amount that the concentration of VOCs in groundwater or air would increase due solely to VOCs in a subsite's soils is referred to as the *incremental concentration*, and the risk to public health posed by the incremental concentration of VOCs is referred to as the *incremental risk* from that subsite. For IBW-South, the Plug-in Criteria are limits on the incremental risk and incremental concentrations of VOCs from a subsite.

The Plug-in Criteria for IBW-South are *not* point-specific concentration limits for the soil medium itself. Rather, they apply to the effect of soil VOCs on *other* media. This effect is estimated by the process put forth in Section 8.3.6. For IBW-South, EPA has defined four of the five Plug-in Criteria in terms of incremental risk by three pathways of exposure for VOCs in soil identified in the risk assessment (Appendix A of the Feasibility Study; also summarized below in Section 8.4).

The reasoning for risk pathways assigned to each criterion was discussed in the Feasibility Study ("FS"), Chapter 5, and the Risk Assessment, Appendix A of the FS.

The cancer risk Plug-in Criteria, based on 1 in 1 million, or 10^{-6} excess cancer risk, may be considered conservative (erring on the side of greater safety). However, in this case, EPA believes that reasonably protective levels are appropriate for several reasons. First, there are as yet unquantified risks, such as groundwater risks, that may apply to IBW-South. EPA must allow for all risks at the site. Second, the proximity of the contaminated subsites to each other cannot be fully determined initially, introducing some uncertainty as to the cumulative effects of the risks posed by the subsites. Third, it is important to ensure that the future threat to groundwater is reduced sufficiently so no subsite could by itself produce enough groundwater contamination to make a groundwater remedy necessary in areas where it is not otherwise needed today. Finally, the Arizona drinking water classification for IBW-South aquifers, which is an ARAR, requires that stringent source control be implemented with the objective of keeping or restoring the aquifer to drinking water standards.

In short, there is sufficient uncertainty and cause to select Plug-in Criteria for VOCs in soils that are near the more protective end of EPA's risk range of 10^{-4} to 10^{-6}.

The Plug-in Criteria for this remedy are shown in the Table II-11. Execution of SVE will be required if the VOCs present in the soils at a subsite would, as calculated by the risk assessment, exceed any of the five criteria listed.

Table II-11 The Plug-in Criteria	
1	Present a cancer risk (incremental risk) of more than 1 in 1 million to a person from both ingestion of VOCs in groundwater and inhalation of VOCs during other household uses of groundwater, such as showering, over a lifetime.
2	Present a cancer risk to a person of more than 1 in 1 million from inhalation of air above the soils at the subsite itself, over a lifetime.
3	Present a hazard index for non-cancer effects of more than 1 to a person from both ingestion of VOCs in groundwater and inhalation of VOCs during household uses of groundwater, over a lifetime.
4	Present a hazard index for non-cancer effects of more than 1 to a person from inhalation of air above the soils at the subsite itself, over a lifetime.
5	Increase the concentration of VOCs in groundwater (incremental concentration) by an amount greater than the federal Maximum Contaminant Level (MCL) under the Safe Drinking Water Act.

There is one Plug-in Criterion (No. 5) that is not based directly on risk, but rather on federal drinking water standards. Note that this Plug-in Criterion does *not* set a limit on the allowable total concentration of VOCs in groundwater. Rather, it limits that part of the groundwater concentration due solely to the incremental (extra) VOCs from soils at a subsite that would reach the groundwater over time. Therefore, by this criterion, a subsite would not be allowed to increase the existing groundwater concentration by more than one "MCL's worth" of any VOC.

This standard is purposely designed so that, where there is no groundwater contamination today, a single subsite would not be able to raise the groundwater concentration above the MCL in the future. However, where there is groundwater contamination today, a separate groundwater cleanup may be necessary to ensure protective groundwater levels.

Table II-12 presents a list of the MCL standards that will be used as the basis for Plug-in Criterion No. 5. This criterion (No. 5) shall not be in effect for compounds which have no MCL (shown in Table II-12 as "--"). Adequate human health protection from such compounds will be provided by the other four Plug-in Criteria. In fact, in the majority of cases, the risk-based Plug-in Criteria (Nos. 1 through 4) will be more stringent than Criterion No. 5. Note that the MCLs are *not* ARARs for this remedy (See Appendix A) because this remedy does not directly address groundwater. Rather, EPA has chosen MCLs as one basis for selecting Plug-in Criteria.

Table II-12 Standards for Plug-in Criterion No. 5: Federal MCLs (Concentrations in µg/l)			
Acetone	--	trans-1,2-Dichloroethylene	100
Benzene	5	1,2-Dichloropropane	5
Benzyl Chloride	--	1,3-Dichloropropene	--
Bromodichloromethane	100	Dichlorotetrafluoroethane	--
Bromoform	100	Ethylbenzene	700
Bromomethane	--	Hexachlorobutadiene	--
Carbon Tetrachloride	5	Methylene chloride	--
Chlorobenzene	100	Methyl Ethyl Ketone	--
Chloroform	100	Styrene	100
Chloromethane	--	1,2,2,2-Tetrachloroethane	--
Dibromochloromethane	100	Tetrachloroethylene	5
1,2-Dibromoethane	0.05	Toluene	1,000
1,2-Dichlorobenzene	600	1,2,4-Trichlorobenzene	70
1,3-Dichlorobenzene	600	1,1,1-Trichloroethane	200
1,4-Dichlorobenzene	75	1,1,2-Trichloroethane	5
Dichlorodifluoromethane	--	Trichloroethylene	5
1,1-Dichloroethane	--	Trichlorofluoromethane	--
1,2-Dichloroethane	5	1,1,2-Trichloro-2,2,1-Trifluoroethane	--
cis-1,2-Dichloroethane	70	Vinyl Chloride	2
1,1-Dichloroethylene	7	Xylenes (Total)	10,000

The risk assessment presents a complete strategy for integrated risk management so that it can be verified that all remedies for IBW-South, operating together, are protective of human health. The Plug-in Criteria are based only on those exposure pathways pertinent to the contaminants in this Operable Unit, the VOCs-in-Vadose-Zone soils. The Plug-in Criteria are not intended to have any bearing on whether a groundwater remedy may be necessary at a later date for contaminants already in the groundwater.

8.3.6. Specification of How Exceedance of the Plug-In Criteria Will be Evaluated

The process described in this section is depicted in Figure II-30.

VOCs in the vadose zone at a subsite may pose a threat if they migrate from soils to groundwater or to ambient air. The purpose of the soil remedy is to limit the amount of VOCs that can enter the groundwater or the air, due to any particular subsite. Evaluating the threat of a subsite must depend, therefore, on making an estimate of the *incremental* VOCs that will enter the groundwater (or the atmosphere) over time *due to any one subsite*. The process in this section will be used to estimate the maximum effect that the VOC mass distribution at a subsite will have on groundwater or ambient air in the future. This estimated effect will then be compared with the Plug-in Criteria.

Focused RI Data Collection

Data will be obtained from Focused RIs for each subsite subject to the Plug-in Process. Information obtained during the Focused RI at each subsite shall include, at a minimum:

- Subsurface lithology from soil borings

- Identification and vertical distribution of non-VOC contaminants in the vadose zone from soil samples obtained from soil borings

- Vertical distribution and type of VOC contaminants in the vadose zone from soil gas samples obtained from SVMWs

- Sufficient numbers of SVMWs and shallow soil gas samples to provide a mass estimate of vadose zone contamination at the subsite

- Groundwater quality information obtained by sampling monitoring wells installed at the subsite

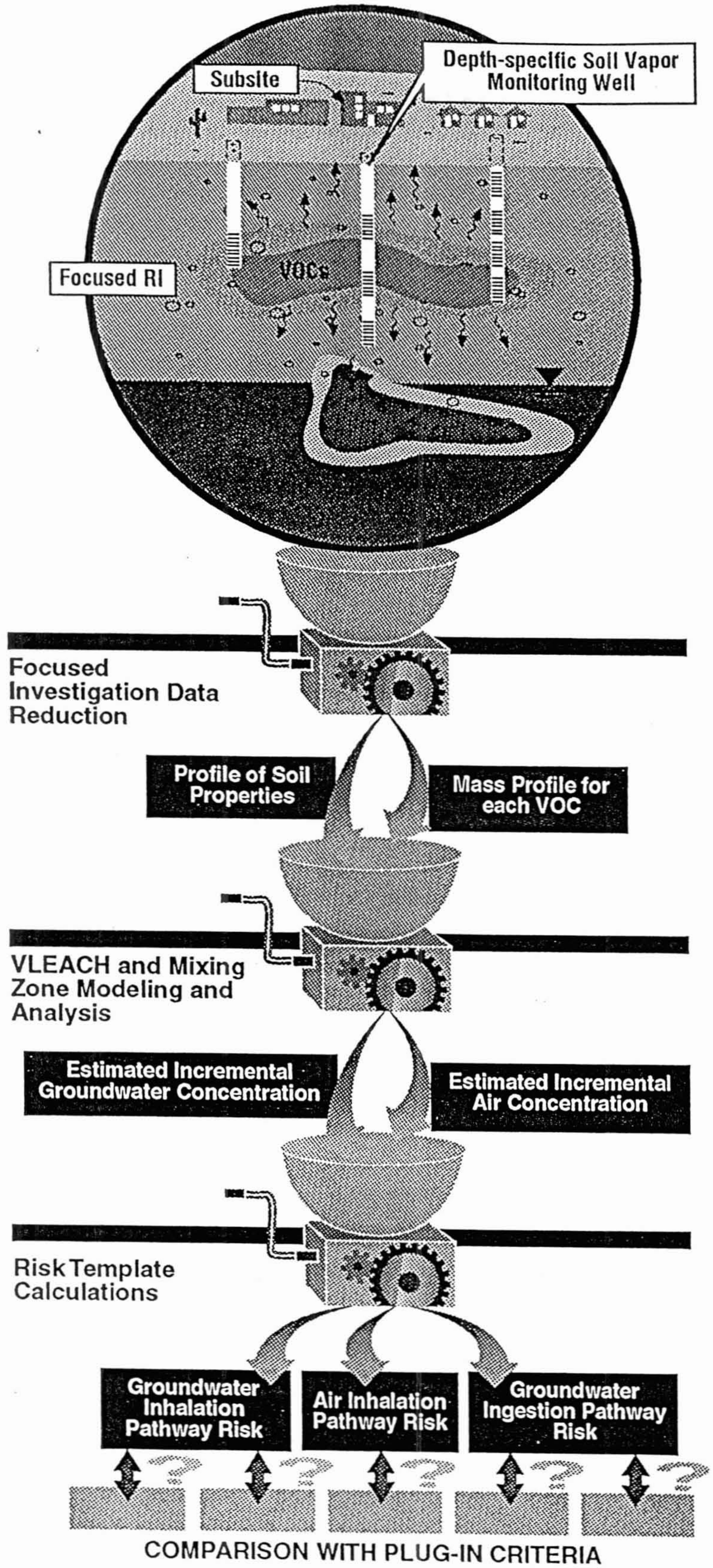
- Any additional information or activities determined necessary by EPA pursuant to regulation, statute, or EPA guidance.

A Focused RI may obtain data on contaminants other than VOCs. It is not necessary for a subsite to be fully characterized for these non-VOC contaminants prior to beginning the Plug-in Process.

Performance of VOC Mass Estimates with Depth

For subsites with VOCs in the vadose zone, the total contaminant mass and the horizontal and vertical distribution of mass shall be estimated for each VOC. The sources of data that will be available to estimate the horizontal and vertical mass distribution are shallow soil gas surveys and depth-specific soil gas samples collected from SVMWs during the Focused RI. The measured soil gas concentrations shall be converted to total contaminant mass estimates.

The horizontal distribution of near-surface contamination will be estimated from shallow soil gas survey data. The mass of contaminant represented by each measured soil gas concentration can be estimated by assuming that each soil gas data point is representative of a given area of soil surrounding the sampling location.



1280_11

FIGURE II-30
THE SUBSITE EVALUATION APPROACH WITHIN THE PLUG-IN PROCESS
INDIAN BEND WASH - SOUTH ROD

The estimation of the vertical distribution of VOC mass in the vadose zone may be more uncertain due to a lower density of data points available to characterize the distribution. If the data collected from SVMWs indicate a consistent contaminant distribution with depth across the subsite, the results from the shallow soil gas survey can be applied to a normalized depth distribution to obtain the vertical contaminant distribution at each sampling location. If the vertical contaminant distributions vary across the subsite, the subsite will be divided into regions. The vertical contaminant distribution in each region shall be defined separately by the data collected from the SVMWs. Subsequent calculations, determinations, and completion of cleanup for each area shall then be accomplished and verified for each area separately.

VLEACH Vadose Zone Transport Model

EPA will estimate the maximum future incremental concentrations from the VOCs in soils at any one subsite by using a computer model. The model to be used shall be the EPA computer model VLEACH, or an equivalent model approved by EPA for IBW–South. VLEACH is a one-dimensional, computer-based finite difference model. The mass distribution of VOCs with depth in soils is input to VLEACH. The model then simulates the movements of VOCs in the vadose zone and predicts the mass loading (flux, or rate of leaching) of volatile contaminants to groundwater and ambient air over time. A separate VLEACH analysis is required for each VOC identified in the vadose zone.

VLEACH shall be applied in accordance with Appendix C of the Feasibility Study, which is incorporated by reference into this ROD. That appendix presents a more detailed model description, the VLEACH user's guide, a listing of the VLEACH FORTRAN code, a sample input file, and an application case study. VLEACH shall be applied in accordance with the example given in the case study (unless otherwise approved by EPA) and with all other requirements in this ROD. EPA shall approve the design of the model application. Should a later version of VLEACH be approved by EPA, the later version, and its user's guide, shall replace the version and user's guide presented in Appendix C of the Feasibility Study and shall become applicable to the Plug-in Process under this remedy.

In cases where EPA determines that the outcome of VLEACH is mathematically certain without running the model, EPA may approve that the conclusion be accepted without running the model. For example, one could make the extreme assumption that the entire VOC mass in the vadose zone instantly arrived in groundwater. An estimate of the effect of VOCs on groundwater under such an assumption would be much greater than a corresponding VLEACH estimate, as VLEACH computes the gradual arrival of VOCs over many years. If even under this assumption, the Plug-in Criteria would not be exceeded, then actually running VLEACH may not be necessary. EPA will have sole discretion to make such determinations.

It should be noted the VLEACH model simulates the movement of VOCs in the vadose zone. If other contaminants, such as semi-volatiles or heavy metals, are detected during a Focused RI, the subsite cannot directly plug in to the VOCs-in-Vadose-Zone remedy. Other means will then be required to assess contaminant transport to groundwater, and these would be developed by a separate or modified remedial action.

Mixing Zone Model Calculations

The flux (output) from VLEACH is then input into a "Mixing Zone Model." There is one mixing zone model for groundwater and one for ambient air. EPA will use the **maximum** flux over time, as estimated by VLEACH, in the mixing zone model. The model calculates an incremental concentration in groundwater or air due to VOCs in the vadose zone at one subsite.

Estimating Incremental Groundwater Concentrations: The Groundwater Mixing Zone

For groundwater, a simple mixing zone model shall be used to convert the maximum mass fluxes of VOCs over time predicted by VLEACH into concentration levels. The simple mixing zone approach calculates groundwater concentrations on the basis of an assumed mixing depth in the aquifer beneath the subsite and an estimated flow of clean groundwater originating from upgradient sources.

The saturated thickness of the UAU beneath the IBW-South site has been observed to vary dramatically with recharge from the Salt River. In the simple mixing cell model, EPA proposes to use a mixing depth of 50 feet, or the saturated thickness of the UAU, whichever is less. This scheme is proposed for several reasons.

First, 50 feet is a reasonable estimate of the recent thickness of the UAU during dry (non-river flow) conditions. It is not reasonable to use the current saturated thickness of the UAU (about 80 to 90 feet) because wet (river flow) conditions currently exist, and the thickness of the UAU in the short term is therefore increased compared to its long-term average. The leaching of the contaminants will occur over a long timeframe in the future, during which dry conditions are more likely to prevail, especially after the planned raising of the upstream dams on the Salt River.

Second, 50 feet is a reasonably conservative estimate for the length of a well screen that might be used on a drinking water well.

Third, if the mixing zone depth is much more than 50 feet, the assumption of uniform mixing departs too far from the realm of plausibility.

EPA may change the mixing cell model procedure if necessary to address technical conditions. As an example, if the UAU were to dewater entirely, the model would have to address the MAU rather than the UAU, and different parameters may be indicated.

Note that clean water flow-though is assumed in the mixing cell model, even though the current groundwater may be already contaminated. This is because the Plug-in Criteria address the incremental VOCs resulting from leaching from soils only. Existing groundwater contamination will be addressed by a separate remedy, as necessary. EPA's overall integrated risk strategy does allow for existing groundwater contamination.

Alternate methods to estimate incremental groundwater concentrations may be considered if EPA believes they are better suited for the individual subsite being evaluated.

Estimating Incremental Ambient Air Concentrations: The Air Mixing Zone

A box modeling technique shall be used to convert the maximum mass fluxes of VOCs predicted by VLEACH into air concentrations. The formulation of the model is based on guidance presented in EPA's *Assessing Potential Indoor Air Impacts for Superfund Sites*, 1992, as cited in the Feasibility Study, Admin. Rec. No. 1599. While an indoor air model is used, the parameters are formulated to address both indoor and outdoor conditions at the subsite. Estimation of air concentrations is based generally on the following:

$$C = \frac{E}{Q} \qquad [1]$$

Where:

C = Air concentration (g/m^3)

E = Contaminant infiltration rate into the structure (g/s)

Q = Structure ventilation flow rate (m^3/s)

Assuming that soil gas enters a structure only by diffusion, contaminant infiltration into the building can be estimated as:

$$E = J \times A \times F \qquad [2]$$

Where:

J = Contaminant flux estimated from VLEACH (g/m^2-s)

A = Floor area of the structure (m^2)

F = Fraction of floor area through which soil gas can enter. $F \simeq 0.7$ to 1.0 for buildings with ventilated crawl spaces

The structure ventilation flow rate can be estimated as follows:

$$Q = \frac{ACH \times V}{3600\, s/hr} \qquad [3]$$

Where:

ACH = Building air changes per hour (1/hr), typical ranges from 0.5 to 1.5

V = Building volume (m^3)

The incremental air concentration is then calculated by dividing the contaminant infiltration rate (***E***) by the ventilation flow rate (***Q***).

Other similar modeling methods may be used with EPA's approval, depending on subsite-specific conditions.

Risk Templates

Once the model has estimated the incremental concentrations, the risk templates in the Risk Assessment (Appendix A of the Feasibility Study, and also included in this document at the end of Part II) can be used to estimate the incremental risk (the risk due to the incremental concentration). The risk templates are simple spreadsheets which act as a "fill in the blanks" baseline risk assessment into which the toxicological profiles and scenarios of the Risk Assessment are already installed. Incremental concentrations are entered on the left, the prescribed calculations are run, and the estimated incremental risk emerges on the right.

The calculated risks then will be compared to the risk-based Plug-in Criteria. If the Plug-in Criteria are exceeded, then a remedial action is required.

Virtually any VOC that may be present in the vadose zone at IBW-South will be represented on the templates; nonetheless, if a VOC is found at a subsite that does not appear on the template, *the templates for that subsite may be revised by EPA to incorporate that VOC*.

Figure II-30, presented earlier, illustrates the concepts just described. These procedures are referenced by the Decision Tree in Section 8.3.8.

8.3.7. Specification of Cleanup Performance Standards

The SVE system at each subsite that plugs in to the remedy will operate continuously until the VOCs in soils have been reduced such that Plug-in Criteria selected in Section 8.3.5 are no longer exceeded. Evaluation of whether Plug-in Criteria are still exceeded as cleanup nears completion shall be accomplished by the same process and methods used to determine that the Plug-in Criteria were exceeded originally; through sampling of soil vapor, use of the VLEACH and mixing zone models, and the risk templates.

The party responsible for remediating the subsite will be required to submit a monitoring plan along with the remedial design to EPA for approval. This monitoring plan shall include provisions to meet all requirements in this ROD, monitoring methods, schedules, documentation and tracking, methods of analysis, a time frame for continued monitoring after cleanup performance requirements have been met, and a provision for resuming remedial action if post-cleanup monitoring reveals exceedance of cleanup standards as defined in this ROD. The monitoring plan shall also include a reporting procedure to notify EPA when cleanup performance requirements have been met, with allowance for EPA to verify analysis. Monitoring plans and programs may be subject to other requirements based on EPA regulations or guidance.

Each subsite's monitoring program will audit the progress of the subsite's remedial action. SVMWs will be sampled periodically, according to an EPA-approved plan, to estimate the mass of contamination remaining in the vadose zone after a period of implementation. In addition, the contaminated offgas will be sampled periodically before and after treatment to assess the mass of contamination removed and the quality of the air discharge, in accordance with Section 8.2.4.

The remedial action plan shall identify additional requirements that shall apply to an SVE system before it is determined that the SVE system can be shut down. These requirements shall include:

1. A minimum number of samplings spaced evenly over a specified period of time that must show contamination not exceeding the Performance Standards before the SVE system can be shut down

2. After SVE system shutdown, a minimum number of samplings spaced evenly over a specified time period that must show contamination below the cleanup standards in this ROD, proving that contamination is not returning, before the SVE system is made no longer immediately available

3. A provision for using the pulsed pumping enhancement in the event that contaminant levels rebound

If a system is shut down after reaching cleanup standards, and VOC levels rebound to levels above the cleanup standards, then the above requirements shall apply anew.

Each subsite monitoring plan approved by EPA shall include a schedule of frequency and duration of long-term monitoring of the remedial action, and compliance with the 5-year review requirement in accordance with CERCLA §121(c).

Treatment-Derived Wastewater

An air/water separator may be required on SVE systems to remove soil vapor from the air stream prior to treatment. EPA will address this treatment-derived water in accordance with all identified ARARs. Among the options available would be to discharge this water to the sewer under a pretreatment permit, treat the water to health-based levels onsite, and to discharge the water to the ground surface if it is sampled and found not to be a hazardous waste.

In accordance with the policy stated in the memo from Sylvia Lowrance, Director of EPA Office of Solid Waste, to Jeff Zelikson, Director of EPA Region IX Toxics and Waste Management Division, dated January 24, 1989, groundwater from CERCLA actions may be considered to be not a RCRA waste if it contains chemicals in concentrations below health-based levels selected by EPA Region IX. Table II-13 shows these levels for the IBW-South site. If treatment-derived water is to be discharged to the land, the water will first be treated to these health-based levels.

In addition, if a scrubber is necessary to neutralize excess hydrochloric acid with an offgas treatment using catalytic or thermal oxidation, then water with high total dissolved solids and high pH may result. Such water would be handled in accordance with ARARs. If found to be a RCRA characteristic waste, the water will be treated to remove the hazardous characteristics before being discharged, or properly removed from the site as a hazardous waste.

8.3.8. The Decision Tree

Figure II-31 shows graphically the decision tree for the Plug-in Process that will be used for this remedy. The details of the process displayed by the decision tree are specified in the foregoing sections.

There are three major blocks on the detailed decision tree in Figure II-31. These correspond to the three fundamental questions:

A. Does the subsite fall within the Remedy Profile?

B. Is remedial action necessary for VOCs in soils (i.e., does the subsite exceed Plug-in Criteria)?

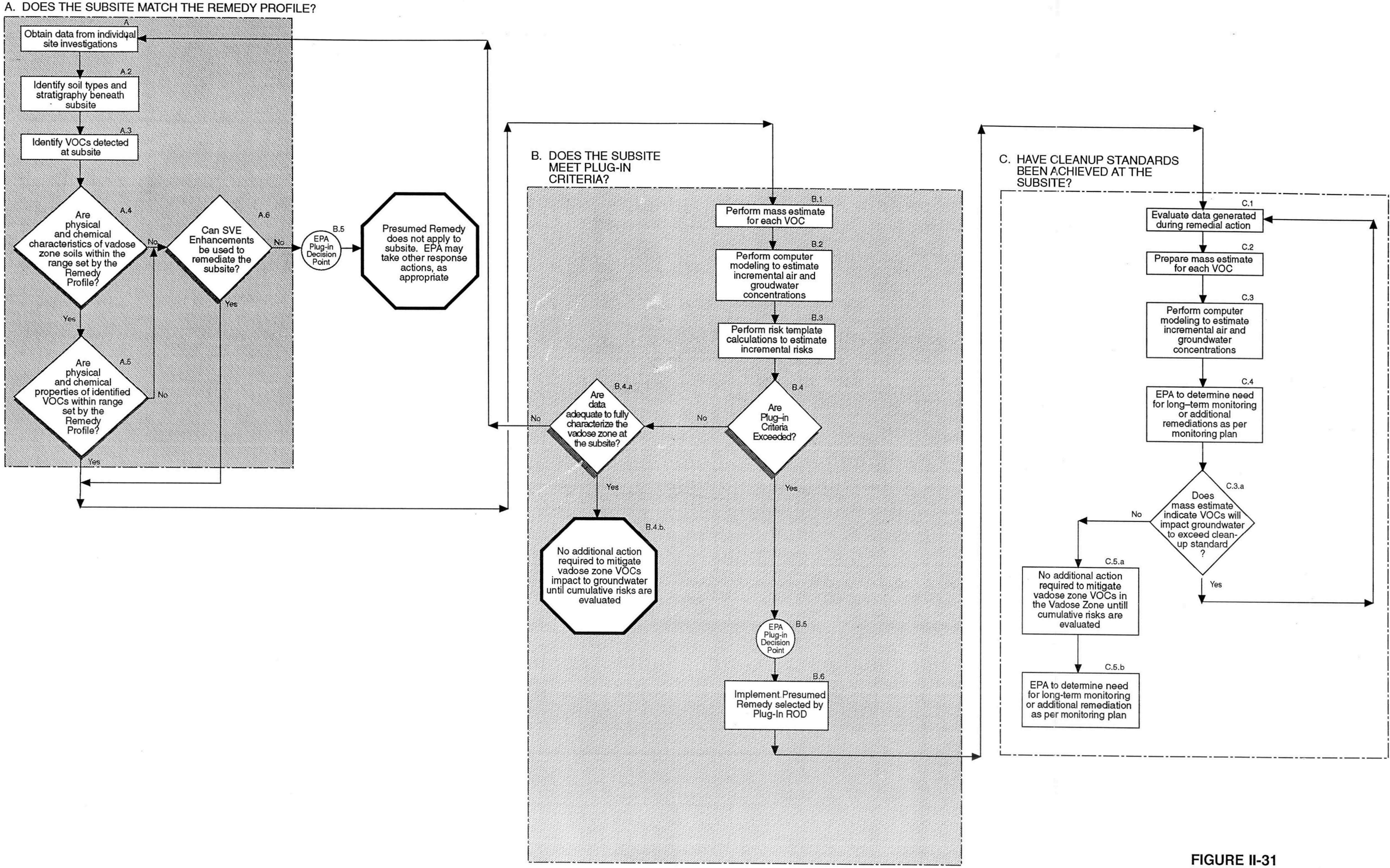
C. Have cleanup performance requirements been achieved at the subsite?

Table II-13
Threshold Values For
RCRA Hazardous Waste Classification at IBW-South
(Concentrations in µg/l)

Acetone	700[a]	trans-1,2-dichloroethylene	100
Benzene	5	1,2-Dichloropropane	5
Benzyl Chloride	140[a]	1,3-Dichloropropene	0.19[a]
Bromodichloromethane	100	Dichlorotetrafluoroethane	100[b]
Bromoform	100	Ethylbenzene	700
Bromomethane	9.8[a]	Hexachlorobutadiene	1.4[a]
Carbon Tetrachloride	5	Methylene chloride	5[c]
Chlorobenzene	100	Methylethylketone	350[a]
Chloroform	100	Styrene	100
Chloromethane	2.8[a]	1,2,2,2-Tetrachloroethane	0.08[d]
Dibromochloromethane	100	Tetrachloroethylene	5
1,2-Dibromoethane	0.05	Toluene	1,000
1,2-Dichlorobenzene	600	1,2,4-Trichlorobenzene	70
1,3-Dichlorobenzene	600	1,1,1-Trichloroethane	200
1,4-Dichlorobenzene	75	1,1,2-Trichloroethane	5
Dichlorodifluoromethane	1,400[a]	Trichloroethylene	5
1,1-Dichloroethane	1,000[d]	Trichlorofluoromethane	2,100[a]
1,2-Dichloroethane	5	1,1,2-Trichloro-2,2,1-Trifluoro-ethane	210,000[a]
cis-1,2-Dichloroethane	70	Vinyl Chloride	2
1,1-Dichloroethylene	7	Xylenes (Total)	10,000

[a]Level based on Arizona Health-Based Guidance Level for water.
[b]No formal toxicity standards exist for this compound, which is also known as FREON 114. Level is based on a limited no-observed-adverse-effect-level as determined by data from the Hazardous Substance Database, with an uncertainty factor of 10. The study used as the basis was *Campbell DD et al; Br J Ind Med 43:107-11 (1986).*
[c]Level based on proposed MCL.
[d]Level based on *EPA Region IX Preliminary Remediation Goals, Third Quarter, 1993,* for tap water, which are based on a 10^{-6} excess cancer risk or a non-cancer hazard index of 1 for a person drinking water at the concentration over an average lifetime.

Note: All levels based on MCL unless otherwise footnoted.



1280_09

FIGURE II-31
DECISION TREE - SPECIFIC
VOCs IN VADOSE ZONE FS
INDIAN BEND WASH - SOUTH ROD

8.4. Integrated Risk Approach and Risk Templates for Subsite Risk Characterization

8.4.1. *Summary of Integrated Risk Approach*

EPA's Interim Risk Assessment for IBW–South currently appears as Appendix A to the Feasibility Study. This section provides a summary of risk assessment for IBW–South. Because of the Plug-in Approach, a specialized approach is being used for site risks. The risk assessment with risk templates for completing risk characterization is hereby incorporated into the remedy by reference. The following is only a summary.

While the interim risk assessment identifies and considers risks to ensure protection of human health and the environment, risks must also be evaluated at different stages, timed with this and other Operable Unit remedies for IBW–South. The risk assessment presented in Appendix A of the Feasibility Study is therefore "interim" until all risks have been evaluated.

The current version of the interim risk assessment develops the framework for considering risks at *all* Operable Units of IBW-South, including future Operable Units not addressed by the VOCs-in-Vadose-Zone remedy. It then characterizes risks addressed by the VOCs-in-Vadose Zone remedy. When the FS and ROD for the groundwater remedy (and other remedies if needed) is completed, this risk assessment will be amended to evaluate groundwater risks and integrate them with the VOCs-in-Vadose-Zone risks. By considering all risks at the beginning, EPA will select interim risk goals for the Operable Unit remedies along the way so that the total risk after cleanup will not exceed EPA's acceptable risk range.

8.4.2. *Specialized Strategy for Plug-in*

The Plug-in Approach requires a specialized strategy for risk assessment for the VOCs in the vadose zone because the selection of the remedy occurs prior to completion of Focused RIs at each subsite. As of this date, the subsite-specific data are not available to determine the risk at any given subsite. *Therefore, the risk assessment becomes a component within the context of the Plug-in Process.*

In this strategy, the current risk assessment does not calculate the baseline risk for any given subsite. Rather, it performs all but the final calculations for a standardized subsite. Subsite data then "fill in" a risk template to arrive at the baseline risk. A separate baseline risk assessment for VOCs in soils is, in effect, complete each time the Plug-in Process is executed. Just as this ROD provides a standard remedy which becomes the remedy for a particular subsite when connected with a Plug-in Determination, so also the risk assessment and template become a baseline risk assessment for a particular subsite once subsite-specific data are available. Based on the resulting baseline risk, EPA can compare the subsite with the risk-based Plug-in Criteria.

The risk assessment supports setting the Plug-in Criteria, using the Plug-in Criteria to make a Plug-in Determination, and setting the cleanup standards for this remedy. The risk template serves as the standardized means for determining whether Plug-in Criteria have been exceeded.

8.4.3 Exposure Pathway Categories For IBW–South

Potential exposure pathways at IBW-South have been classified into three different categories. Each of the exposure pathway categories, or "compartments," can be conceptualized as one section of a *risk prism* (see Figure II-32). This risk prism is a geometric representation of the total risk that exists at IBW–South.

The three compartments are (1) potential exposure pathways associated with VOCs in the vadose zone (VOCs-in-Vadose-Zone Compartment), (2) potential exposure pathways associated with contamination in the groundwater (Groundwater Compartment), and (3) potential exposure pathways associated with metals or other non-VOCs in the vadose zone (Non-VOCs Compartment).

The pathways in the VOCs-in-Vadose-Zone Compartment are different in that they imply potential future rather than current exposures due to the VOCs migrating from the soils to the other media. Unless the VOCs are removed from the soil, these future risks will become current risks. Figure II-33 provides an illustration of the potential exposure pathways at the IBW-South site. The VOCs-in-Vadose-Zone remedy will address risks resulting from the pathways in the VOCs-in-Vadose-Zone Compartment. The groundwater remedy, if necessary, will address risks resulting from the pathways in the Groundwater Compartment.

Other Operable Units, removal actions, or even modifications to the VOCs-in-Vadose-Zone remedy may address risks resulting from the pathways in the Non-VOCs Compartment, if necessary.

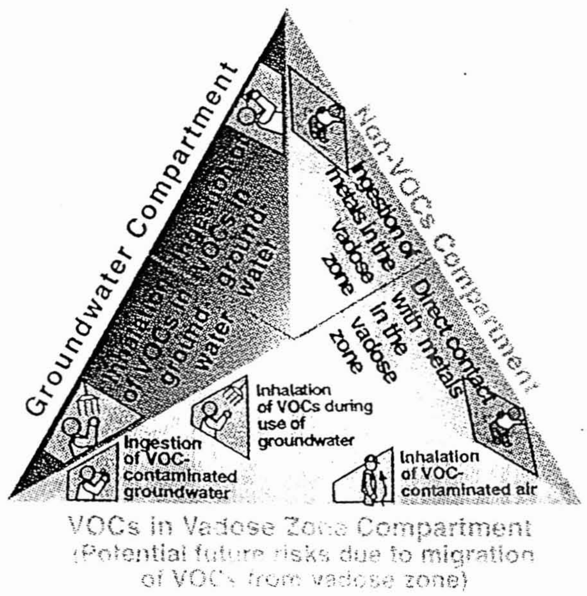
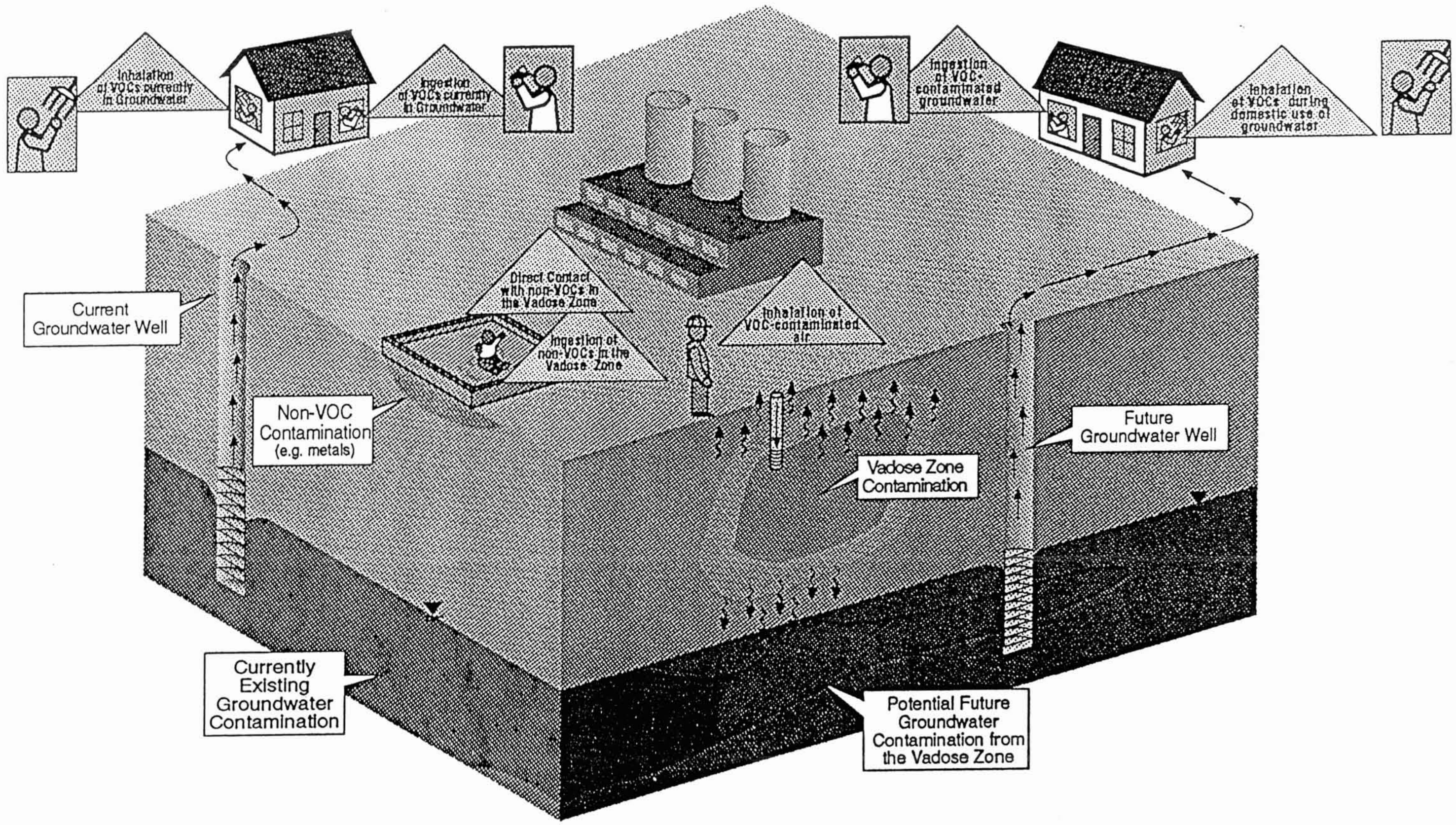


FIGURE II-32
RISK PRISM FOR IBW–SOUTH



Disclaimer: The intent of this figure is to illustrate possible exposure routes at IBW-South. The exposure scenarios shown may not exist at IBW-South.

FIGURE II-33
ILLUSTRATION OF POTENTIAL EXPOSURE PATHWAYS AT IBW-SOUTH
INDIAN BEND WASH - SOUTH ROD

1280_08

Because VOCs can migrate from soils to the groundwater, the pathways associated with the VOCs-in-Vadose-Zone Compartment nonetheless include exposure routes that *involve* groundwater. The Groundwater Compartment covers risks from contamination *currently* existing in the groundwater. In contrast, the VOCs-in-Vadose-Zone Compartment covers risks solely attributable to the potential for VOCs in soils *today* to enter the groundwater or the air in the future. The VOCs-in-Vadose-Zone Compartment addresses how much of an *incremental risk* is posed by the fact that VOCs currently reside in soils at a particular subsite.

8.4.4. Exposure Pathways Associated with VOCs in Vadose Zone

The pathways associated with the VOCs in Vadose Zone Compartment are those associated with the future migration of VOCs from the soils to other media, namely groundwater and ambient air. Where VOCs reside in the soils at depths beyond likely excavation, a direct exposure pathway does not exist. However, when the VOCs migrate, a potential pathway from VOCs in soil to a receptor is completed, through the other media. These pathways are called "future potential exposure pathways."

The future potential pathways for VOCs in soil, which the VOCs-in-Vadose-Zone Remedy must address, are:

1. Ingestion of VOCs that migrate from the vadose zone to the groundwater. An example of this would be a person in the future drinking domestic groundwater that was contaminated by VOCs observed today in the vadose zone.

2. Inhalation of VOCs that migrate from the vadose zone to the groundwater. An example of this would be a person in the future using domestic groundwater for shower water that was contaminated by VOCs observed today in the vadose zone.

3. Inhalation of VOCs, by a person in the future, that have migrated from the vadose zone through the ground surface to the ambient air at the subsite itself.

EPA expects that the third pathway is insignificant unless the concentration of VOCs at a subsite is fairly high and the VOCs are at a shallow depth. Nonetheless, to be protective, Plug-in Criteria will be based on this exposure pathway.

Plug-in Criteria for cancer and non-cancer contaminants have been developed for the sum of the risk from the first two pathways, and separately for the risk from the third pathway. This is based on the assumption that exposure by all three pathways at once is unlikely.

8.4.5. Summary of Chemicals of Concern and Toxicity Assessment

For the purposes of the risk assessment, "chemicals of concern" were taken to be the majority of chemicals on the EPA Method TO-14 list of volatile organics plus methylethylketone. Although not all of these chemicals have been detected at IBW–South, EPA developed the risk template using all the chemicals, so that if new VOC chemicals were discovered at subsites in the future, the risk templates would still serve as a standardized means of determining whether Plug-in Criteria were exceeded. These chemicals of concern , and their corresponding toxicity values and characteristics, are presented in Tables II-14 and II-15. These tables discuss the primary chemicals of concern, those that have actually been commonly detected at IBW–South. These include 1,1-dichloroethylene (1,1-DCE), cis- and trans-1,2-dichloroethylene (1,2-DCE), tetrachloroethylene (perchloroethylene, PCE), trichloroethylene (TCE), and vinyl chloride.

8.4.6. Summary of Basic Exposure Assumptions

For the ingestion of groundwater pathway, EPA assumed a residential scenario. The assumed exposed individual had a mass of 70 kg, and the exposure averaging time was 70 years for carcinogens, 30 years for non-carcinogens. Exposure duration was assumed to be for 30 years, 350 days per year. Ingestion rate was assumed to be 2 liters of water per day.

For the inhalation of VOCs during domestic use of groundwater pathway, the same assumptions were used, except the daily inhalation rate was assumed to be 15 cubic meters of air per day. Table II-16 on page II-87 shows the assumed efficiencies with which various household water uses would transfer VOCs to the air.

For the pathway involving inhalation of VOCs due to volatilization from soils at the subsite, the same assumptions were used, except that the inhalation rate was assumed to be 20 cubic meters of air per day, because the exposed individuals would likely be workers at IBW–South facilities. A residential scenario was imposed, nonetheless, because the future uses of the IBW–South area are uncertain. There are some mobile homes in the area, and residences border the study area on three sides. Once bank protection is provided to the Salt River banks, there is no guarantee that residential development will not occur. Therefore, to be protective of human health, a residential scenario has been used.

8.4.7. Templates: Risk Characterization at Each Subsite

As discussed previously, the incremental risk due to VOCs in soils at each subsite will be estimated and compared with the Plug-in Criteria, which place a limit on that risk. The Plug-in Criteria for the incremental risk due to VOCs in soils at each subsite are specified in Section 8.3.5 of this ROD.

Table II-14
Oral/Inhalation Carcinogenic Classification and Critical Toxicity Values for Chemicals of Concern
IBW-South Interim Risk Assessment

Chemicals[a]	Carcinogenic (oral/inhalation)			Noncarcinogenic (oral/inhalation)	
	Slope Factor $(mg/kg\text{-}day)^{-1}$	Weight of Evidence	Source	RfD (mg/kg-day)	Source
Benzene	0.029/0.029	A/A	IRIS/HEAST	–/–	IRIS/–
Benzyl Chloride	0.17/–	B2/–	IRIS/–	–/–	–/–
Bromomethane	–/–	D/D	IRIS/IRIS	0.0014/0.00143	IRIS/[b]
Carbon Tetrachloride	0.13/0.053	B2/B2	IRIS/HEAST	0.0007[c]/–	IRIS/–
Chlorobenzene	–/–	D/D	IRIS/IRIS	0.02/0.005	IRIS/HEAST
Chloroform	0.0061/0.081	B2/B2	IRIS/HEAST	0.01/–	IRIS/–
Chloromethane	0.013/0.0063	C/C	HEAST/HEAST	–/–	IRIS/–
1,2-Dibromoethane	85/0.76	B2/B2	IRIS/IRIS	–/–	–/–
1,2-Dichlorobenzene	–/–	D/D	IRIS/IRIS	0.09/0.04	IRIS/HEAST
1,3-Dichlorobenzene	–/–	D/D	IRIS/IRIS	–/–	–/–
1,4-Dichlorobenzene	0.024/–	C/C	HEAST/HEAST	–/0.2	IRIS/[b]
1,1-Dichloroethane	–/–	C/C	IRIS/IRIS	0.1/0.1	HEAST/HEAST
1,2-Dichloroethane	0.091/0.091	B2/B2	IRIS/HEAST	–/–	–/–
1,1-Dichloroethylene	0.6/1.2	C/C	IRIS/HEAST	0.009/–[d]	HEAST/–
cis-1,2-Dichloroethylene	–/–	–/–	IRIS/–	0.009[e]/–	HEAST/–
trans-1,2-Dichloroethylene	–/–	–/–	IRIS/–	0.009[e]/–	HEAST/–
Dichloromethane (Methylene Chloride)	0.0075/0.00165	B2/B2	IRIS/[b]	0.06/0.86	IRIS/[b]

Table II-14
Oral/Inhalation Carcinogenic Classification and
Critical Toxicity Values for Chemicals of Concern
IBW-South Interim Risk Assessment

Chemicals[a]	Carcinogenic (oral/inhalation)			Noncarcinogenic (oral/inhalation)	
	Slope Factor $(mg/kg\text{-}day)^{-1}$	Weight of Evidence	Source	RfD (mg/kg-day)	Source
1,2-Dichloropropane	0.068/–	B2/B2	HEAST/–	–/–	IRIS/–
cis-1,3-Dichloropropene	0.18[f]/0.13[f]	B2[f]/B2[f]	HEAST/[b]	0.0003[f]/0.0057[f]	IRIS/[b]
trans-1,3-Dichloropropene	0.18[f]/–	B2[f]/–	HEAST/–	0.0003[f]/–	IRIS/–
Ethylbenzene	–/–	D/D	IRIS/IRIS	0.1/0.286	IRIS/[b]
4-Ethyltoluene	–/–	–/–	–/–	–/–	–/–
Freon 11 (Trichlorofluoromethane)	–/–	–/–	–/–	0.3/0.2	IRIS/HEAST
Freon 12 (Dichlorodifluoromethane)	–/–	–/–	–/–	0.2/0.05	IRIS/HEAST
Freon 113	–/–	–/–	–/–	–/–	–/–
Freon 114 (Dichlorotetrafluoroethane)	–/–	–/–	–/–	30/8.6	IRIS/[b]
Hexachlorobutadiene	0.078/0.078	C/C	IRIS/HEAST	0.002/–	IRIS/–
Methyl Ethyl Ketone	-/-	D/D	HEAST/HEAST	0.05/0.1	HEAST/HEAST
Styrene	–/–	B2/B2	IRIS/IRIS	0.2/0.29	IRIS/[b]
1,1,1,2-Tetrachloroethane	0.026/0.026	C/C	IRIS/HEAST	0.03/–	IRIS/–
Tetrachloroethylene (PCE)	0.051/0.0018	B2/B2	HEAST/HEAST	0.01/–	IRIS/–
Toluene	–/–	D/D	IRIS/IRIS	0.2/0.114	IRIS/[b]
1,2,4-Trichlorobenzene	–/–	D/D	IRIS/IRIS	0.01/0.003	IRIS/HEAST
1,1,1-Trichloroethane	–/–	D/D	–/IRIS	0.09/0.03	HEAST/[b]

Table II-14
Oral/Inhalation Carcinogenic Classification and Critical Toxicity Values for Chemicals of Concern
IBW-South Interim Risk Assessment

Chemicals[a]	Carcinogenic (oral/inhalation)			Noncarcinogenic (oral/inhalation)	
	Slope Factor $(mg/kg\text{-}day)^{-1}$	Weight of Evidence	Source	RfD (mg/kg-day)	Source
1,1,2-Trichloroethane	0.057/0.057	C/C	IRIS/HEAST	0.004/–	IRIS/–
Trichloroethylene (TCE)	0.011/0.006	B2/B2	HEAST/HEAST	–/–	IRIS/–
Vinyl Chloride	1.9/0.29	A/A	HEAST/HEAST	–/–	HEAST/–
Total Xylenes	–/–	D/D	IRIS/IRIS	2.0/0.09	HEAST/[b]

[a]Based on analytes from U.S. EPA Method TO-14.
[b]This value is calculated from the Unit Risk Factor or Reference Concentration.
[c]This value is for subchronic; no chronic value is given.
[d]EPA Region IX recommends characterizing health risks using a modified RfD value of 0.0009 mg/kg/day (*Exposure Factors Handbook*, U.S. EPA, 1990, as cited in Appendix A of the Feasibility Study, Admin. Rec. No. 1599.
[e]This value is based on 1,2-Dichloroethylene mixture.
[f]This value is based on 1,3-Dichloropropene mixture.

Notes:
– = No date/data not available/inadequate data.
* = pending

Table II-15
Toxicity Summaries for Primary Chemicals of Concern -
VOCs-in-Vadose-Zone

Chemical	Acute Toxicity Summary	Chronic Toxicity Summary	Cancer Potential
1,1-Dichloroethylene (Vinylidene chloride; 1,1-DCE)	Exposures to high levels can produce central nervous system (CNS) depression. The liquid is moderately irritating to the skin and eyes (Siegel et al., 1971; Hathaway et al., 1991).	1,1-DCE administered in drinking water to rats for two years produced dose-related fatty changes and swelling in the liver. The lowest observed adverse effect level (LOAEL) was calculated to be 9 mg/kg-day (Quast et al., 1983). Fatty changes in the liver have also been produced in rats by chronic inhalation exposure (Quast et al., 1986).	1,1-DCE is classified as a possible human carcinogen (Category C), based on tumors observed in one inhalation mouse bioassay (Maltoni et al., 1985). Several other animal bioassays are negative for carcinogenicity. 1,1-DCE is mutagenic in several bacterial test strains, but not in mammalian cells. 1,1-DCE is structurally related to vinyl chloride, a known human carcinogen (U.S. EPA, IRIS, 1992).
cis- and *trans*-1,2-Dichloroethylene (1,2-DCE)	Exposures to high levels can produce CNS depression and pathological changes in the heart. Vapor or aerosols are mildly irritating to the eyes. 1,2-DCE in combination with ether has been used in the past as a general anesthetic (Hathaway et al., 1991).	*trans*-1,2-DCE administered in drinking water to rats for 90 days produced dose-related increases in kidney weights (Hayes et al., 1987).	Has not exhibited mutagenicity in bacterial or mammalian cell assays. As with other chlorinated hydrocarbons, 1,2-DCE has promoted unscheduled DNA synthesis. No animal bioassay or human epidemiological data available. Regarded as not classifiable as to human carcinogenicity (Category D) (U.S. EPA, IRIS, 1992).
Tetrachloroethylene (Perchloroethylene, PCE)	Occupational exposure to high levels in air has produces CNS depression with symptoms including dizziness, light-headedness, and difficulty in walking. The liquid is moderately irritating to the skin and eyes. Liver injury following acute occupational exposures has been reported (NIOSH, 1976; Stewart, 1969; Hathaway et al., 1991).	Prolonged occupational exposure has produced symptoms including memory impairment, numbness of the extremities and visual impairment (NIOSH, 1976), and clinical detectable neurological impairment (WHO, 1984). Studies of reproductive toxicity in workers are inconclusive (Hathaway et al., 1991). Subchronic exposures to rats and mice (both by oral and inhalation routes) have produced liver toxicity, with mice showing greater sensitivity than rats (Buban and O'Flaherty, 1985; Schumann et al., 1980; Kjellstrand et al., 1984). The no observed adverse effect level (NOAEL) for liver toxicity is estimated to be 14 mg/kg-day (Buban and O'Flaherty, 1985).	PCE is judged to be a probable human carcinogen based on increased incidence of liver tumors in mice (Category B2). Weight-of-evidence classification is currently under review by EPA. Evidence of carcinogenicity based on epidemiological data or mutagenicity testing is inconclusive (U.S. EPA, IRIS, 1992).

Table II-15
Toxicity Summaries for Primary Chemicals of Concern -
VOCs-in-Vadose-Zone

Chemical	Acute Toxicity Summary	Chronic Toxicity Summary	Cancer Potential
Trichloroethene (TCE)	Occupational exposure to high levels has produced CNS depression and intolerance to alcohol ("degreaser's" flush), the latter presenting as a transient redness to the face and neck. TCE is a mild skin and eye irritant (NIOSH, 1976; Hathaway et al., 1991).	Long-term occupational exposure has produced CNS effects, with symptoms including fatigue, vertigo, dizziness, headaches, and memory impairment. Some evidence of mild liver dysfunction has been observed in workers exposed to levels sufficient to produce marked CNS effects (Hathaway et al., 1991). Fatty liver and hepatotoxicity have been observed in mice exposed by ingestion (Stott et al., 1982). Worker exposure studies have not indicated a potential for adverse reproductive effects (Hathaway et al., 1991). Adverse reproductive effects also have not been reported in studies with laboratory animals (Schwetz et al., 1975; Taylor et al., 1985).	Classified as a probable human carcinogen based on hepatocellular tumors observed in mice (Category B2). Classification is currently under review (U.S. EPA, IRIS, 1992). Recent epidemiological studies have not shown significant or persuasive association between TCE exposure and excess of cancer (Spirtas et al., 1991).
Vinyl chloride	Exposures to very high levels in air produce central nervous system depression. Skin and eye contact with the liquified gas can produce frostbite (Siegel et al., 1971; Hathaway et al., 1991).	Long-term occupational exposure has produced effects including impaired liver function, Raynaud's syndrome, hematological effects, and acroosteolysis (degeneration of tissue in the fingers) (Hathaway et al., 1991).	The principal adverse effect of vinyl chloride exposure in humans is an increased incidence of cancer of the liver. Carcinogenicity of vinyl chloride in the liver has been confirmed in studies with laboratory animals, and the EPA has identified vinyl chloride as a known human carcinogen (Category A) (U.S. EPA, IRIS, 1992).

NOTE: References listed in this table include the following: Buben, J. A., and E. J. O'Flaherty, 1985; Hathaway, G. J., et al., 1991; Hayes, J. R., et al., 1987; Kjellstrand, P., et al., 1984; Maltoni, C., et al., 1985; NIOSH (National Institute for Occupational Safety and Health), 1976; Quast, J. F., et al., 1986; Schumann, A. M., et al., 1980; Schwetz, B. A., et al., 1975; Siegel, J., et al., 1971; Spirtas, R., et al., 1991; Stewart, R. D., 1969; Stott, W. T., et al., 1982; Taylor, D. H., et al., 1985; U.S. EPA, IRIS (Integrated Risk Information System Data Base). 1992; and WHO (World Health Organization), 1984. All of these references are as cited in Appendix A of the Feasibility Study [Admin. Rec. No. 1599].

Table II-16 Assumed Transfer Efficiencies for Various Water Uses in a Typical House			
Water Use	**Daily Quantity (l)**	**Transfer Efficiency (%)**	**Weighted Value**
Showers	150	63	9,450
Tub baths	150	47	7,050
Toilet	365	30	10,950
Laundry	130	90	11,700
Dishwasher	55	90	4,950
Drinking and kitchen use	30	30	900
Cleaning	10	90	900
Total Water Use	890		
Weighted Sum			45,900
Use volume-weighted mean			51.6
(Source: Prichard and Gesell, 1982, "An Estimate of Population Exposures Due to Radon in Public Water Supplies in the Area of Houston, Texas," Health Phys. 41:599-606, as cited in Appendix A of the Feasibility Study, Admin. Rec. No. 1599.)			

The risk estimates for each subsite will be carried out using the calculations in the risk templates. These templates are used to perform the risk estimates for each subsite. There are three templates that address the following:

- Cancer risks from VOCs in Groundwater–Template T-1
- Non-cancer effects from VOCs in Groundwater–Template T-2
- Inhalation of VOCs Volatilized from Soil–Template T-3

Each template provides a location for entering information identifying the subsite, locations for entering incremental concentrations in groundwater or air (which have been estimated by VLEACH modeling), and step-by-step instructions for calculating chemical intake rates and health risk estimates and comparing the risk estimates to the Plug-in Criteria. Chemical intake rates (in mg/kg-day) for each exposure pathway can be related to the exposure concentrations by simple relationships, shown in Table A-6 of the Risk Assessment.

Health risks for each subsite are calculated in a two-step process: (1) calculate risks (either lifetime cancer risks or hazard quotients) from the modeled exposure concentrations for each VOC, and (2) add the risk estimates from all VOCs to estimate the total lifetime cancer risk or the hazard index for the subsite. The multiplicative factors in the templates already take into account all of the exposure assumptions and toxicity values.

The templates shall be used as the basis for determining whether a subsite has exceeded the Plug-in Criteria. The basis and assumptions for establishing the relationships between exposure and risk, and a sample calculation, are included in the Risk Assessment, Appendix A to the Feasibility Study. Virtually any VOC that may be present in the vadose zone at IBW-

South will be represented on the templates; nonetheless, if a VOC is found at a subsite that does not appear on the template, *the templates for that subsite may be revised by EPA to incorporate that VOC*. The templates are located at the back of Part II.

8.4.8. Evaluation of Environmental Risks

No endangered species or critical habitats have been identified at IBW–South. There are no wetland habitats. The one exception to this may be at the Salt River itself, which is ephemeral. The U.S. Fish & Wildlife Service has not identified wetlands in this area to EPA. The VOCs are underground, and the IBW–South area is heavily urbanized and largely paved. There are no identifiable populations, nor modes for surface wildlife to be exposed to VOCs in soils or the groundwater.

8.5. Clarifying Statement on Subsites Situated on Landfill

As stated above, the IBW site includes areas which contain landfill material. There are generally two types of such material: inert and municipal solid waste ("MSW"). Inert materials do not release methane or other gases and typically include construction debris such as bricks, mortar, cement, and similar wastes. MSW supports a wide range of microorganisms and typically produces copious amounts of methane as it degrades. At IBW–South, there are some locations where a layer of normal soil fill is packed on top of landfill material, and a facility is sitting on top of the soil fill.

The following addresses the issue of the applicability of this remedy in the event that such a facility has contaminated the soil and/or landfill material beneath it with VOCs.

EPA and the State of Arizona are exploring various regulatory options for addressing cleanup, stabilization, and closure of the landfills. Therefore, while Focused RIs may be conducted for subsites on fill material, EPA and the State may address the subsites under another regulatory program.

Even if EPA decides to address subsites situated on the landfills with this remedy, there are certain situations in which the SVE Alternative selected by this document may not apply to landfill materials or to soil fill above landfill materials. These situations are discussed below.

In the event that landfill material is inert (see above), SVE would be effective for removing VOCs with no significant changes to the remedy proposed in this document. However, where there is MSW with significant methane gas production, or anaerobic conditions, fundamental or significant modifications may be necessary to the selected remedy. For example, special changes may be necessary to address methane production. Also, anaerobic (no oxygen) microorganisms feeding on MSW usually produce heat. Suddenly adding oxygen to these landfills, by SVE wells or otherwise, may cause landfill fires. These conditions were not evaluated or contemplated by the remedy selection process leading to this ROD.

Accordingly, at subsites situated on or above landfills, EPA will evaluate the soil and fill material prior to plugging in such subsites. If insignificant methane and relatively normal soil oxygen levels are present (indicating the absence of anaerobic MSW breakdown) and the material in the landfill in question is expected to be inert, then such subsites may be plugged in directly.

If there is an absence of oxygen or high levels of methane are present in landfills known or expected to have received MSW, then such subsites will be considered outside the scope of this remedy. In instances where EPA decides to make a fundamental or significant change to the remedy in order to address landfill materials, EPA would amend the remedy or issue an ESD, as appropriate, to incorporate these differences and would follow all public participation and other CERCLA requirements prior to implementing a remedy at the location.

9. Statutory Determinations

9.1. Protection of Human Health and the Environment

This Operable Unit remedy (including modifications, as necessary) is protective of human health and the environment with respect to VOCs in the vadose zone. This remedy must operate in conjunction with other Operable Units to ensure protectiveness of human health and the environment from all contaminants at the site.

At IBW–South, the principal risk to human health is through inhalation and ingestion of VOCs that volatilize from contaminated groundwater. By removing from the vadose zone VOCs that could threaten groundwater quality, the selected remedy will assist in ensuring that the groundwater underlying IBW–South is returned to levels acceptable for drinking water use in a reasonable timeframe. In addition, in areas where there is no groundwater contamination, the selected remedy will reduce levels of VOCs in soils above the water table such that the soils could not, by themselves, cause the groundwater to be contaminated above health-based levels.

This remedy places the continuing soil sources of VOCs under tight control. It therefore limits the extent to which existing groundwater contamination will spread.

This remedy removes VOCs to levels such that any threat from direct inhalation of VOCs from soils above health-based levels is eliminated.

The requirements of this remedy were designed in response to an integrated risk assessment that accounts for all eventual Operable Units, so that the risks to any one reasonably exposed individual from carcinogenic contaminants will ultimately be reduced to within the

EPA risk range of 10^{-6} to 10^{-4}. Likewise, the hazard index due to exposure to non-carcinogenic contaminants for any reasonably exposed individual will be reduced below a value of 1.

9.2. Compliance with ARARs

Appendix A identifies the ARARs for IBW–South. The selected remedy shall comply with all ARARs identified in Appendix A.

9.3. Cost-Effectiveness

The remedial actions selected in this remedy are cost-effective. Because it requires much more time and money to remove VOCs from groundwater than to remove VOCs from soil gas, this remedy is a good investment against the prospect of a greatly worsened future groundwater problem. Groundwater problems typically require extensive monitoring and many costly groundwater wells, and can require as much as 100 years to clean up. In addition, the cost of the loss of the groundwater resource in the IBW arid environment during a groundwater cleanup would be substantial.

SVE involves minimal disruption to urban soils and environment, thereby reducing costs from lost business and use of property. Because only air is extracted from the soil, the costs of disposal are also minimized. SVE is easily amenable to modular enhancements that allow for incremental outlay of capital costs. SVE is less expensive, or at worst, equal in cost to most VOC remedies for soils, especially ex situ remedies such as soil washing or incineration.

At the same time, SVE will reduce the primary risks from the VOCs in soils to the cleanup standards within a reasonable time.

In addition, using the Plug-in Process will ensure that a protective cleanup is achieved, while saving EPA and PRPs both the time and the money required to evaluate and select separate remedies on every subsite within IBW–South.

9.4. Utilization of Permanent Solutions and Alternative Treatment Technologies or Resource Recovery Technologies to the Maximum Extent Practicable

The remedy selected by this ROD utilizes permanent solutions and alternative technologies or resource recovery technologies to the maximum extent practicable. EPA has determined that the selected SVE alternative provides long-term effectiveness and permanence; reduction in toxicity, mobility, and volume of contaminants through treatment; short-term effectiveness; implementability; and cost-effectiveness, considering both state and community acceptance.

The State of Arizona has concurred with this remedy; the community has expressed very few concerns related to the SVE remedy itself or the Plug-in Approach.

The SVE Alternative will reduce both the mobility and volume of VOCs, permanently eliminating a long-term threat to groundwater and an immediate threat to ambient air without unreasonable costs or significant short-term impacts. SVE was chosen presumptively as the remedy, so no comparison of treatment alternatives was made. However, the substantial period of time over which groundwater quality would be impaired with the No-Action Alternative was a significant factor in choosing SVE.

VOCs can be recovered from SVE for reuse. SVE, in removing a source of contaminants to groundwater, assists in recovery of the groundwater resource.

9.5. Preference for Treatment as a Principal Element

The SVE systems selected in this remedy, which cause removal of VOCs followed by emissions treatment, satisfy the statutory preference for the use of remedies that include treatment as a principal element.

10. Significant Changes

1. EPA has selected remedy Performance Standards that comply with certain Maricopa County Air Pollution Control Division Rules and Guidelines for Remediation of Contaminated Soil, even though these guidelines are *not* ARARs. This is discussed in Section 8.2.4 and in Appendix A, ARARs. The effect of this decision is that emission control (offgas treatment) systems must be at least 90 percent effective.

2. EPA has reconsidered Plug-in Criterion No. 5 as it appeared in the Feasibility Study and the Proposed Plan Factsheet and has chosen to modify it. Criterion No. 5 (the fifth of five), as originally proposed by EPA, would have required that a subsite plug-in to the remedy if subsite VOCs would cause groundwater concentrations to increase by more than the more stringent of the federal MCL or the Arizona Health-Based Guidance Level for water (HBGL). EPA has decided to remove the HBGL from the criterion, which is now based solely on the federal MCL.

   Upon reconsideration, EPA decided that HBGLs were not appropriate for this use. The principal goal of Criterion No. 5, as a standard-based criterion, is to provide an added assurance that no single subsite is able to cause clean groundwater to become contaminated above groundwater standards in the future. HBGLs are not promulgated and are not intended to be used as in situ groundwater standards. EPA is confident that the four risk-based Plug-in Criteria (Nos. 1 through 4) will be sufficient to protect human health and will in most cases be more stringent than either the original or modified Criterion No. 5.

3. EPA has clarified that this remedy may be used to address subsites situated on landfill materials under certain circumstances. This is discussed in Section 8.5 of this Decision Summary.

4. EPA has clarified that when a subsite is plugged in, EPA will document the plug-in and also provide public notice of the plug-in determination. This determination will contain a declaration of the most-likely offgas treatment and enhancement options that will be used. After a determination is made to plug in a subsite to the remedy, there will be a 30-day public comment period. During such comment periods, the selection of the SVE technology and the Plug-in Process itself shall not be subject to comment. Details are provided in Section 8.3.3.

5. In response to a public comment, EPA has modified the risk templates to allow for segregating the effect of non-cancer toxicity by target organ. In instances where non-cancer risk is the sole Plug-in Criterion which is exceeded, the effect of non-cancer risk will be evaluated for each target organ separately, rather than as a sum over all compounds. This approach is supported by EPA's *Risk Assessment Guidance for Superfund.*

6. The ROD, in Section 8.3.7, provides levels at which treatment-derived wastewater (such as water from the air/water separator component of SVE systems) will be treated as a RCRA hazardous waste. The FS did not provide as much detail about EPA's intentions with regard to this water.

7. Appendix B of the FS inadvertently stated that certain requirements were ARARs. The FS identifies only *potential* ARARs; the ROD (Appendix A) solely identifies actual ARARs for this remedy.

8. Figure 1-3 in the Feasibility Study was incorrectly labeled. This figure appears again in the ROD with the correct label. The figure shows about 70 facilities which represent the universe of facilities for which EPA has gathered investigation data. However, not all of these facilities will undergo focused RIs, as indicated by the label in the FS.

Figure T-1
Risk Assessment Template for:
Cancer Risks from VOCs in Groundwater
Indian Bend Wash - South

Subsite Information: ______________________

Prepared By: ____________
Date: ______

See instructions following this template.

Chemical	Line 1 Concentration in Groundwater (mg/L)	Line 2 Chemical Intake - Ingestion (mg/kg-day)	Line 3 Chemical Intake - Inhalation (mg/kg-day)	Line 4 Oral Slope Factor $(mg/kg\text{-}day)^{-1}$	Line 5 Inhalation Slope Factor $(mg/kg\text{-}day)^{-1}$	Line 6 Estimated Cancer Risk - Ingestion	Line 8 Estimated Cancer Risk - Inhalation
Benzene				0.029	0.029		
Benzyl chloride				0.17			
Bromomethane							
Carbon Tetrachloride				0.13	0.053		
Chlorobenzene							
Chloroform				0.0061			
Chloromethane				0.013	0.0063		
1,2-Dibromoethane				85	0.76		
1,2-Dichlorobenzene							
1,3-Dichlorobenzene							
1,4-Dichlorobenzene				0.024			
1,1-Dichloroethane							
1,2-Dichloroethane				0.091	0.091		
1,1-Dichloroethylene							
cis-1,2-Dichloroethylene							
trans-1,2-Dichloroethylene							
Dichloromethane				0.0075	0.0016		
1,2-Dichloropropane				0.068			
cis-1,3-Dichloropropene				0.18	0.13		
trans-1,3-Dichloropropene				0.18	0.13		
Ethylbenzene							
4-Ethyltoluene							
Trichlorofluoromethane (Freon 11)							
Dichlorodifluoromethane (Freon 12)							
1,1,2-trichloro-1,2,2-trifluoroethane (Freon 113)							
Dichlorotetrafluoroethane (Freon 114)							
Hexachlorobutadiene				0.078	0.078		
Methylethylketone (MEK)							
Styrene							
1,1,1,2-Tetrachloroethane				0.026	0.026		
Tetrachloroethylene (PCE)				0.051	0.0018		
Toluene							
1,2,4-Trichlorobenzene							
1,1,1-Trichloroethane							
1,1,2-Trichloroethane				0.057	0.057		

Figure T-1
Risk Assessment Template for:
Cancer Risks from VOCs in Groundwater
Indian Bend Wash - South

Subsite Information:

Prepared By: ____________
Date: ______

See instructions following this template.

Chemical	Line 1 Concentration in Groundwater (mg/L)	Line 2 Chemical Intake - Ingestion (mg/kg-day)	Line 3 Chemical Intake - Inhalation (mg/kg-day)	Line 4 Oral Slope Factor $(mg/kg\text{-}day)^{-1}$	Line 5 Inhalation Slope Factor $(mg/kg\text{-}day)^{-1}$	Line 6 Estimated Cancer Risk - Ingestion	Line 8 Estimated Cancer Risk - Inhalation
Trichloroethylene (TCE)				0.011	0.006		
Vinyl chloride				1.9	0.29		
Total Xylenes							

Line 7 Total Ingestion Risk ______

Line 9 Total Inhalation Risk ______

Line 10 Total Subsite Risk ______

Line 11: Estimated Lifetime Cancer Risk Exceeds Plug-in Criteria ☐

Line 12: Estimated Lifetime Cancer Risk Does Not Exceed Plug-in Criteria ☐

Be sure to also compare concentrations in groundwater with MCL values.

Template T-1

Cancer Risks from VOCs in Groundwater

Instructions for Risk Assessment Template Preparation

Step 1: Enter concentration in groundwater of each individual VOC in Line 1 (concentrations are obtained from modeling performed prior to preparing this template). Groundwater concentrations must be in units of mg/l (1 mg/l = 1,000 µg/l). If a VOC has not been modeled or detected at the subsite, enter zero for that VOC.

Step 2: Multiply the value for each VOC in Line 1 by **0.01174**. Enter the result in Line 2. Skip this step if the line is filled for that VOC.

Step 3: Multiply the value for each VOC in Line 1 by **0.044**. Enter the result in Line 3. Skip this step if the line is filled for that VOC.

Step 4: Multiply the value for each VOC in Line 2 by the corresponding value in Line 4. Enter the result in Line 6. Skip this step if the line is filled for that VOC.

Step 5: Add the values for all of the VOCs in Line 6 and enter the sum in Line 7.

Step 6: Multiply the value for each VOC on Line 3 by the corresponding value in Line 5. Enter the result in Line 8. Skip this step if the line is filled for that VOC.

Step 7: Add the values in Line 8 and enter them in Line 9.

Step 8: Add the values in Lines 7 and 9 and enter the sum in Line 10. Round the value in Line 10 to one significant figure (for example, 1.17×10^{-6} is rounded to 1×10^{-6}).

Step 9: If the value in Line 10 exceeds 1×10^{-6} or 0.000001, enter a check in Line 11; otherwise enter a check in Line 12.

Step 10: Be sure to also compare the concentrations in groundwater (Line 1) with MCL values.

Figure T-2

Risk Assessment Template for:

Noncancer Effects from VOCs in Groundwater

Indian Bend Wash - South

Subsite Information: ______________________

____

____

Prepared by: ______________________

Date: ____________

See instructions following this template.

Chemical	Line 1 Concentration in Groundwater (mg/L)	Line 2 Chemical Intake - Ingestion (mg/kg-day)	Line 3 Chemical Intake - Inhalation (mg/kg-day)	Line 4 Oral Reference Dose (mg/kg-day)	Line 5 Inhalation Reference Dose (mg/kg-day)	Noncancer Target Organ/ Critical Toxic Effect - Ingestion	Line 6 Noncancer Hazard Quotients - Ingestion	Noncancer Target Organ/ Critical Toxic Effect - Inhalation	Line 8 Noncancer Hazard Quotients - Inhalation
Benzene									
Benzyl chloride									
Bromomethane				0.0014	0.001	GI		URT	
Carbon Tetrachloride				0.0007		LIVER		LIVER	
Chlorobenzene				0.02	0.005	LIVER		LIVER	
Chloroform				0.01		LIVER		LIVER	
Chloromethane									
1,2-Dibromoethane									
1,2-Dichlorobenzene				0.09	0.04	LIVER		LIVER	
1,3-Dichlorobenzene									
1,4-Dichlorobenzene				0.1	0.2	LIVER		LIVER	
1,1-Dichloroethane				0.1	0.1	LIVER		LIVER	
1,2-Dichloroethane									
1,1-Dichloroethylene				0.0009	0.0009	LIVER		LIVER	
cis-1,2-Dichloroethylene				0.009		LIVER			
trans-1,2-Dichloroethylene				0.009		LIVER			
Dichloromethane				0.06	0.86	LIVER		LIVER	
1,2-Dichloropropane					0.001			URT	
cis-1,3-Dichloropropene				0.0003	0.006	LIVER		URT	
trans-1,3-Dichloropropene				0.0003	0.006	LIVER		URT	
Ethylbenzene				0.1	0.29	LIVER		DEV	
4-Ethyltoluene									
Trichlorofluoromethane (Freon 11)				0.3	0.2	BW		URT	
Dichlorodifluoromethane (Freon 12)				0.2	0.05	BW		LIVER	
1,1,2-trichloro-1,2,2-trifluoroethane (Freon 113)				30	8.6	BW		BW	
Dichlorotetrafluoroethane (Freon 114)									
Hexachlorobutadiene				0.002		LIVER			
Methylethylketone (MEK)				0.05	0.1	CNS		DEV	
Styrene				0.2	0.3	LIVER		LIVER	
1,1,1,2-Tetrachloroethane				0.03		LIVER			
Tetrachloroethylene (PCE)				0.01		LIVER			
Toluene				0.2	0.1	LIVER		CNS	
1,2,4-Trichlorobenzene				0.01	0.003	LIVER		LIVER	
1,1,1-Trichloroethane				0.09	0.3	LIVER		LIVER	
1,1,2-Trichloroethane				0.004		LIVER			

Figure T-2

Risk Assessment Template for:
Noncancer Effects from VOCs in Groundwater
Indian Bend Wash - South

Subsite Information: ____________________

Prepared by: ____________________
Date: __________

See instructions following this template.

Chemical	Line 1 Concentration in Groundwater (mg/L)	Line 2 Chemical Intake - Ingestion (mg/kg-day)	Line 3 Chemical Intake - Inhalation (mg/kg-day)	Line 4 Oral Reference Dose (mg/kg-day)	Line 5 Inhalation Reference Dose (mg/kg-day)	Noncancer Target Organ/ Critical Toxic Effect - Ingestion	Line 6 Noncancer Hazard Quotients - Ingestion	Noncancer Target Organ/ Critical Toxic Effect - Inhalation	Line 8 Noncancer Hazard Quotients - Inhalation
Trichloroethylene (TCE)									
Vinyl chloride									
Total Xylenes				2	0.09	LIVER		CNS	

Line 7 Total Ingestion HQ: ____

Line 9 Total Inhalation HQ: ____

Line 10 **Hazard Index**: ____

Segregated Hazard Quotients

	Ingestion		Inhalation	Critical effect/ Target organ
Line 11a		**11b**		GI
Line 12a		**12b**		URT
Line 13a		**13b**		LIVER
Line 14a		**14b**		DEV
Line 15a		**15b**		BW
Line 16a		**16b**		CNS

Segregated Hazard Indices

Line 17		GI
Line 18		URT
Line 19		LIVER
Line 20		DEV
Line 21		BW
Line 22		CNS

Line 23: Estimated Hazard Index Exceeds Plug-in Criteria ____

Line 24: Estimated Hazard Index Does Not Exceed Plug-in Criteria ____

Be sure to also compare concentrations in groundwater with MCL values.

Template T-2

Non-Cancer Effects of VOCs in Groundwater

Instructions for Risk Assessment Template Preparation

Step 1: Enter concentration in groundwater of each individual VOC in Line 1 (concentrations are obtained from modeling performed prior to preparing this template). Groundwater concentrations must be in units of mg/l (1 mg/l = 1,000 μg/l). If a VOC has not been modeled or detected at the subsite, enter zero for that VOC.

Step 2: Multiply the value for each VOC in Line 1 by **0.0274**. Enter the result in Line 2. Skip this step if the line is filled for that VOC.

Step 3: Multiply the value for each VOC in Line 1 by **0.0001**. Enter the result in Line 3. Skip this step if the line is filled for that VOC.

Step 4: Divide the value for each VOC in Line 2 by the corresponding value in Line 4. Enter the result in Line 6. Skip this step if the line is filled for that VOC.

Step 5: Add the values for all of the VOCs in Line 6 and enter the sum in Line 7.

Step 6: Divide the value for each VOC in Line 3 by the corresponding value in Line 5. Enter the result for that VOC in Line 8. Skip this step if the line is filled for that VOC.

Step 7: Add the values for all of the VOCs in Line 8 and enter the sum in Line 9.

Step 8: Add the values in Lines 7 and 9 and enter the sum in Line 10. Round the value in Line 10 to two significant figures (for example, 1.2731 is rounded to 1.27).

Step 9: If the value in Line 10 exceeds 1.0, hazard indices need to be segregated by target organ/critical effect; proceed to Step 9a. If the value in Line 10 is less than 1.0, go to Step 12.

Step 9a. Sum ingestion hazard quotients (HQs) in Line 6 for all chemicals with GI (gastrointestinal) target organ/critical toxic effect. Enter the result in Line 11a.

Sum inhalation HQs in Line 8 for all chemicals with GI target organ/critical toxic effect. Enter the result in Line 11b.

Step 9b. Sum ingestion hazard quotients (HQs) in Line 6 for all chemicals with URT (upper respiratory tract) target organ/critical toxic effect. Enter the result in Line 12a.

Sum inhalation HQs in Line 8 for all chemicals with URT target organ/critical toxic effect. Enter the result in Line 12b.

Step 9c. Sum ingestion hazard quotients (HQs) in Line 6 for all chemicals with LIVER target organ/critical toxic effect. Enter the result in Line 13a.

Sum inhalation HQs in Line 8 for all chemicals with LIVER target organ/critical toxic effect. Enter the result in Line 13b.

Step 9d. Sum ingestion hazard quotients (HQs) in Line 6 for all chemicals with DEV (developmental toxicity) target organ/critical toxic effect. Enter the result in Line 14a.

Sum inhalation HQs in Line 8 for all chemicals with DEV target organ/critical toxic effect. Enter the result in Line 14b.

Step 9e. Sum ingestion hazard quotients (HQs) in Line 6 for all chemicals with BW (reduced body weight) target organ/critical toxic effect. Enter the result in Line 15a.

Sum inhalation HQs in Line 8 for all chemicals with BW target organ/critical toxic effect. Enter the result in Line 15b.

Step 9f. Sum ingestion hazard quotients (HQs) in Line 6 for all chemicals with CNS (central nervous system) target organ/critical toxic effect. Enter the result in Line 16a.

Sum inhalation HQs in Line 8 for all chemicals with CNS target organ/critical toxic effect. Enter the result in Line 16b.

Step 10a. Sum Lines 11a and 11b and enter the result in Line 17.

Step 10b. Sum Lines 12a and 12b and enter the result in Line 18.

Step 10c. Sum Lines 13a and 13b and enter the result in Line 19.

Step 10d. Sum Lines 14a and 14b and enter the result in Line 20.

Step 10e. Sum Lines 15a and 15b and enter the result in Line 21.

Step 10f. Sum Lines 16a and 16b and enter the result in Line 22.

Step 11. If any of the values in Lines 17 through 22 are greater than 1.0, enter a check in Line 23.

Step 12. Enter a check in Line 24 (value in Line 10 is less than 1.0).

Step 13: Be sure to compare the concentrations in groundwater (Line 1) with MCL values.

Figure T-3
Risk Assessment Template for:
Inhalation of VOCs Emitted from Soil
Indian Bend Wash - South

Subsite Information: ______________________

Prepared by: ______________________
Date: ____________

See instructions following this template.

Chemical	Line 1 Concentration in Air (mg/m^3)	Line 2 Chemical Intake - Carcinogens (mg/kg-day)	Line 3 Chemical Intake - Noncarcinogens (mg/kg-day)	Line 4 Inhalation Slope Factor (mg/kg-day)$^{-1}$	Line 5 Inhalation Reference Dose (mg/kg-day)	Line 6 Estimated Lifetime Cancer Risk	Noncancer Target Organ/ Critical Toxic Effects	Line 8 Noncancer Hazard Quotients
Benzene				0.029				
Benzyl chloride								
Bromomethane					0.001		URT	
Carbon Tetrachloride				0.053				
Chlorobenzene					0.005		LIVER	
Chloroform				0.081				
Chloromethane				0.0063				
1,2-Dibromoethane				0.76				
1,2-Dichlorobenzene					0.04		LIVER	
1,3-Dichlorobenzene								
1,4-Dichlorobenzene					0.2		LIVER	
1,1-Dichloroethane					0.1		LIVER	
1,2-Dichloroethane				0.091				
1,1-Dichloroethylene					0.0009		LIVER	
cis-1,2-Dichloroethylene								
trans-1,2-Dichloroethylene								
Dichloromethane				0.0016	0.86		LIVER	
1,2-Dichloropropane					0.001		URT	
cis-1,3-Dichloropropene				0.13	0.006		URT	
trans-1,3-Dichloropropene				0.13	0.006		URT	
Ethylbenzene					0.29		DEV	
4-Ethyltoluene								
Trichlorofluoromethane (Freon 11)					0.2		URT	
Dichlorodifluoromethane (Freon 12)					0.05		LIVER	
1,1,2-trichloro-1,2,2-trifluoroethane (Freon 113)					8.6		BW	
Dichlorotetrafluoroethane (Freon 114)								
Hexachlorobutadiene				0.078				
Methylethylketone (MEK)					0.1		DEV	
Styrene					0.3		LIVER	
1,1,1,2-Tetrachloroethane				0.026				
Tetrachloroethylene (PCE)				0.0018				
Toluene					0.1		CNS	
1,2,4-Trichlorobenzene					0.003		LIVER	
1,1,1-Trichloroethane					0.3		LIVER	
1,1,2-Trichloroethane				0.057				

Figure T-3
Risk Assessment Template for:
Inhalation of VOCs Emitted from Soil
Indian Bend Wash - South

Subsite Information: ____________________

Prepared by: ____________________
Date: ____________

See instructions following this template.

Chemical	Line 1 Concentration in Air (mg/m^3)	Line 2 Chemical Intake - Carcinogens (mg/kg-day)	Line 3 Chemical Intake - Noncarcinogens (mg/kg-day)	Line 4 Inhalation Slope Factor $(mg/kg\text{-}day)^{-1}$	Line 5 Inhalation Reference Dose (mg/kg-day)	Line 6 Estimated Lifetime Cancer Risk	Noncancer Target Organ/ Critical Toxic Effects	Line 8 Noncancer Hazard Quotients
Trichloroethylene (TCE)				0.006				
Vinyl chloride				0.29				
Total Xylenes					0.09		CNS	

Line 7 Total Cancer Risk: [ ]

Line 9 Hazard Index: [ ]

Segregated Hazard Indices

		Target Organ/ Critical Toxic Effect
Line 10		URT
Line 11		LIVER
Line 12		DEV
Line 13		BW
Line 14		CNS

Line 15: Estimated Lifetime Cancer Risk Exceeds Plug-in Criteria [ ]

Line 16: Estimated Lifetime Cancer Risk Does Not Exceed Plug-in Criteria [ ]

Line 17: Estimated Hazard Index Exceeds Plug-in Criteria [ ]

Line 18: Estimated Hazard Index Does Not Exceed Plug-in Criteria [ ]

Template T-3

Inhalation of VOCs Emitted from Soil

Instructions for Risk Assessment Template Preparation

Step 1: Enter concentration in air of each individual VOC in Line 1 (concentrations are obtained from modeling performed prior to preparing this template). Concentrations in air must be in units of mg/m^3 ($1\ mg/m^3 = 1{,}000\ \mu g/m^3$). If a VOC has not been modeled or detected at the subsite, enter zero for that VOC.

Step 2: Multiply the value for each VOC in Line 1 by **0.1174**. Enter the result in Line 2. Skip this step if the line is filled for that VOC.

Step 3: Multiply the value for each VOC in Line 1 by **0.274**. Enter the result in Line 3. Skip this step if the line is filled for that VOC.

Step 4: Multiply the value for each VOC in Line 2 by the corresponding value in Line 4. Enter the result in Line 6. Skip this step if the line is filled for that VOC.

Step 5: Add the values for all of the VOCs in Line 6 and enter the sum in Line 7. Round the value in Line 7 to one significant figure (for example, 1.17×10^{-6} is rounded to 1×10^{-6}).

Step 6: Divide the value for each VOC in Line 3 by the corresponding value in Line 5. Enter the result for that VOC in Line 8. Skip this step if the line is filled for that VOC.

Step 7: Add the values for all of the VOCs in Line 8 and enter the sum in Line 9. Round the value in Line 9 to two significant figures (for example, 1.2713 is rounded to 1.27).

Step 8: If the value in Line 7 exceeds 1×10^{-6} or 0.000001, enter a check on Line 15, otherwise enter a check on Line 16.

Step 9: If the value in Line 9 exceeds 1.0, calculate segregated hazard indices in Step 10, otherwise enter a check on Line 18.

Step 10a. Sum hazard quotients (HQs) in Line 6 for all chemicals with URT (upper respiratory tract) target organ/critical toxic effect. Enter the result in Line 10.

Step 10b. Sum hazard quotients (HQs) in Line 6 for all chemicals with LIVER target organ/critical toxic effect. Enter the result in Line 11.

Step 10c. Sum hazard quotients (HQs) in Line 6 for all chemicals with DEV (developmental toxicity) target organ/critical toxic effect. Enter the result in Line 12.

Step 10d. Sum hazard quotients (HQs) in Line 6 for all chemicals with BW (reduced body weight) target organ/critical toxic effect. Enter the result in Line 13.

Step 10e. Sum hazard quotients (HQs) in Line 6 for all chemicals with CNS (central nervous system) target organ/critical toxic effect. Enter the result in Line 14.

Step 11. If any of the values in Lines 10 through 14 are greater than 1.0, enter a check in Line 17.

III. RESPONSE SUMMARY

III. RESPONSE SUMMARY

The purpose of the Response Summary is to summarize EPA's response to the comments received from the public on EPA's cleanup proposal for VOCs in soils at the Indian Bend Wash Superfund Site, South Area (IBW–South). EPA has received three kinds of comments–formal oral and written comments at EPA's public meeting, formal written comments received during the public comment period, and informal questions and comments received both during the public comment period and over the course of the project. EPA is required by law to address only the first two types of formal comments, if they are significant. These comments are made with the intent of being included in the Administrative Record.

EPA attempts to address all informal comments at the time they are received. However, there are certain informal questions and comments that are common and therefore may represent the concerns of significant segments of the public. EPA has grouped several of these general informal comments in the response summary as well.

EPA is required to address only those comments that are directly pertinent to the remedial action itself. However, EPA has addressed selected common concerns related to enforcement and liability, as well.

Specific comments and questions are indexed for convenient reference. Indexes run consecutively through the entire Response Summary, regardless of section.

1. EPA Formal Comment Period and Public Meeting

EPA provided a public review and comment period on EPA's Proposed Plan and Feasibility Study for VOCs in Vadose Zone soils at IBW–South from June 14 to July 14, 1993. In response to a public request, EPA extended the public comment period to August 14, 1993. EPA's Interim Remedial Investigation Report and the Administrative Record for the VOCs-in-Vadose-Zone Remedy were also available for public comment during the comment period.

On July 7, 1993, EPA held a public meeting at Gililland Jr. High School in Tempe, Arizona. During the meeting, EPA presented a summary of the plan, including both the proposed cleanup technology and the innovative administrative approach being used as part of the remedy. The format for the meeting was (1) a presentation by EPA, (2) a question and answer period to provide clarifications and aid in formal public comment, and (3) a formal public comment period. The proceedings of the meeting were recorded by a court reporter. Transcripts of the meeting became part of the Administrative Record for Indian Bend Wash–South. At the meeting, EPA attempted to respond to all questions during the question-and-answer period. Formal comments from the meeting are addressed in this summary.

2. Oral Comments Received at the Public Meeting

2.1. Question and Answer Session-Selected Questions

The following selected comments and questions were answered by EPA at the public meeting on July 7, 1993. To review all oral questions and answers from the public meeting, see the transcript of the public meeting.

◊ *Index No. 1*

One person wanted to know how EPA would address VOC contamination that moved from one property onto another property. Would EPA make someone investigate or clean up if he contended that his neighbor's VOCs were on his property? Also, how much of the VOCs that we are seeing in the soils actually came from the contaminated groundwater?

Response:

In theory, VOCs may move from one property to another either directly through the soils, or by entering the groundwater and then later offgassing upward from the water table. However, based on data seen to date, EPA believes only the first mechanism is plausible at IBW-South.

A sampling investigation will usually reveal whether contamination came from one property, or another, or both. EPA could seek investigation and cleanup from either party. However, in practice, EPA would use discretion based on whether it was more likely that one party was a source than the other.

As to whether VOCs might be offgassing from the water table, based on groundwater data collected to date, the concentrations of VOCs in groundwater are too low for this effect to be appreciable, except perhaps within one or two feet of the water table.

◊ *Index No. 2*

Two persons wanted to know whether the groundwater contamination found in IBW–South was coming under the Salt River from IBW–North, where contamination due to a number of large sources has been found in groundwater.

Response:

In IBW-North, a large number of wells seem to indicate that VOC contamination dwindles a good distance north of the river. When the river flows, it serves as a divide; that is, groundwater will not flow from north to south under the river. The river only flows about 10 percent of the time. The remainder of the time, there is no barrier to groundwater flowing under the river, if groundwater flow directions are so aligned. EPA has not observed this alignment, however. If contamination had moved from north to south under the river, we would expect to be able to trace it straight through. It is possible that the river has flushed the aquifer near the river, but this is merely speculation at this time. Therefore, while it is possible that contamination moved from north to south under the river at some point in time, we have to conclude from the current data that it is more likely that the contamination in IBW-South originates from sources within IBW-South itself.

◊ *Index No. 3*

One person asked why VOCs might be present in higher concentrations deeper in the ground than near the surface.

Response:

There are several possible reasons that this might happen. First, the point of entry of the VOCs into the ground may not have been at the ground surface. For instance, disposal may have occurred into a dry well, a French drain, through a leach field system, leaking pipes, trenches, etc. Therefore, points further underground actually can be closer to the original source. Second, VOCs very near the surface tend to evaporate away. Third, VOCs follow various flow paths as they migrate downward, depending on the type of material under the ground that the VOCs encounter on the way down. A sample at depth may intersect a "preferential flow path"; an area along which VOCs "prefer" to flow due to geologic conditions. EPA has documented cases where levels of VOCs at depth exceed the levels at the surface by a factor of a thousand.

◊ *Index No. 4*

Several persons questioned EPA's strategy for identifying facilities for investigation. These persons questioned whether EPA was discriminating against certain types of businesses, for instance, dry cleaners. These persons also asked whether the boundaries of the Superfund study area had unfairly subjected those inside the boundary to a cleanup compared to those outside the boundary in the same business who may actually have the same degree of contamination.

Response:

EPA's mandate under Superfund is to protect human health and the environment. EPA has sought sources of contamination solely with this objective. At IBW–South, there was a region within which it was known there was groundwater contamination, and therefore there had to be sources or causes of that contamination. It is necessary that EPA locate as many of these sources as possible. One would not expect VOCs everywhere in IBW–South. It would be expected that EPA prioritize and focus its investigation.

EPA therefore has used available information to estimate what and where the most likely sources are. One of those pieces of information is the type of chemicals that a business is likely to have used. For instance, a dry cleaner or a circuit board manufacturer which uses VOCs would be a more likely VOC source than a grocery store, which does not. In this sense, it is true that certain businesses will initially be more suspect than others.

However, EPA does not use a standard formula for a particular business type. EPA uses all information available to it on a case-by-case basis to decide whether to pursue a particular facility. EPA also does not rule out any facility as a source–including those that typically do not use VOCs–if groundwater data or other information indicate that it may be a source.

Technically, there is no difference between a VOC-using facility inside the IBW–South boundary and the same facility outside the boundary. In practice, it is true that a facility inside IBW–South is more likely to receive scrutiny from EPA than a similar facility far outside IBW–South because IBW–South is where EPA is focusing its investigation. Nonetheless, both facilities are subject to the same requirements under the law. If either facility has released hazardous substances into the environment, it can be liable for Superfund investigation and cleanup. In fact, if EPA discovers a facility outside the boundaries that can be shown to be contributing to the same IBW–South groundwater problem, the boundaries could be expanded to incorporate that facility, or EPA could investigate the facility as a separate Superfund site.

◊ *Index No. 5*

One person asked whether EPA might ultimately investigate more facilities than the 70 (approximately) that were identified in the meeting.

Response:

While EPA believes that most of the major sources will be found among currently identified facilities, EPA will add more facilities if information indicates that they may be sources of VOCs contributing to soil or groundwater contamination.

◊ *Index No. 6*

One person asked how will EPA know, when the SVE system is installed, that we are not drawing contamination from some great distance through underground gravel beds and then forcing the person who installed the system to pay for cleaning up contamination for a great distance around.

Response:

There will be one SVE system for each contiguous VOC problem in soil. Typically, this will be one facility, but it may be a small cluster of facilities. Before any SVE system is installed, the investigation will determine the extent of the release of the contamination; the maximum levels and where it falls to non-detectable levels. EPA will therefore know the size of the problem it is dealing with. A network of monitoring wells will be installed so that the levels of VOCs can be monitored as the cleanup takes place. In addition, EPA will know the profile of the soil with depth; where there are gravel layers and where there are clay layers, etc. These will be accounted for in deciding from what depth the soil vapor will be removed in each SVE well.

Given this, the VOCs would not be drawn from areas away from the site for several reasons. First, the SVE system is properly configured for the known contaminant plume, and areas of gravel vs. clay are already accounted for. Second, the monitoring network would reveal VOCs leaking in from another location. Third, each extraction system is not powerful enough to draw vapor from a great distance. Each will be designed for a radius only large enough to address the known problem.

◊ *Index No. 7*

Some persons indicated that they felt EPA should inform all persons before they buy property that this is a Superfund site, or have the City of Tempe or real estate agents do it. Some persons said that, had they known about the site, the chemicals they were thinking of using and the chemicals EPA had found in the area, they never would have purchased property there because EPA might look to them as the source of contamination.

Response:

There is an issue as to what sellers and real estate agents should have to disclose to a potential buyer before a sale. Nonetheless, neither Arizona lawmakers nor sellers, real estate agents, or the City of Tempe are within EPA control with regard to disclosure. Persons with interest in disclosure laws or having Tempe make disclosures should contact their state legislator or the City of Tempe.

EPA maintains many community relations activities, and the locations of all areas of investigation for Superfund, as well as the results of those investigations, are publicly available to those who inquire or visit an information repository. EPA gives notice to those parties whom it believes may or will be subject to enforcement actions. But it is not possible for EPA to monitor real estate transactions and still have resources left to carry out its mandate of protecting human health and the environment.

We suggest that the prudent buyer take the responsibility to make the appropriate inquiries, use the publicly available information, and make an informed decision. We welcome any additional comments as to how EPA might modify its existing community relations activities to increase the public's awareness of the Superfund site.

◊ *Index No. 8*

One person wanted to know whether EPA routinely considers dry wells to be a source of VOCs to soils at IBW–South.

Response:

EPA considers dry wells to be *potential* sources of VOCs. However, the degree to which EPA investigates any dry well will depend on other data and information available to EPA. In most cases, rainwater dry wells in parking lots are not VOC sources.

◊ *Index No. 9*

One person wanted to know why EPA did not include dermal exposure to VOCs (absorption through the skin) as a pathway (way in which someone might be exposed to chemicals from the environment) in its risk assessment.

Response:

EPA's risk assessment does consider dermal exposure; however, it concludes that dermal exposure is not a likely pathway and so it is not used to lead to a Plug-in Criterion (the criteria defining at what point a facility would have to be to require an SVE cleanup).

Dermal exposure is unlikely because VOCs would not likely be present in soils very close to the surface of the ground (where dermal exposure would occur) in the Arizona climate. Under such conditions, the VOCs vaporize from the very near-surface soils shortly after disposal. In addition, even if there were enough VOCs near the surface to create a dermal threat, EPA believes that the concurrent risk from inhalation would be great enough that the facility would have to clean up anyway based on the Plug-in Criterion for inhalation. Therefore, the dermal pathway is not considered relevant compared to the pathways that are fully evaluated: inhalation at the site, inhalation from domestic use of groundwater, and ingestion of domestic groundwater. A similar conclusion can be made regarding direct ingestion of VOCs in soil.

◊ *Index No. 10*

At least two persons asked whether EPA would ever give a "clean bill of health" to a facility–a letter declaring someone's property to be free of VOCs. One person asked whether we could "delist" a property if we determined that it was not contaminated.

Response:

First, regarding "delisting," there may be some confusion on this point. None of the facilities being investigated are individually "listed" on the National Priorities List. Rather, the IBW–South study area is listed, and EPA is investigating for contamination within it. A Superfund site includes the actual boundaries of the contamination. It is possible that the commenter may be using a more informal definition of "delisting," meaning for EPA to declare a property, previously listed as being "under investigation," uncontaminated.

EPA does not issue notices declaring properties uncontaminated. Even after fully sampling a property, there is always the possibility that contamination was missed. However, EPA can present all known data about a facility and describe any possible limitations on these data.

Realizing that this is an important issue to many people within IBW–South, EPA is evaluating the possibility of issuing a letter indicating EPA's current disposition toward properties where no current data suggest they are a source of contamination. However, even such a letter would not rule out further investigation or cleanup, should new information be discovered indicating that a property could be a source of contamination.

◊ *Index No. 11*

Several persons at the meeting raised the issue of small businesses and their financial hardship in doing Superfund work. One person said, "Does EPA consider a small business person and their obligation to their employees to allow them time to create even tens of thousands of dollars just to go ahead and say, "I guess you can walk?"...Do you consider what a small business person goes through and allows in cash flow to do the investigation to prove they're innocent? You talked about guilty before proven innocent. Exactly what is it? Do you allow them time to go ahead and prove that before they go bankrupt? Do you consider their needs and wants?"

Response:

The issue of small business impacts has been extremely common among Potentially Responsible Parties because so many of the PRPs at IBW–South are small businesses. This question is addressed later in this document under Section 5.3, "Financial Impacts on Small Business."

This question also contains an element pertaining to "proving innocence." CERCLA Section 107 provides that PRPs are liable for all work and costs associated with responding to a release or threat of a release of a hazardous substance to the environment, including investigation costs. In some cases, EPA has little information indicating a release or threat of release of hazardous substances; a facility is investigated because it used solvents. In these cases, a limited, simple screening sampling may be all that is needed to resolve the question of possible contribution, and EPA performs this screening, in most cases. If no VOCs are found, EPA generally does not require such a party to pay for the screening.

However, if there is evidence of a release or threat of a release, based upon actual data or other information, then all sampling costs are "costs incurred in responding to a release or threat of a release of a hazardous substance." This is true even if the sampling results in a determination that the remaining VOCs are not serious enough to require an SVE cleanup.

◊ *Index No. 12*

One person asked whether EPA would consider Phase I and Phase II audits done for the real estate industry as screening samples to convince EPA that there was no further problem with a property.

Response:

EPA will examine data in audits and use them where appropriate and where they meet EPA quality control standards. However, based on past experience, the data produced by most audits cannot be used to support the needed conclusions. First, most audits do not sample for soil gas, which EPA would require. Second, most audits take so few soil samples that the results are inconclusive. Third, many such audits use field, sampling, and laboratory methods that are improper and produce ambiguous results. Fourth, most sampling methods are not properly documented and the results carry little or no quality control documentation. Without such documentation, EPA cannot check whether the samplers or the laboratory actually performed the work properly. Finally, many such audits pass over critical existing data about past chemical use at a facility.

◊ *Index No. 13*

One person asked how long the municipal wells in the area have been shut down, saying that the City never notified the public of the wells being removed from service. The person said that, based on her understanding, the Arizona Department of Water Resources and water purveyors could turn the water back on at any time without notice. If there was a period of drought, the purveyors could be blending and averaging and the public would never know it. The person asked whether EPA is going to notify the public if the wells are turned back on.

Response:

The municipal wells and the Salt River Project (SRP) well in the IBW–South area have not been used since approximately 1982. The City has obtained its water from sources outside IBW–South. EPA has provided this information in community relations factsheets for IBW for several years. If EPA became aware of the City again drawing water from any of the wells for domestic use, EPA would inform the public of that change by factsheets and other community relations activities.

Ideally, the groundwater at IBW would be cleaned so that all production wells could again be used. In the meantime, EPA is encouraging the City and SRP to join EPA's cleanup efforts rather that remaining indefinitely in a situation where they would have to blend and average to be able to use the water.

EPA's involvement in a Superfund area in IBW–South does not change the City's legal obligation under the Safe Drinking Water Act (SDWA) to supply water that meets federal drinking water standards. These standards apply at the tap, not in the ground. Under certain circumstances, blending and averaging are allowed under the SDWA as long as the water at the tap meets the federal drinking water standards. Were the City to again use the wells, EPA would inform the public of this change. It would then be incumbent on the City to demonstrate to EPA's SDWA program that federal standards were being met.

2.2. Oral Comments at Public Meeting

The following comments were received at the public meeting during the comment period. In a few cases, persons made comments during the question-and-answer period but they were noted at the time as comments for the record. In either case, EPA did not respond to such comments at the meeting, as it had with questions, but is addressing them here.

◊ *Index No. 14*

An unidentified speaker, in the course of questions, commented that "Motorola approached EPA as to what to do about chlorofluorocarbons and they were advised to dispose of them underground. Like, back in the 60s." This was identified as a comment to be addressed later.

Response:

EPA did not exist in the 1960s, and EPA is unaware of any such advice given to Motorola. Releases from Motorola are being addressed through action required for IBW-North.

◊ *Index No. 15*

This comment was received during the question-and-answer session at the public meeting, but was marked at the time as a comment for response at a later time. The comment is paraphrased.

Mr. Leibovitz stated that he spent a year trying to get a permit at the City of Tempe so that he could put in a boiler for his dry-cleaning business. He stated that, during this time, no one at the City ever told him not to start or operate his business in the area. Mr. Leibovitz believes that the City and EPA had an obligation to tell him that this area was under EPA investigation and that the chemicals he was going to use in his business were the chemicals that were the subject of the investigation. He believes that the City should have issued his boiler permit with a warning of "proceed at your own risk," and that EPA should have told Tempe to tell business owners to "stay the hell out."

Mr. Leibovitz stated that everyone is looking the other way except EPA, who is now telling people that dry cleaners are killing their children, and that no dry cleaners have died from using PCE. He stated that he never did anything illegal or dishonest, didn't dump PCE, and doesn't know how the PCE got into the ground at his facility.

Response:

This comment is largely addressed by EPA's response to a question above in which disclosure was discussed. EPA has no control over the City of Tempe or any other party with regard to disclosure. EPA itself does not have the resources to follow all real estate transactions and make sure that each buyer is fully aware of the Superfund site. In addition, it would not be EPA's place to provide legal advice to a buyer as to whether to purchase a property.

Ultimately, each facility owner must assume responsibility for knowing the legal requirements that will pertain to his operation. Each buyer must assume responsibility for obtaining information about a property, as necessary, before assuming any risks in buying it. Information about where Superfund activities are occurring and the results of EPA's investigations is available to the public.

Moreover, buying property within a Superfund area such as IBW–South does not necessarily represent an unacceptable risk to a buyer, even a VOC-user. There are many users of VOCs in IBW–South whom EPA is not pursuing, because there is no evidence that VOCs were released into their soils. At other facilities, there is direct sampling evidence indicating that VOCs are present in the soils at significant levels.

EPA has not said that dry cleaners are killing people. Rather, there are some dry cleaners in IBW–South that have VOCs in their soils, and these VOCs are potential carcinogens that would represent a threat to public health if they entered the drinking water supply.

We understand Mr. Leibovitz's position that he does not know how VOCs ended up in the soil. Superfund is <u>not</u> a criminal law; it establishes civil liability. If there has been a release of VOCs on his property, then Mr. Leibovitz could be liable for costs of investigation and cleanup. EPA understands the financial impact that this liability may have on Mr. Leibovitz, and as stated in response to other questions, is evaluating ways to lessen this burden for small businesses.

◊ *Index No. 16*

This comment was made by Mr. Leibovitz during the public comment period at the public meeting. The comment is paraphrased.

Mr. Leibovitz stated that he has a dry cleaning business in Indian Bend Wash South, and that he believes that EPA should have put the City of Tempe on notice to tell businesses in the area that EPA was going to investigate the soil. He stated that a very dramatic lifestyle change is imminent for him and for dry cleaners in the area because of the Superfund Action, despite the fact that he believes he complied with all waste documentation requirements.

He stated that he believed that certain types of businesses, or businesses that use a certain product, such as dry cleaners, were being singled out for action by EPA. He expressed frustration that, unlike problems in the rest of his life, this Superfund problem was one that he did not seem to be able to solve given his resources and efforts. He stated his disagreement with Congress' decision to make the responsible party pay for Superfund cleanups, and that the poor taxpayer shouldn't have to pay.

Mr. Leibovitz believes that dry cleaners and any other business where a "truck leaked" are being characterized as "monsters" and that these parties are doing nothing wrong. He said that the government is not going to change the law, and so the only way is for each business owner to be warned before buying property.

Response:

It should be noted that EPA did not know as the investigation started which facilities would have to be investigated, nor did EPA know how serious the groundwater problem would turn out to be. There is no way that EPA or any other agency could have predicted or known that Mr. Leibovitz's property would both come under investigation and show VOCs in the soils, prior to Mr. Leibovitz purchasing the property. Again, prospective owners must assume responsibility for obtaining information and assessing their own risks under the law.

EPA does not believe it is true that all prospective buyers should "stay away" from a Superfund area such as IBW–South. As we have said, there are many facilities within IBW–South that are not sources of VOCs and are not bearing any liability. Not all properties come with the same risk of future liability, even among VOC users. It would not be appropriate for EPA or any other agency to declare a uniform "warning," which would be unwarranted for existing owners in the area, many of whom do not have any contamination on their property.

EPA makes available information from the Superfund investigation, including the types of chemicals that are being investigated, to anyone who asks, and then lets each buyer decide for himself or herself.

The comment also mentions the debate over who pays for Superfund. Congress decided to make liable those persons who either caused the problem or who own or operate the property on which the problem exists.

◊ *Index No. 17*

Mr. Frye owns a dry cleaning business in IBW-South. He stated that his concern is with regard to liability under Superfund. Mr. Frye believes that if there is contamination between two adjacent properties, one or the other party will pay for it. Instead of thinking in terms of only two people paying, he encouraged lawsuits against real estate people who did not disclose that property was within a Superfund site, their insurance companies, and the Cities. He believes that PRPs should join together in legal actions against these third parties.

Response:

EPA has fully addressed the issue of EPA's approach in the case where contamination exists on two neighboring properties. Responses pertaining to this comment are found above, and below under "Other Common Concerns and Questions."

EPA has also addressed the issue of disclosure to potential buyers in this document. EPA cannot provide advice as to whom Mr. Frye may be able to sue. EPA would again point out, however, that the IBW–South study area is a zone in which EPA is looking for VOC sources and contamination. EPA has not declared all property within IBW–South to be contaminated; and relatively few properties will actually be subject to a cleanup. It is likely that most remaining non-industrial properties are not the sources of any contamination.

3. Comments Received at Public Meeting on Cards

◊ *Index No. 18*

If using activated carbon as a treatment alternative, how will the generating facilities treat and dispose of this material? Will it meet listing criteria? Also, during the groundwater remedial phase of this program will pumped groundwater be considered a listed waste? The classification of this (wastewater/carbon) material as a listed hazardous waste will certainly increase disposal costs.

Response:

If the carbon is disposed of directly, it would be disposed properly as a listed hazardous waste under the Resource Conservation and Recovery Act (RCRA). If the carbon is regenerated by removing the VOCs for recycling, then the carbon can be reused and would not be considered a listed waste once regenerated.

EPA has not developed its cleanup proposal for groundwater. However, based on the "contained-in" policy, groundwater contaminated with a listed waste would have to be managed as a RCRA waste. The commenter is correct that costs for disposal of listed wastes are often substantial.

◊ *Index No. 19*

EPA has specific requirements for SVMW construction standards. Regarding the SVE, will individual sites have the opportunity to select their own SVE option, whether it be carbon, catalytic, or thermal units?

Response:

The type of SVE treatment option selected will be subject to EPA approval as part of the remedial design plan. However, in cases where more than one option would be equally effective, and the PRP would carry out the work, EPA would give extra weight to the preference of the PRP.

◊ *Index No. 20*

Regarding the original Plug-in Criteria:

1. Will each site have its own Plug-in Criteria based on site-specific conditions?

2. How may site-specific Plug-in Criteria differ from federal MCL and/or state HBGLs?

3. Can the EPA, or will the EPA, notify [PRPs] of their cleanup level requirements in writing or will the EPA use some sort of rule-of-thumb approach?

Response:

1. The Plug-in Criteria are numerical limits on cancer risk and non-cancer risk. There is also one criterion based on federal water standards. These numbers are fixed and are the same for all facilities. If any one of the criteria is exceeded, the facility plugs in. The same Plug-in Criteria could be exceeded by a number of varying site-specific conditions. Therefore, while the Plug-in Criteria do not vary from facility to facility, the actual conditions resulting in exceedance of the criteria will vary.

2. Only one of the criteria is based on water standards. The other criteria are based on risk calculations. Whichever is more stringent (risk or water standards) in any particular case will govern the decision on whether to plug in a facility.

   Important: the criteria do not represent limits on the final groundwater concentration, as this soil cleanup cannot control VOCs that are already in the groundwater today. Rather, the criteria set a limit on how much extra VOCs a facility may add to the groundwater over time. This is called "source control."

3. The cleanup criteria, risk calculations, and process for determining whether site-specific conditions warrant cleanup are all pre-determined in EPA's proposal. Once the levels of VOCs are obtained for a facility, the risk can be calculated and compared to the pre-set criteria.

4. Written Comments Received During Public Comment Period

4.1. Written Comments from Individuals

◊ *Index No. 21*

Donn Frye: My name is Donn Frye. I am the president of the family-owned dry cleaning business, Prestige Cleaners. Prestige opened for business on June 1, 1964, currently has eight locations, and employs about 100 people. Prestige has been named a PRP at a location at 128 Siesta Lane, Tempe, Arizona. Prestige operated a drycleaning, laundry, and drapery facility at this location from February 1987 to September 1988. We are now being required to perform a remedial investigation to see if we might have contributed to soil and groundwater contamination. This investigation is not limited to the property where we operated but includes testing at adjacent property; additionally, wells downstream from our site have to be constructed and monitored. We have been cooperative with the EPA from the onset, but now find the extent of testing as well as the timing of how quickly the testing has to be completed will financially jeopardize our small business. I ask that the EPA balance the desire to demonstrate timeliness in resolving this issue with the common sense not to put another small company out of business, at which point the funding to do any work on the Siesta Lane site would stop completely.

Response:

EPA is aware of the financial burdens that Superfund investigation and cleanup may place on small businesses, and it is not EPA's intent to bankrupt small businesses. The Superfund law does contain broad provisions of liability, and EPA will still seek contributions from liable parties. However, EPA is examining various approaches that could be used to ease the burdens that small businesses face. The Plug-in Approach in EPA's proposal is one result of such efforts. Under the Plug-in Approach, in most cases the PRP is freed from having to pay for a feasibility study and the costs of separate remedy selections at each facility. Other approaches, such as timing arrangements, cost settlements, and strategies to enhance the benefits of economies of scale, may be possible.

At the same time, it should be noted that EPA would be remiss to postpone work in many areas. For example, some groundwater monitoring wells are needed immediately to give EPA a composite picture of the groundwater situation and allow for EPA's groundwater proposal. Likewise, where very high levels of soil gas contaminants exist, it may be critical to remove them before they reach groundwater and become much more difficult and expensive to remove. Nonetheless, EPA will continue to work with PRPs fairly and in a manner that complies with the law.

◊ *Index No. 22*

Mark Grenard: I would prefer to see GAC or resin-based systems used at the present sites as their contamination levels do not appear to be the same as Unidynamics out at PGA which went to thermal oxidation due to contamination levels double previous tests in 1991.

I would also like to know why resin-based systems are not mentioned as an alternative in the ESD or the EPA handout for IBW–South given their flexibility and I would assume based on Jeff Dhont's [EPA Remedial Project Manager] verbal description reduced cost compared to GAC systems in terms of hauling and disposal fees. Thank you for your help in explaining the process to date at the site.

Response:

Catalytic oxidation and thermal oxidation systems are proposed in addition to adsorption-based systems (carbon or resin) because under the Plug-in Process, we do not know the maximum levels that we will find until we investigate the suspect facilities thoroughly. Already we have found levels in soil vapor sampling at two separate facilities in IBW–South that exceed 9,000 µg/l and 12,000 µg/l, TCE and PCE, respectively. The second of these was a surface soil gas sample and is likely to indicate even higher levels at depth.

Therefore, it is not accurate to imply that only low levels of soil gas contaminants exist at IBW–South. While GAC or resin systems may be effective even at these levels, it may prove more effective and cost-efficient to employ oxidation in these cases. In contrast, there are likely to be several facilities with lower levels where granular activated carbon (GAC) or resin would be more appropriate (See Chapter 3 of the Feasibility Study). All proposed types of treatment can be designed to be effective and safe.

While resin-based systems are not directly mentioned in the Proposed Plan (GAC is stated as the prototype of a class of treatments called "adsorptive" in the Plan text), the Feasibility Study describes resin systems along with GAC. Resin-based systems could be used at IBW–South as part of system design. Mr. Grenard is correct that the resin-based systems may save money in the handling of spent carbon. However, the removed VOCs must still be properly handled and disposed and the cost of the two systems are not identical (resin systems commonly use a desorb cycle that requires an energy input). Therefore, whether total cost savings is achieved would depend on the vendor of the technology and the circumstances at a particular facility.

◊ *Index No. 23*

Philip G. Kauffman: The property I own is in the Indian Bend Wash South Superfund site, as described in the Arizona Republic newspaper today. My official notification from you asking for public comment, came from having read the above newspaper. By accident I saw that you were interested in getting public comments, and that they must be postmarked by this Wednesday.

I have owned the above property since 1982, and do not know of any environmental problems. Obviously, if there is a potential problem to our groundwater, repairs need to be done. According to the newspaper, it will cost between $700,000 and $1.9 million to clean up each site.

I am retired and rely on the little income I get from renting this property. I do not have any funds to pay for cleanup. If you sue me, I will have to give up the land, give up my house, live in the streets, and then you will have my possessions.

I hope this approach makes you happy.

Response:

EPA is not targeting all properties within IBW–South for a cleanup. Among thousands of parcels of property, EPA is focusing its efforts on those few properties that are or could be sources of the contamination that has been found in groundwater.

If you own land on which no chemicals have ever been used and no releases of hazardous substances have ever occurred, then it is highly unlikely that EPA would seek to take Superfund action there. While the cost figures cited in the newspaper are essentially correct, they will apply to those parties of whom EPA requires a cleanup, not to every party who owns property within the Superfund study zone.

4.2. IMC Magnetics Corporation

(Body of letter reproduced in entirety; indices added)

IMC is in general agreement with the approach to the application of soil vapor extraction (SVE) to the cleanup of volatile organic compounds (VOCs) from soil in the Indian Bend Wash, South Area (SIBW). We understand that the proposed plan is designed to expedite the soil cleanup by bypassing a feasibility study and the site specific decision process at each facility. EPA has determined that soil conditions are sufficiently uniform across the IBW–South area and are amenable to SVE technology such that other alternatives for VOC cleanup need not be considered at each facility. IMC agrees that expediting cleanup is desirable and takes this opportunity to suggest ways in which soil cleanup can be expedited even further.

Plug-in Criteria (Indices No. 24 and 25)

◊ *Index No. 24*

EPA proposes to determine whether VOCs at a facility exceeds the Plug-in Criteria by applying the VLEACH model. There may be instances where the VOCs are present in the soil at concentrations sufficiently high to be of concern to the facility owner that plug-in could be voluntary without extensive soil gas monitoring and application of VLEACH. IMC recommends that voluntary plug-in be available to those owners of facilities that desire to expedite VOC remediation at their sites.

Response:

EPA does not believe that "voluntary plug-in" would expedite VOC cleanup significantly. Monitoring and VLEACH are not used solely to determine whether plug-in should occur. Even if plug-in were "voluntary," depth-specific soil vapor monitoring wells, in conjunction with surface soil gas samples, would still be required to (1) properly design the SVE system, (2) properly site the SVE extraction wells, (3) properly decide on the offgas treatment that is appropriate, and (4) to monitor the SVE cleanup to ensure its effectiveness.

In addition, VLEACH would still be necessary to determine when cleanup standards have been met. VLEACH (or equivalent EPA-approved modeling) is a part of the selected remedy, and is used to compare soil gas levels with the health risk-based Plug-in Criteria. Therefore, the supposition that voluntary plug-in would remove the need for monitoring or the application of VLEACH is incorrect.

Under the voluntarily plug-in proposed by IMC Magnetics, the party involved would have to agree to operate SVE until all cleanup levels were achieved and EPA would still require installation and sampling of soil vapor monitoring wells, and proper application of the process in the ROD, including VLEACH, to ensure that the cleanup was appropriate, complete, and effective.

◊ *Index No. 25*

At some facilities, it may be expedient to have a phased plug-in. For example, based on available data, there may be one or more areas within a facility where VOC concentrations are sufficient to trigger plug-in either on a voluntary basis or on the application of a vadose zone transport model such as VLEACH. Also there may be other areas within the facility for which further data may be necessary before the need for SVE can be determined. By allowing a phased plug-in, soil cleanup could be expedited in those areas where cleanup is clearly needed or prudent without waiting for a complete characterization of VOC contamination over the entire facility. IMC recommends that EPA incorporate the concept of phased plug-in at such facilities. The intent and objective of phased plug-in would be to expedite VOC remediation.

Response:

Assessing a facility for plug-in in phases would already be possible under the current proposal without adding a formalized administrative reference to "phasing." However, it would only be used at EPA's discretion under the proper circumstances.

Cleanup Confirmation (Indices No. 26 and 27)

◊ *Index No. 26*

Except for indicating that SVE systems will operate until VOCs in soil no longer exceed the Plug-in Criteria, EPA has stated that additional requirements will be introduced in the ROD to ensure that VOC levels in soil are reduced to acceptable levels. These requirements should be open to public comment prior to inclusion in the ROD.

Response:

The "additional requirements" referred to pertain to sampling and SVE operations time and may be necessary because, even after cleanup standards are set, there must be a definition of when cleanup standards have been met. It is insufficient to declare cleanup complete based on a single sampling showing levels below the cleanup standards. This is because there could be a statistical or temporal fluctuation in the data, and also because VOCs levels may rise after SVE is shut down due to diffusion of VOCs from less-preferential flow zones. Therefore, there must be a certain number of samplings showing levels below the cleanup levels before SVE can be shut down. Subsequently, there must be a certain number of samplings **after** SVE is shut down that prove that levels are not rising again. As an example, EPA may require roughly two quarters of data indicating cleanup levels are met, followed by one year of post-shutdown data indicating levels have not rebounded, but this may vary from site to site.

Typically, the specifics of these requirements are established in the remedial design plan, which is subject to EPA approval.

◊ *Index No. 27*

It is conceivable that details of cleanup confirmation will depend on site-specific conditions and will differ among facilities and among sources within a facility. Procedures for cleanup confirmation should be based on site-specific conditions and on information developed in the remedial investigation and during the SVE program. As with a phased plug-in, components of the overall site SVE system at various locations could be phased out as cleanup progresses.

Response:

As already mentioned, there will be some pre-determined standards for determining cleanup confirmation. Other factors, as IMC Magnetics points out, arise from site-specific conditions, and these will be addressed by the EPA-approved design plan for each SVE system.

The proposal already contains, in essence, the concept of a "phase-out" of locations within a site. As shown in Appendix C of the Feasibility Study, each soil vapor extraction well defines a "polygon," or area to which one run of VLEACH applies. If a facility contains multiple polygons, some may reach cleanup standards before others. These may shut down while the others continue SVE.

4.3. Gateway Area Coalition

◊ *Index No. 28*

Some improvement in the notification to concerned residents of public meetings and other informational sources is needed.

Response:

EPA shares Gateway's concern that we reach and inform as many people as possible when public meetings are held or when important information becomes available. CERCLA and the Superfund regulation, the NCP, direct EPA to keep the public informed and to solicit public participation. These are EPA's goals, and a strong public turnout and involvement at public meetings is our preference.

For this proposal at IBW–South, EPA published notices over two days in two major local newspapers, issued press releases to most newspapers and the television media, issued more than 1,100 factsheets to interested parties, informed and encouraged dissemination by local and state officials, and made reach-out calls and held separate meetings for citizen groups and potentially responsible parties.

We believe many of the ideas presented to EPA by Gateway and other groups are excellent and are worthy of trying, where EPA's budget will permit. We are evaluating most closely the idea of running radio and/or T.V. interviews or spots on news programs, and the idea of having cities place a notice in utility bills. While EPA was not able to implement these ideas before the close of the public comment on this proposal, we will seek to implement them, where practical and possible, in future community relations activities at this and other Superfund sites.

◊ *Index No. 29*

Enforcement procedures have not always been strict enough to protect the public, especially where follow-up monitoring to assure that strict compliance with the agreed-upon remedy is (not) met.

Response:

Gateway's opinion on this matter is noted. To clarify, EPA signs a Record of Decision (ROD) to legally establish what (and in the case of this cleanup, where) the remedy will be. The ROD does not establish who will actually construct and operate the cleanup. This could be either a private party or EPA itself.

In cases where a private party (rather than EPA) will be constructing and operating the cleanup action, EPA uses either administrative orders or consent agreements with the private party. Such enforcement instruments require that the private party carry out the cleanup in accordance with the requirements in the ROD, and there are penalties for failing to do so.

EPA intends to use these enforcement instruments to ensure proper implementation of the remedy if private parties carry out the cleanup work. Gateway also is concerned that follow-up be made once the cleanup starts to ensure that the requirements of the ROD are not violated. EPA would do this as part of its oversight of the cleanup.

◊ *Index No. 30*

A comprehensive look at all the risks to the public should be included.

Response:

EPA believes that its risk assessment for the VOCs in soils at IBW–South addresses all plausible risks from the VOCs that will be the subject of the cleanup.

It is important to note that there are many potential risks to the public from a variety of factors (air pollution, pesticides, ultraviolet rays, food additives, second-hand smoke, etc.). While these are real risks that are not to be ignored, the purpose of a Superfund risk assessment and the Superfund program is to identify and evaluate those risks associated with an uncontrolled release of a hazardous substance within a particular site, and reduce those risks to safe levels by way of a remedy (a cleanup).

◊ *Index No. 31*

Did you look at the sewers even when the wastes entering them was "permitted?" It still affects the residents. With your oversight comments in hand we as citizens can start to change the permit system.

Response:

From the context of EPA's meeting with Gateway, EPA assumes this comment refers to VOCs that are discharged into the sewer system by businesses, usually under permit by a city which is in turn bound by federal regulations under the Clean Water Act. The permit sets limits on the amount of VOCs that can be discharged, which then flow to the local treatment plant. While the sewer lines are intact, Gateway's concern is that the VOCs may be backing up into people's homes through their sewer hookups.

EPA has not considered the sewers as part of its Superfund cleanup for IBW–South. There are two reasons for this. First, EPA believes such a scenario is unlikely. The trap systems that keep nuisance-smelling sewer gas out of homes would also keep VOCs out of homes. EPA has received no complaints of odors or widespread or even limited health effects, or any other evidence that would indicate such an occurrence in the IBW–South area. While there is no direct sampling of homes and therefore no direct data, EPA does not believe that VOCs in intact sewer lines are entering homes in IBW–South. Accordingly, we do not believe persons are exposed to VOCs by this route.

Second, even if this were occurring, we do not believe it would be regulated by CERCLA. If the sewer lines were leaking in a particular location, and were contaminating soils and groundwater with VOCs, such an uncontrolled release might be subject to Superfund cleanup. However, with an intact sewer system, the issue is with the levels of ongoing controlled release of VOCs that are allowed under other laws governing such releases. If this were considered a Superfund problem, the entire sewer system of the Phoenix valley would have to be declared a "Superfund site." Subsequently, the "cleanup" needed would be to regulate the ongoing flow of VOCs into the sewer system, an action already addressed by other laws and programs. This would not be a problem that Superfund was designed to address.

If Gateway has evidence of such an effect in the Tempe area, we strongly recommend that it be presented to the City Department of Public Works, and the City and County Health Departments. In addition, it should be presented to EPA's Wastewater Program. We can assist by passing information along and providing Gateway with the appropriate contacts.

◊ *Index No. 32*

We feel that the response time between the public meeting and the end of the public comment period is too short. It again gives us too little time to use the libraries since they are, at best, difficult to access.

Response:

Based on Gateway's and others' concerns, and a request sent to EPA in writing, EPA extended the public comment period by 31 days to August 14, 1993.

4.4. Arizona Department of Environmental Quality

The State of Arizona, in a letter to EPA dated July 22, 1993, has stated that it considers the Feasibility Study acceptable, but issued the following comments (Indexes No. 33 through 36) pertaining to Appendix B, "ARARs Analysis for the SVE Remedial Action, IBW–South."

◊ *Index No. 33*

Appendix B: If the surface of a landfill is affected by the proposed remedy, monitoring and pollution control devices may be required. (Arizona Revised Statutes §49-764).

Response:

ROD Section 8.5 directly states EPA's intentions with regard to subsites situated on landfills. As stated there, monitoring would be necessary in some cases.

However, EPA has reviewed ARS §49-764 and determined that its provisions are not substantive cleanup standards and therefore cannot be ARARs (53 Federal Register 51443). ARS §49-764 provides an administrative procedure by which applicable substantive requirements may become effective through issuance of an order by the Director of ADEQ.

◊ *Index No. 34*

Table B-1: "Maricopa County Air Quality Rules" should read, "Maricopa County Air Pollution Control Division Regulations." Also, "Arizona Statutory Code" should read, "Arizona Revised Statutes."

Response:

Comment noted. The ARARs section and other sections of the ROD reflect these changes in reference to the County agency, accept that "rules" continue to be used as a synonym for "regulations."

◊ *Index No. 35*

Table B-1: The reference to "Lakes Bill" needs clarification.

Response:

The ARARs section of the ROD will remove this reference. The Lakes Bill is not an ARAR for the purposes of this remedy.

◊ *Index No. 36*

Table B-2: Should 1,1,2-Trichloro-2,2,1-Triflouroethane be written as 1,1,2-Trichloro-1,1,2-Triflouroethane?

Response:

The original compound is correct; it can also be written as 1,1,2-trichloro-1,2,2-trifluoroethane. The compound indicated in the comment as the possible correction does not exist.

4.5. Arizona Public Service Company

◊ *Index No. 37*

Page 1-4 (Sec. 1.3.1)

The boundaries of a superfund site have significant impacts on property owners and facilities located within the site boundaries. Location within a superfund site can depress property values, marketability of properties, and intensity and type of regulatory oversight. The Operable Unit Feasibility Study (OUFS) states that the study area boundaries are not a legal definition and the actual extent of contamination defines the boundaries of the Superfund Site. The current IBW Boundaries represented on numerous drawings and maps are the study area boundaries, not the actual site boundaries. What are the actual legal site boundaries as they exist at this time? Because of the impacts on property owners and facilities within superfund sites, it may be more appropriate to use boundaries that reflect the legal definition of the superfund site.

Response:

EPA's response to the property-related issues of site boundaries and property values are also discussed in Section 5.2 of this Response Summary. Section 300.5 of the National Contingency Plan ("NCP"), the regulations required by CERCLA, Section 105, define "on-site" as "the areal extent of contamination and all suitable areas in very close proximity to the contamination necessary for implementation of the response action."

Because Focused RI work and the groundwater RI work are not complete at IBW-South, the exact areal extent of contamination within the study boundary is not known. EPA is authorized to investigate contamination whether it is onsite, offsite, within a "study boundary," or outside it. If contamination is found at a location where it was unknown before, the site boundaries expand to incorporate that location. Site boundaries change without an administrative action by EPA.

EPA has stated that not all properties within the study area boundary can be considered contaminated. EPA cannot identify the exact limits of contamination throughout all of IBW-South at this time. However, Focused RIs and the groundwater RI will determine the extent of contamination prior to the execution of each remedial action. "Onsite" will be the contaminated area and adjacent areas in proximity to the contamination necessary to carry out each remedial action. Those areas where no contamination is present (and therefore no remedial action is necessary) may be considered "offsite."

◊ *Index No. 38*

Page 1-4 (Sec. 1.3.1)

EPA states that some properties in IBW-South may contain metal C waste. What is metal C waste?

Response:

"Metal C" is a typographical error, and should read "metal".

◊ *Index No. 39*

Page 1-8 (Sec. 1.3.3)

Figure 3 lists facilities planned to perform focused RIs. Publishing this list has significant impact on those facilities included in the list. APS recommends that EPA publish a list of facilities where no further action is required after the focused RIs are complete.

Response:

The title on Figure 3 was incorrect, and this is noted in the ROD. Figure 3 shows facilities that EPA has begun investigating or from which it has obtained information. The actual number of facilities undergoing full Focused RIs will be less than the number of facilities on Figure 3. Many facilities will be screened out without requiring a Focused RI.

At those subsites for which a Focused RI is performed, the result of the Focused RI and comparison with Plug-in Criteria will be published regardless of whether the subsite requires the remedial action. Therefore, such "no further action" determinations will be a matter of record.

◊ *Index No. 40*

Page 1-10 (Sec. 1.3.4)

EPA states that groundwater contamination in the IBW-South groundwater is difficult to trace to its original sources. However, review of the IBW-South groundwater data indicates a strong signature of groundwater contamination immediately down gradient of identified sources.

Response:

EPA agrees that there appears to be a signature of VOC contamination downgradient of certain identified sources. The signature is stronger for some sources than others. Nonetheless, tracing sources and ensuring that all contributing sources are identified is complicated by the complexities in the hydrogeology and contaminant transport pathways.

◊ *Index No. 41*

Page 1-11 (Sec. 1.4)

EPA states that soil investigations will generally consist of two components: 1. EPA Performs a PPI and if the results indicate that the facility warrants more investigation then, 2. EPA issues an administrative order requiring PRPs to perform a Focused RI. It is unclear what mechanisms EPA is using to encourage voluntary compliance and cooperation and when an Administrative Order will be issued.

Response:

The enforcement mechanisms to be used to execute a remedy are not selected by a Record of Decision. While the FS mentions the administrative order because it is the most likely mechanism, there is nothing to prevent EPA from using other mechanisms as appropriate and allowed by law.

EPA will consider the use of voluntary compliance without enforcement actions at its sole discretion. EPA will also consider whether such an approach is in the public interest and protective of the environment. EPA encourages compliance and cooperation, whether or not an Administrative Order is issued. If a responsible party is fully compliant and cooperative with EPA, then that party's work will be completed in a timely fashion with no penalties to that party, whether the work is voluntary or under an Administrative Order.

◊ *Index No. 42*

Page 1-23 (Sec. 1.6.5)

The description of how plug-in of a subsite will be documented is unclear. How specifically will EPA document subsite plug-in? What is the relationship between the ROD and public notice of the decision tree process results?

Response:

The manner in which EPA will plug in a facility and notify the public is specified in Section 8.3.3 of Part II of the ROD.

◊ *Index No. 43*

Page 5-8 (Sec. 5.4.1)

APS supports EPA's efforts to streamline the process to achieve remediation. In particular, we agree that it is not necessary for a site to be fully characterized prior to developing the site profile and beginning the plug-in process.

Response:

Comment Noted.

◊ *Index No. 44*

Page 5-10 (Sec. 5.4.1)

EPA states that a cleanup time of roughly 5 years will be used for a basis of comparison to determine use of SVE technological enhancements. APS encourages EPA to consider a cost benefit analysis to make this determination, rather than relying on an arbitrary time period.

Response:

EPA has not stated that technological enhancements cannot be used when cleanup is projected to last *less* than 5 years. If a potentially responsible party believed, by virtue of a cost-benefit or other analysis, that an enhancement would be preferable even though unenhanced SVE could reach cleanup in *less* than 5 years, EPA would still consider the use of the enhancement.

With regard to projected cleanup times in excess of 5 years, EPA has specified the 5 year guideline as a point of departure for *considering* enhancements. EPA considers 5 years reasonable for achieving remediation by SVE in most cases at IBW-South. Protectiveness of human health and the environment must be considered in addition to cost when considering the length of cleanup times. Given the range of costs attributable to the enhancements (0.5-2.5 times the unenhanced costs), and the difficulty in quantifying the "cost" to the environment due to long cleanup times, EPA believes that the consideration of enhancements, as appropriate, for projected cleanup times in *excess* of 5 years is still appropriate. EPA will consider cost-benefit analyses submitted by outside parties, and may decide in a particular case not to use enhancements even if the unenhanced cleanup time would exceed 5 years.

◊ *Index No. 45*

Page 5-11 (Sec. 5.4.2)

EPA states that other contaminant transport models will be acceptable to EPA. What other models has EPA accepted or would EPA consider accepting?

Response:

The model selected in this remedy for making plug-in and cleanup determinations is the VLEACH model, unless another equivalent model is approved by EPA for use <u>at IBW-South</u>. No models other than VLEACH are approved at this time. EPA is not prepared to identify other models that it may consider in the future. EPA is currently working on updated versions of VLEACH itself, which may be used as soon as they are approved.

◊ *Index No. 46*

Page 5-14 (Sec. 5.4.2.2)

Soil gas sampling locations can be established on an appropriate grid in a workplan. However, implementation of the workplan is always affected by actual field conditions and sampling locations may have to change as a result. In particular, in SIBW-South, cobbly subsurface conditions can significantly influence the success of placing subsurface soil gas probes. Facilities should be allowed flexibility to respond to field conditions.

Response:

EPA agrees that flexibility is sometimes required to respond to field conditions. In particular, it may not be possible to collect samples at some sample points on a planned grid due to field conditions. EPA would allow for such conditions, as appropriate, in approving plans and under its oversight of field work.

Responses to APS on the Interim Risk Assessment

◊ *Index No. 47*

Page A-6 (Section A.2.3)

Page A-6 states that the reasonable maximum exposure (RME) scenario is developed by combining several 90th or 95th percentile estimates of exposure variables with the 95% UCL of the exposure concentration. It appears that this approach for evaluating potential risks at individual OUs represents a theoretical upper bound estimate (TUBE) analysis. A TUBE analysis, as defined by EPA, results from combining several upper-bound estimates of exposure and toxicity to produce estimates of potential risk that far exceed what may reasonably be expected to occur in reality, often exceeding the 99.99th percentile.

Recent EPA Guidance for Exposure Assessment (57 F.R. 22888) specifically cautions against using such a TUBE analysis in risk assessment. Rather than a TUBE approach, EPA recommends using simulation modeling, such as Monte Carlo, to estimate RME exposures and risks. APS believes that TUBE analysis may result in an overly conservative representation of potential risks, which could result in unnecessary remedial action. Therefore, APS supports the EPA recommendation of using simulation modeling.

Response:

The intent of the Reasonable Maximum Exposure (RME) scenario is to estimate a conservative exposure, one that is above average but still within the range of possible exposures.

EPA Region IX supplemental guidance (U.S. EPA, 1989, *Risk Assessment Guidance for Superfund. Human Health Risk Assessment.* U.S. EPA Region IX Recommendations, as cited in Appendix A of the Feasibility Study, Admin. Rec. No. 1599) for risk assessments implements the RME scenario by using a combination of 90-95th percentile values for contact/intake variables, mean body weight value and the 95 percent upper confidence limit (UCL) of the arithmetic mean contaminant concentration (note that the 95 percent UCL was not used, as described below).

Specific formulations of the exposure parameters were:

- Drinking water intake rate: 2 liters/day, the 90th percentile value for the U.S. population, and close to the historical recommendation for drinking water requirements by health professionals
- Exposure frequency: 350 days/year; insufficient data available for determining a distribution of days/year spent at a residence. This value is based on an assumption of 15 days/year away from the residence
- Exposure duration: 30 years, the 90th percentile value for duration at one residence for the U.S. population
- Inhalation rate: 20 m^3/day: insufficient data available to estimate a distribution of values; parameter obtained from a time-activity level study developed through a consensus of experts
- Body weight: 70 kg, median (50th percentile) value for an adult[1]
- Exposure concentrations in air and water: Based on computer modeling.
- Slope factor: 95 percent UCL on the dose-response slope

The parameter distributions are characterized in different fashions. Therefore, estimating the distribution of risk with the parameters as formulated, as APS suggests, would not be appropriate.

While APS argues that EPA has presented a TUBE analysis, this is not the intent of the exposure scenarios in the risk assessment. The TUBE is a type of bounding estimate used to eliminate pathways from the risk assessment that are not significant.

The plug-in nature of the remedy does not involve a TUBE analysis because: 1) the significance of exposure pathways at any particular site would not be known until after exposure concentrations have been modeled, and 2) a conservative methodology for estimating exposures is reasonable to ensure that the remedy applied to VOCs-in-the-vadose zone is permanent.

[1]Note that use of adult values for intake and body weight can underestimate exposures, since intake to body weight ratios for children generally are greater.

Also, EPA states that "the TUBE is calculated by assuming limits for all of the variables used to calculate exposure and dose that, when combined, will result in the mathematically highest exposure or dose (highest concentration, highest intake rate, lowest body weight, etc.)." This statement does not characterize any of the exposure variables used in the risk assessment.

APS states that EPA recommends use of simulation modeling, such as Monte Carlo analysis, to estimate RME exposures and risks. The Monte Carlo technique is one method recommended by EPA for characterizing uncertainty in estimated exposures. A Monte Carlo simulation can produce a distribution of exposures, from which statistical estimators can be selected (such as the 50th percentile, or 95th percentile of the distribution).

EPA cautions that unless a great deal is known about exposures or doses at the high end of the distribution, simulated distributions may not be able to differentiate between bounding estimates and the high-end estimates of exposure. This raises questions about the extent to which collection of additional data on exposure parameters would be sufficient, within the constraints of available resources, to sufficiently refine the exposure estimates. A further concern, beyond cost of the analysis, is that development of such refined exposure and risk estimates for individual subsites may result in insufficient overall protection of groundwater from VOC migration from the vadose zone.

While EPA shares APS's concern that a TUBE analysis could result in an overly conservative estimation of potential risks, the TUBE approach was not used in the risk assessment. More accurate estimates of exposures and health risks could result from applying Monte Carlo techniques; however, it is unlikely that these estimates would significantly influence the nature of the plug-in decisions to be made in the ROD.

◊ *Index No. 48*

Page A-6 (Section A.2.3)

Before statistical parameters, including the 95% upper confidence limit (UCL) can be calculated, several decisions must be made with regard to the data; these include 1) the method for determining the shape of the distribution of the data, which determines which 95% UCL equation to use; 2) how non-detect (ND) samples will be treated, including how data containing greater than 10-15% NDs will be evaluated (using one-half the detection limit is not appropriate when the data contain more than 10-15% NDs); 3) whether potential hot-spots will be evaluated separately; and 4) how data from multiple sampling events (e.g. more than one round of groundwater sampling) will be combined. Oftentimes, the manner in which data are evaluated can have a profound influence on the final conclusions of the risk assessment.

EPA Region IX supplemental guidance (U.S. EPA, 1989, *Risk Assessment Guidance for Superfund. Human Health Risk Assessment.* U.S. EPA Region IX Recommendations, as cited in Appendix A of the Feasibility Study, Admin. Rec. No. 1599) for risk assessments implements the RME scenario by using a combination of 90-95th percentile values for contact/intake variables, mean body weight value and the 95 percent upper confidence limit (UCL) of the arithmetic mean contaminant concentration (note that the 95 percent UCL was not used, as described below).

Specific formulations of the exposure parameters were:

- Drinking water intake rate: 2 liters/day, the 90th percentile value for the U.S. population, and close to the historical recommendation for drinking water requirements by health professionals
- Exposure frequency: 350 days/year; insufficient data available for determining a distribution of days/year spent at a residence. This value is based on an assumption of 15 days/year away from the residence
- Exposure duration: 30 years, the 90th percentile value for duration at one residence for the U.S. population
- Inhalation rate: 20 m^3/day: insufficient data available to estimate a distribution of values; parameter obtained from a time-activity level study developed through a consensus of experts
- Body weight: 70 kg, median (50th percentile) value for an adult[1]
- Exposure concentrations in air and water: Based on computer modeling.
- Slope factor: 95 percent UCL on the dose-response slope

The parameter distributions are characterized in different fashions. Therefore, estimating the distribution of risk with the parameters as formulated, as APS suggests, would not be appropriate.

While APS argues that EPA has presented a TUBE analysis, this is not the intent of the exposure scenarios in the risk assessment. The TUBE is a type of bounding estimate used to eliminate pathways from the risk assessment that are not significant.

The plug-in nature of the remedy does not involve a TUBE analysis because: 1) the significance of exposure pathways at any particular site would not be known until after exposure concentrations have been modeled, and 2) a conservative methodology for estimating exposures is reasonable to ensure that the remedy applied to VOCs-in-the-vadose zone is permanent.

[1]Note that use of adult values for intake and body weight can underestimate exposures, since intake to body weight ratios for children generally are greater.

Also, EPA states that "the TUBE is calculated by assuming limits for all of the variables used to calculate exposure and dose that, when combined, will result in the mathematically highest exposure or dose (highest concentration, highest intake rate, lowest body weight, etc.)." This statement does not characterize any of the exposure variables used in the risk assessment.

APS states that EPA recommends use of simulation modeling, such as Monte Carlo analysis, to estimate RME exposures and risks. The Monte Carlo technique is one method recommended by EPA for characterizing uncertainty in estimated exposures. A Monte Carlo simulation can produce a distribution of exposures, from which statistical estimators can be selected (such as the 50th percentile, or 95th percentile of the distribution).

EPA cautions that unless a great deal is known about exposures or doses at the high end of the distribution, simulated distributions may not be able to differentiate between bounding estimates and the high-end estimates of exposure. This raises questions about the extent to which collection of additional data on exposure parameters would be sufficient, within the constraints of available resources, to sufficiently refine the exposure estimates. A further concern, beyond cost of the analysis, is that development of such refined exposure and risk estimates for individual subsites may result in insufficient overall protection of groundwater from VOC migration from the vadose zone.

While EPA shares APS's concern that a TUBE analysis could result in an overly conservative estimation of potential risks, the TUBE approach was not used in the risk assessment. More accurate estimates of exposures and health risks could result from applying Monte Carlo techniques; however, it is unlikely that these estimates would significantly influence the nature of the plug-in decisions to be made in the ROD.

◊ *Index No. 48*

Page A-6 (Section A.2.3)

Before statistical parameters, including the 95% upper confidence limit (UCL) can be calculated, several decisions must be made with regard to the data; these include 1) the method for determining the shape of the distribution of the data, which determines which 95% UCL equation to use; 2) how non-detect (ND) samples will be treated, including how data containing greater than 10-15% NDs will be evaluated (using one-half the detection limit is not appropriate when the data contain more than 10-15% NDs); 3) whether potential hot-spots will be evaluated separately; and 4) how data from multiple sampling events (e.g. more than one round of groundwater sampling) will be combined. Oftentimes, the manner in which data are evaluated can have a profound influence on the final conclusions of the risk assessment.

Response:

Exposure concentrations in drinking water and air in the risk assessment will not be based on a 95 percent UCL. Exposure concentrations will be estimated from vadose zone transport modeling, which will use soil gas concentrations taken from soil vapor monitoring wells as input data. Approximately three points will be available from each soil vapor monitoring point at the time a plug-in determination is made. This number of data points is not sufficient to allow for the use of a UCL approach. Instead, the *maximum* soil gas detection that meets laboratory QA/QC requirements generally will be used as modeling input.

As specified in Section 8.3.3 of Part II of the ROD, EPA will accept comments from the public pertaining to the subsite-specific *use of data* in the Plug-in Determination at the time that a subsite plugs in to the remedy.

◊ *Index No. 49*

Page A-15 (Section A.3.4.2)

The text states correctly that calculating a hazard index for all chemicals without regard to target organ or mechanism of effect overestimates potential non-carcinogenic effects. EPA Risk Assessment Guidance for Superfund states that when hazard indices calculated in such a manner exceed the target Hazard Index of 1.0 (termed here as the Plug-In Criterion), organ specific hazard indices should be calculated. The approach presented in Appendix A does not include such a contingency. Therefore, risk management decisions should not be based on potential noncarcinogenic effects unless additional refinement of the approach is conducted.

Response:

The risk assessment approach in the templates has been revised to provide for calculation of hazard indices segregated by target organ or critical effect in cases where a hazard index calculated initially from all chemicals exceeds 1.0.

◊ *Index No. 50*

Page A-23 (Sec. A.4.2)

EPA states that a future residential land use scenario is assumed for evaluation of VOC exposures in air because of the uncertainties associated with future development at the site and the length of time required to "determine the need for plug-in at all subsites." This is not self-evident. There appears to be no reason why both a residential and a commercial/industrial scenario cannot be evaluated simultaneously. The information gained from including this scenario may prove useful in determining the need for cleanup.

Response:

EPA believes that a uniform residential scenario is appropriate because it will: (1) be protective under likely future residential development, (2) be protective of persons living in existing scattered homes within the commercial areas, (3) provide flexibility in future land use options, and (4) ensure that the Superfund cleanup actions are permanent.

Because of the scattering of residences within the commercial zones, selection of a rule to differentiate the use of commericial and residential scenarios would be difficult and likely inappropriate. Further residential development is likely given the planned flood protection for the area.

If residential development occurs, remedial actions completed under a commercial/industrial ("C/I") scenario may no longer be adequately protective of human health. Therefore, unless future land uses were limited to C/I, cleanups previously considered complete and permanent would have to be considered incomplete. SVE systems then would have to be reassembled and reactivated. Given the likelihood of current and eventual residential proximity, the C/I scenario is not appropriate.

◊ *Index No. 51*

Page A-24 (Sec. A.4.4)

In two locations it is stated that either residents or workers could be exposed to site-related VOCs through inhalation of air. Although residents would likely be at higher risks (because of the longer exposure time and duration), this would support the contention that both receptors be evaluated.

Response:

EPA believes a uniform residential scenario is appropriate for reasons given in the last response. EPA believes this will provide the greatest flexibility in future land uses. As APS points out, residents would have a longer exposure time and duration. This would outweigh workers' higher inhalation rate in calculating exposures of the two types of individuals. Therefore, the residential scenario is the more protective of the two scenarios for both types of individual.

◊ *Index No. 52*

Page A-27 (Section A.4.4.3)

The inhalation rate assumed for adult residents (20 m^3/day) for evaluation inhalation risks associated with VOCs in air is based on a 24 hour per day exposure. Assuming residents stay at their homes for this length of time is unreasonable. An estimate of 16 hours/day would be more reasonable.

While at a residence, a person may spend a portion of their time indoors and a portion outdoors, It is unclear from Appendix A if concentrations were estimated for both indoors and outdoors. If not, then this supports our contention that an estimate of 16 hours/day would be more reasonable.

Response:

The time-activity study performed by EPA in 1990 in developing the inhalation rate used for the risk assessment was based on the time-use/activity level data reported in the "*Development of Statistical Distributions or Ranges of Standard Factors Used in Exposure Assessments*" prepared by the EPA Office of Health and Environmental Assessment (OHEA). The data were used to calculate an RME inhalation rate for both the residential and occupational settings as follows:

- The time-use/activity level data reported by OHEA were analyzed for each occupation subgroup.
- The data were divided into hours spent at home vs. hours spent at the workplace (lunch hours spent outside of work and hours spent in transit were excluded).
- The hourly data were subdivided into hours spent indoors vs. outdoors.
- The corresponding activity level was assigned to each hour and the total number of hours spent at each activity level was calculated.
- For time spent inside the home, 8 hours per day were assumed to be spent at rest.
- The total number of hours spent at each activity level was multiplied by average inhalation rates (reported in the EPA's "*Exposure Factors Handbook*," 1990, a cited in Appendix A of the Feasibility Study, Admin. Rec. No. 1599). Average values were used since only minimum, maximum, and average values were reported. The use of maximum values would have been considered "worst case." Values for average adults were applied to all by housewife data (where average rates for women were applied)

The results showed that the highest weekly inhalation rate was 18.3 m^3/day for the residential setting and 18 m^3/day for the workplace. These values represent the highest among the weekly averages and were derived from coupling "worst case" activity patterns with "average" adult inhalation rates. It was concluded that 20 m^3/day would be representative of a reasonably conservative inhalation rate for total (i.e. indoor plus outdoor) exposures at home and in the workplace.

Therefore, the inhalation rate value is not based on an assumption of 24 hour/day exposure at home.

Concentrations in air are estimated on an indoor air basis. This accounts for time-use/activity level studies reporting that individuals spend the largest portions of their time indoors.

◊ *Index No. 53*

Page A-28 (Sec. A.4.5)

In describing the sample calculation, it is stated that soil gas data were used to estimate concentrations in air and groundwater. The use of soil gas data in risk assessments is an issue undergoing extensive discussion at present. Until recently, such data were considered only qualitative and not suitable for used in a risk assessment. Only recently have the techniques for soil gas measurement been able to achieve the requisite level of sensitivity for use in risk assessment. Therefore, the validity of the use of soil gas in the risk assessment at the Indian Bend Wash-South site will depend on how the samples were collected, analyzed and validated. Without additional details, this issue cannot be evaluated.

This statement in Section A.4.5 regarding the use of soil gas data highlights the lack of discussion in Appendix A of data evaluation issues that must be addressed prior to beginning the exposure and risk calculations. Without additional description of the intended manner in which data will be chosen and evaluated for usability in the risk assessment, APS cannot determine if this approach is reasonable.

Response:

Soil gas data were used at IBW-North in 1991 to estimate future impacts to groundwater. The quantitative use of soil gas is appropriate given the specific process and objectives for which it is being used in this remedy. Plug-in Criteria and Performance Standards for this remedy are not based on the concentration at a particular point in the soil, as a soil sample would imply. Rather, they are based on a VOC mass distribution over an area. With sufficient numbers of surface soil gas samples and strategically placed depth-specific soil vapor monitoring wells, soil gas can be used quantitatively to meet these objectives.

The manner in which soil gas samples will be collected, sampled, and analyzed will be determined by work plans, field sample plans, and quality assurance project plans approved for each subsite. The standard protocols which serve as the basis for these plans have been established by EPA in a document called "Field and Analytical Methods for IBW-South" (U.S. EPA, 1992, as cited in the Feasibility Study, Admin. Rec. No. 1599). This document is available to the public. These methods will produce data that is acceptable for use in a risk assessment.

As specified in Section 8.3.3 of Part II of the ROD, EPA will accept public comment pertaining the subsite-specific *use of data* at the time that a particular subsite plugs in to the remedy.

Responses to APS on the VLEACH Model

◊ *Index No. 54*

Page C-1, et. seq.

The limitations of the VLEACH model are the many assumptions that are made to simplify the model. Eight assumptions are stated; however, the potential impact of the assumptions to the model's calculations are not discussed. These limitations will need to be considered along with the results of the model predictions when evaluating sites for potential remedial actions.

Response:

The VLEACH model makes simplifying assumptions, and as a result has some limitations, as does any model. These limitations are summarized in Appendix C of the FS. While EPA recognizes VLEACH limitations, EPA believes that the model is appropriate for the subsurface conditions expected at IBW-South. VLEACH has already been tested and used with success at two Superfund sites that have similar subsurface conditions as IBW-South: Phoenix-Goodyear Airport (PGA), and IBW-North. EPA will consider any unexpected situations where model limitations may have an inordinate effect on a case-by-case basis.

◊ *Index No. 55*

For the model, it is assumed that K_D and K_H are constant. If an investigated area contained elevated levels of contaminants, the K_D would decrease and sorption would be less than predicted by the original value because of lack of sorption sites. This would result in overestimates of the mass of VOCs sorbed on the soils and predict a longer clean up period. In addition, the K_D may also be orders of magnitude larger if very dry soils were encountered as would be expected in some areas of the SIBW sites.

Response:

At high contaminant conditions, the K_D value will decrease due to depletion of available sorption sites. However, the goal of the VLEACH modeling is to determine if a subsite has vadose zone contamination that exceeds some threshold level (as specified by the Plug-in Criteria). EPA expects that the contaminant concentrations required to impact the K_D will be high enough to exceed the Plug-in Criteria, even if a constant K_D is used in the VLEACH model. This expectation will be verified on a subsite-specific basis through sensitivity analyses that assess the impact that different magnitudes of soil sorption have on the VLEACH results. An example of such a sensitivity analysis is provided in the VLEACH case study (see Appendix C3, Figure C3-10, in the FS).

◊ *Index No. 56*

The K_Ds presented in the report appear low due to the extremely low organic carbon in the soils. The sorption onto the mineral surfaces appears to have been disregarded and under these conditions could be substantial.

Response:

Mineral sorption is not expected to be a significant factor for the conditions at IBW-South. Laboratory experiments have shown that mineral sorption can be significant in extremely dry soils. However, soils of the type seen at IBW-South contain enough moisture to render mineral sorption insignificant (Rosenbloom, et al., "Application of VLEACH to Vadose Zone Transport of VOCs at an Arizona Superfund Site," in *Ground Water Monitoring & Remediation*, Summer 1993).

◊ *Index No. 57*

The moisture content profile is assumed constant; however, the arid conditions may need to be evaluated because the dry soils near the surface may be a factor and partitioning of VOCs from soil to gas may need to be considered or at least recognized. In addition, a soil moisture percentage of 5 was stated in the appendix for the middle layer; this is an extremely low moisture content.

> **Response:**
>
> Subsite-specific data will be used to determine the most appropriate moisture content to be used in the model. Moisture content data will be obtained from different depths and the data will be evaluated to determine the most appropriate value to be input into the model. For the case of extreme moisture content variation with depth, model sensitivity analyses can be performed to evaluate the impact of this depth variation on VLEACH predictions. The 5 percent value used for the case study was based on data for the actual site evaluated and may or may not apply to subsites at IBW-South.

◊ *Index No. 58*

Three phases are assumed to be present in equilibrium in each cell. However, to evaluate the assumption of equilibrium in each cell the method for defining the cell should have been more precisely specified. One reference in the Appendix stated on Page C1-1 that "current limitations include constant cell diameter".

> **Response:**
>
> VLEACH, as a one-dimensional transport model, uses cell dimensions that are constant with depth. However, the lateral dimensions of the cells can take on many different geometries at a single subsite, depending on the distribution of vadose zone contamination. The assumption of equilibrium is realistic for the timeframes and conditions anticipated for subsites at IBW-South, and represents a standard approach for evaluating contaminant transport.

◊ *Index No. 59*

Free product is not assumed to be present. It should be pointed out that if a fourth free product phase was present the mass estimates would be grossly underestimated, and that the time to remediate would be significantly increased.

Response:

The goal of the VLEACH modeling is to determine whether a subsite has vadose zone contamination that exceeds some *critical level* (as specified by the Plug-in Criteria). At IBW-South a subsite which has free product present will have a significant contamination problem. For such a case VLEACH results will exceed Plug-in Criteria, despite neglecting the impacts attributable to the non-aqueous phase component of the contamination. Note that VLEACH is not used to predict cleanup times. Cleanup time predictions will occur on a subsite-specific basis during remedial design.

◊ *Index No. 60*

Degradation is not considered, which, if occurring, may result in overestimating the VOC mass in the vadose zone and correspondingly the clean up time.

Response:

In situ degradation cannot be entrusted to protect the groundwater. Aerobic degradation process rates for the primary VOCs of concern have not yet been developed (Rosenbloom, et al., "Application of VLEACH to Vadose Zone Transport of VOCs at an Arizona Superfund Site," in *Ground Water Monitoring & Remediation*, Summer 1993). Furthermore, partial degradation of the chlorinated VOCs may not result in a reduction of VOC mass, but rather may create other VOCs that are more mobile and toxic, as in the case of TCE transforming to vinyl chloride. It is reasonable, therefore, to disregard degradation in the transport modeling.

◊ *Index No. 61*

The limitation of assuming homogeneous soils throughout the vadose zone that behave as a uniform porous media can be potentially a large source of error. Zones of higher permeability may exist where preferential flow of both liquid and vapor occur and actual transport times will be less than predicted by the soil's characteristics. If preferential pathways exist, then some areas may be less affected by liquid advection and gas diffusion is the primary mass transfer mechanism, which would be slower and could result in underestimating the cleanup times.

Response:

Variation in the vadose zone stratigraphy can be addressed using the VLEACH model, as demonstrated in the VLEACH case study (Appendix C3 of the FS). Flow through preferential pathways may be insignificant, given the low infiltration rates typical of the IBW-South area (Rosenbloom, et al., "Application of VLEACH to Vadose Zone Transport of VOCs at an Arizona Superfund Site," in *Ground Water Monitoring & Remediation*, Summer 1993). Again, VLEACH does not estimate cleanup times.

◊ *Index No. 62*

The assumption of volatilization as either completely impeded or unimpeded is conservative. The VOC diffusion from groundwater into the vadose zone will need to be evaluated before implementing the proposed SVE technology, as the diffusion from the groundwater may be the limiting concentration for cleanup of the vadose zone. These concentrations may be higher than concentrations calculated that can remain in the vadose zone which will not raise groundwater above the MCLs.

Response:

The concentrations found to date in the groundwater are on the order of 10 to 100 μg/l. These concentrations are not high enough for EPA to suspect that the groundwater is a significant source of vadose zone contamination. As shown in the equations on page C-5 of the FS, the VLEACH model accounts for diffusion from the groundwater table. Therefore, if VLEACH modeling results indicate that a site requires remediation, those results will have already accounted for the groundwater diffusion effect.

◊ *Index No. 63*

Page C-2

Polygons should be clearly defined here for evaluation.

Response:

Polygons are developed so that point data on contamination and soil properties can be assigned to a representative area. Polygons will be drawn using the Thiessen polygon method, which was used in the case study. EPA will consider the use of other rational and appropriate methods at its discretion.

◊ *Index No. 64*

Page C-3

M_T is defined as total mass of contamination in a model cell. The model cell is not defined and no units are provided. It is assumed that a unit area is assigned in the model.

> **Response:**
>
> Model cell refers to the polygon being used for the current calculation. Dimensions of the model cell are specified in the input file (see Appendix C-2 of the FS). M_T is actually the mass per unit area.

◊ *Index No. 65*

Page C-4

The "C" in the equations should be liquid phase concentrations, i.e. C_L. References would be helpful to substantiate the approach and discussion.

> **Response:**
>
> Comment noted.

◊ *Index No. 66*

Page C-5

The concentration "C" should be gas phase i.e., C_G. The discussion of why it was intuitively more appealing to use the space-centered (Crank Nicholson) equation would have been appropriate, as well as a clearer understanding of the "unexpected stability problem", which should have been referenced should have been provided.

Response:

The comment is noted regarding use of the term C_G. The statement that Crank-Nicholson is intuitively more appealing is an expression of the programmer's opinion. This statement had no effect on the equation selected, in fact, the "intuitively more appealing" equation was ultimately *not* used, as can be seen from the text. The "unexpected stability problems" refer to numerical instability that can occur when trying to represent a partial differential equation with a series of algebraic difference equations. The current VLEACH formulation, using backward-differencing for gas diffusion, is more stable.

◊ *Index No. 67*

Page C-6

The units do not balance for this equation. Again, M_T needs to be defined per unit area.

Response:

The comment is correct, M_T is defined per unit area.

◊ *Index No. 68*

Page C3-2

It was not clearly stated how the total TCE concentrations in soil were calculated. Are C_s and C_L calculated from C_G or were C_G and C_L calculated from C_s? In addition, if C_T was calculated from C_G one would expect higher estimates. The lower concentrations of VOCs in the soil gas data was disregarded. Generally, lower VOC concentrations are found in shallow soils and, hence, less mass, which should be considered in the mass calculations. The method used may be overestimating the mass of VOCs in the shallow layer.

Response:

For the case study, the mass in the upper layer was derived from soil boring data. Masses from the other layers were calculated from soil gas data. EPA now believes that mass estimates should be based on soil gas data only, as described in FS Chapter 5, page 5-10, and in ROD Sections 6.2 and 6.3.

◊ *Index No. 69*

Page C3-3

Theissen polygons should be explained further or referenced for the reader's understanding. The use of one-half the distance between inner and outer borings appears arbitrary. This method of establishing the polygons may not be appropriate for soil gas data. In addition, the mass calculations appear to be overestimated based on the limited data used to draw the polygons on the site area photos.

Response:

The Thiessen polygon technique represents one method of assigning point data on contamination and soil properties to a specific area. Upon EPA approval, other technically appropriate methods for drawing polygons may be used at subsites if they reasonably reflect the subsurface soil and contaminant conditions.

◊ *Index No. 70*

Page C3-3

The last bullet states the total TCE concentration in the soil; it is unclear if this was the measured TCE concentrations from the soil samples.

Response:

In the case study, the total concentration for the upper unit is based on soil borings; the total concentration from other units is calculated from the soil gas data, using equilibrium assumptions. EPA now believes that total concentration should always be calculated from soil gas data at IBW-South.

◊ *Index No. 71*

Page C3-8

The mass estimate for the middle vadose zone layer was based solely on soil gas data. However, using the mass distribution calculations, assuming water-filled porosity of 0.05 and a K_D one tenth of the upper zone, the sorbed and liquid phase of TCE may be as much as 20 percent of the gas phase TCE.

Response:

For IBW-South the mass estimates will be performed by assuming equilibrium conditions between three phases: sorbed, solution, and gas. Given soil gas data and properties of the soil and contaminant type, the total mass is calculated through straightforward algebraic relationships.

◊ *Index No. 72*

Page C3-9

The VLEACH transport in the middle layer ignores adsorption to mineral surfaces. Due to the low f_{oc} (0.05%), mineral phase adsorption is likely to dominate over organic phase adsorption and the transport in the middle layer will be much less than predicted here.

Response:

Mineral sorption is not expected to be a significant factor for the conditions at IBW-South. Laboratory experiments have shown that mineral sorption can be significant in *extremely* dry soils. However, soils of the type seen at IBW-South contain enough moisture to render mineral sorption insignificant (Rosenbloom, et al., "Application of VLEACH to Vadose Zone Transport of VOCs at an Arizona Superfund Site," in *Ground Water Monitoring & Remediation*, Summer 1993).

◊ *Index No. 73*

Page C3-22 (Paragraph 2)

The conclusion used the Federal MCL for groundwater clean up levels, which may be too conservative. A higher level may be appropriate based on the finding of the risk assessment.

Response:

The reference in this comment is to the statement in the case study: "...the level of TCE groundwater contamination beneath Areas 7 and 8 is estimated to persist above the MCL for several hundred years." This was an observation within the case study, and did not imply that a groundwater cleanup level had been selected for IBW-South. The subject remedy addresses soils in order to control sources of future groundwater contamination. It does not select groundwater cleanup levels. A determination on groundwater cleanup levels will not be made until EPA issues its groundwater ROD.

5. Other Common Concerns and Questions

The following is a discussion of concerns, and then a list of questions that have been commonly raised during the IBW–South project, but may not have been raised formally at the public meeting or during the public comment period. They are included here in order to more broadly address public concerns.

5.1. Health Concerns

The two concerns noted here have been expressed relating to public health at IBW–South. Some persons have been concerned that they might be drinking contaminated water. Other persons have been concerned about past exposures to VOCs in drinking water before the VOC problem in the area was known and drinking water wells were shut down. Other health concerns-related questions are presented in Section 5.4, "Other Common Questions."

All domestic water within in the City of Tempe is currently being provided by the Salt River Project, from canals and wells outside the IBW–South area. No water from within the IBW–South area has been provided to public domestic conveyance systems since Tempe shut down its IBW–South wells in 1982. There are a limited number of private wells within IBW–South. EPA has made an effort to identify these, and inform the owners. The private wells that EPA knows of today are in areas of the site that have been shown to have no detectable levels (or levels below drinking water standards) of VOCs. Accordingly, EPA believes that there is currently no exposure to VOCs in drinking water from IBW–South that would pose a health risk.

However, the citizens of Arizona and the City of Tempe, the Salt River Project, and numerous other parties with water interests would benefit from again being able to use the groundwater resource in the IBW–South area. EPA also must ensure that contamination will not ultimately spread and reach wells that are being used, which could lead to adverse health effects. Finally, the sources of contamination from soils must be stopped as these continually maintain and renew the groundwater problem, thereby increasing the time and expense of groundwater cleanup. Therefore, EPA's cleanup efforts are aimed at protection of human health and the groundwater resource in the future, even though no exposure to contaminated groundwater is thought to exist today.

As to exposure before EPA's involvement with the site, EPA is not able to determine the levels of VOCs that may have been present in the IBW–South area drinking water prior to 1981, when supply wells in the area were first tested for VOCs. Nor can EPA determine how long prior to 1981 drinking water may have been affected. Therefore, EPA cannot accurately estimate the risks to the community from potential past exposures to VOCs in drinking water.

The Agency for Toxic Substances and Disease Registry (ATSDR) was created to investigate public health issues at Superfund sites. ATSDR is responsible for evaluating the potential effects of previous exposures to VOCs, while EPA is responsible for cleaning up contamination to levels that will be safe in the future. EPA provides to ATSDR all sampling information about IBW–South in EPA's Interim RI Report. On April 14, 1989, ATSDR released a Preliminary Health Assessment for IBW–North. The assessment did not include IBW–South. ATSDR plans to update its 1989 report, identify data gaps (including IBW–South), and address any new data and citizens' concerns since 1989.

5.2. Property Issues

Residents, business owners, and other institutions have expressed concern about several issues related to the sale, value, and location of property within IBW–South. These issues will be discussed in turn.

5.2.1. Study Area Boundaries

Certain factors about IBW–South, in part, give rise to property-related issues. IBW–South is a type of site called "multi-source," or "areawide." This means that there are several sources over a wide area that are contributing to an apparent regional groundwater contamination problem. Because of this, EPA defined an IBW–South Study Area within which EPA is investigating groundwater and soil contamination.

Section 300.5 of the National Contingency Plan ("NCP"), the regulation for Superfund, defines "onsite" as "the areal extent of contamination and all suitable areas in very close proximity to the contamination necessary for implementation of the response action." Because Focused RI work and the groundwater RI work are not complete at IBW-South, the exact areal extent of contamination within the study area is not known. Nonetheless, "onsite" is a subset, and not synonymous, with the study area.

EPA is not prohibited from investigating contamination whether it is on-site, off-site, within a "study boundary," or outside it. If contamination is found at a location where it was unknown before, "onsite" incorporates that location, by the NCP definition. Site boundaries change without an administrative action by EPA. Confusion often arises when the study area boundaries are incorrectly regarded as dividing lines between contaminated and uncontaminated property.

5.2.2. Homeowner Liability

Residents have been concerned that EPA might pursue them for cleanup costs simply because they own property within the study boundaries. Others have been concerned that the soil on their property might have been contaminated by someone else's activities, yet the owner would be stuck with the problem.

In July 1991, EPA released a national policy entitled, "Policy Towards Owners of Residential Property at Superfund Sites" (OSWER Directive #9834.6). In general, the policy states that EPA will not hold owners of residential property liable where they have not actually contributed to the problem. This written policy does not change the way EPA has been addressing residential property at IBW–South and at other Superfund sites around the country. Rather, it affirms EPA's previous exercise of discretionary authority as to which parties will be the subject of EPA enforcement actions.

5.2.3. Lender Liability and Credit Risk

For owners of residential, commercial, and industrial properties alike, the lending community's reluctance to become involved with property in Superfund areas has become a serious issue. The first reason for this arises from the lender's concern that EPA may pursue them as potentially liable parties even when they hold only a security interest in a property (a situation in which the Superfund law, under certain circumstances, specifically exempts them from liability). Historically at certain other Superfund sites, EPA has pursued a limited number of lenders when EPA has believed the lenders effectively became operators of a facility rather than merely holders of a security interest. In order to clarify the activities EPA considers appropriate for a lender to conduct without a risk of Superfund liability, EPA issued a Lender Liability Rule (April 29, 1992, 57 Federal Register 18344; 40 CFR Part 300, Subpart L).

Owners of real property, as well as potential buyers, also have expressed concern that they are unable to obtain financing, in some cases regardless of whether any contamination has been associated with their property. In these cases, lenders are not so much concerned about their own liability as that the loan applicant may become liable to pay Superfund cleanup costs, potentially causing the applicant to default.

EPA understands there is an impact on the local community in the course of performing its duties to protect human health and the environment from VOCs. Several community members have expressed support for EPA's mission, but still feel that they are unfairly being denied credit simply by virtue of being within a study area. As EPA's investigation narrows the field of possible sources and cleanup is underway at the facilities serving as sources, EPA hopes that the lending community will become more confident in granting financing. In the meantime, efforts by EPA and the community at large should continue to educate the lenders and the community about the meaning of the study area boundaries, and about using other factors such as chemical use and disposal practices in determining the credit risk associated with a property.

EPA cannot issue letters releasing persons from any possible liability, especially at properties it has never investigated. However, there are properties that are not likely to be investigated by EPA but nonetheless are located within the study area. Owners of such property have expressed to EPA that they feel they are in a "limbo." EPA is evaluating options to assist such persons.

5.2.4. *Property Values*

Because of the same perceived factors of credit risk and potential liability, some residents and business owners have expressed concern that the values of their properties have declined due to lower real estate demand in the area. EPA understands that to those it affects, it is a serious problem. Again, education can be one step toward reducing this problem.

EPA is attempting to move its response efforts more quickly yet still effectively. The Plug-in Approach to the remedy has the potential to reduce the soils cleanup times by 5 to 10 years. EPA is also evaluating other ways to make enforcement activity more efficient. However, the VOCs in the ground at IBW–South, emanating from multiple sources over 3 square miles and entering complex groundwater regimes, is not a simple problem. Therefore, time will be required to address both the soils and the groundwater in such a way that public health is protected. The cooperation of the community will assist EPA in completing the cleanup as soon as possible.

5.3. Financial Impacts on Small Business

Unlike the source areas at IBW–North or at the Phoenix Goodyear Airport Superfund Site, the source areas at IBW–South are primarily, though not exclusively, facilities being run by small businesses. EPA recognizes that certain PRPs may have financial limitations. EPA will consider these limitations in appropriate circumstances.

5.4. Other Common Questions

◊ *Index No. 74*

Why is it taking so long to clean up the IBW–South site?

Response:

IBW–South is an extremely complex situation that represents, in reality, many sites within a Superfund site. In addition, the hydrogeologic conditions are very complex. Groundwater is affected by basin-range faulting, flows in varying directions with depth, and flow directions at all depths "shift" over time depending on whether the river is flowing. To monitor the deepest aquifers, monitoring wells of almost 800-foot depth are required. Once VOCs enter the environment in this area, finding them and extracting them can be very difficult.

Another factor is that the IBW site was listed on the National Priorities List in 1983. Prior to Superfund, cleanup work of this type had not been done. While there were high expectations, still Superfund problems turned out to be more complex than anticipated, and there were few cleanup technologies, and little research and development to draw upon. EPA's goal of developing permanent, protective remedies at a complex, vast site has required time to achieve.

EPA shares the public view that Superfund can move more quickly. On IBW–South, progress is now occurring much more rapidly than in the past. Not only does the ROD put a remedy for VOCs in soils in place, but it utilizes innovative "Plug-in" and "Presumptive Remedy" approaches that promise to reduce by many years the time to clean up. EPA is evaluating other approaches that may save even more time.

◊ *Index No. 75*

When will soils cleanup work begin and when will it end?

Response:

For the VOCs in soils, it is likely that actual design work of SVE systems will begin within several months of the signing of the Record of Decision, at two facilities. Plug-in is expected quickly at these facilities.

At any given facility, the time between design and completion of construction of an SVE system is typically on the order of a year. Once operating, each SVE system is projected to take between 1.5 and 5 years to reach cleanup levels, although a great percentage of the VOCs may be removed in the first year of operation.

These estimates apply to any single facility. The amount of time it will take to complete work at all facilities cannot be determined now and will depend primarily on two factors: (1) the number of facilities that ultimately exceed Plug-in Criteria, and (2) the number of investigations and SVE designs that EPA can oversee at any one time, which will depend on the level of resources given to the Agency. EPA will continue to do what it can to obtain an expeditious yet permanent and protective cleanup.

◊ *Index No. 76*

Can SVE remove all of the VOCs from the vadose zone?

Response:

While possible, it is unlikely that all VOCs will be removed from the ground by SVE. EPA has set criteria and performance standards for the remedy that are protective of human health and the environment, and it is expected that SVE can meet these in all cases where it is applied within IBW–South.

◊ *Index No. 77*

Can the offgas treatments remove 100% of the VOCs from the air stream?

Response:

The treatment units can be designed to remove all of the VOCs; however, 100 percent efficiency cannot be guaranteed. Treatment units are typically effective to a minimum of about 95 percent efficiency, meaning some VOCs may still enter the atmosphere. This discharge, if it occurs, will nonetheless meet federal and local air discharge regulations. EPA has also set a minimum performance standard of 90 percent efficiency in consideration of Maricopa County air regulations. This is discussed in Section 8.2.4 of the ROD and in Appendix A, ARARs, of this document.

◊ *Index No. 78*

Is there any danger to me from exposure to VOCs while in the area of IBW–South?

Response:

EPA believes that it is safe for persons to go about normal business and living activities within IBW–South without increased risk from exposure to VOCs. The chances of direct contact with VOCs at this time is remote.

The VOCs at IBW–South reside in the soils under certain specific facilities, usually at significant depth. The primary health threat from the VOCs is that they might enter groundwater which could be withdrawn and used for domestic purposes. Groundwater is at 50 to 100 feet under the ground with virtually no chance of direct human contact. The risk of direct contact to VOCs in surface soils is also remote. In the desert climate the VOCs near the surface evaporate away readily after release, leaving VOCs at depths of about 5 feet or more.

There is a potential that VOCs near the source facilities themselves may be leaving the soils and entering the air. EPA believes this is not likely. Persons routinely working long-term at the source facilities would have the highest potential for significant exposure in this manner. EPA has specified a Plug-in Criterion based on this type of exposure, so that if it exists anywhere at unacceptable levels, a cleanup would be required.

◊ *Index No. 79*

What is the level of VOCs in surface soil gas during a screening that would cause EPA to require a full investigation with soil vapor monitoring wells?

Response:

There is no specific "magic" threshold number. EPA reviews all screening data in the context of all information available and the specific circumstances. For a single positive sample, EPA has used a guideline of about 10 μg/l for the VOCs TCE, PCE, and 1,1-TCA for screening purposes. Nonetheless, this value may vary depending on the circumstances. The frequency of detection of VOCs will also have an effect on this screening determination.

It should be noted that surface soil gas samples (samples at about 5 feet) are not usually used as direct measures of health threat, but rather as "pointers" to where high levels of VOCs may exist at greater depths. Thus, having "low levels" of VOCs in surface soil gas may not be a good rationale to discontinue with a depth-specific investigation. EPA has documented cases where VOCs were present at 25 feet at a thousand times the levels that were present near the surface.

◊ *Index No. 80*

If I have no contamination in the soils at my property, but there is groundwater at 100 feet under my property that is contaminated by other sources, will EPA pursue me as a potentially responsible party to pay for cleanup of the groundwater?

Response:

If there is no contamination in the soils at your property, *and* the chemicals that are found in the groundwater have never been used or disposed on your property, then it is EPA's policy to pursue those responsible, rather than pursuing you for groundwater cleanup *solely* because there is groundwater contamination under your property.

Note that this assumes that neither you nor any previous owners and operators (or anyone else, for that matter) have used or disposed of these chemicals on the property. The issue can get somewhat less clear if the chemicals have been used at the property, particularly when the means of disposal is not known. In such a case, your property may be contributing to the contamination along with the other sources, and EPA may evaluate the property to determine whether an enforcement action is warranted.

Appendix A
APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

Appendix A
APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

A.1. Definition of ARARs and TBCs

Congress mandated in Section 121(d) of the 1986 Superfund Amendments and Reauthorization Act (SARA) that remedial actions conducted under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund) must attain a degree of cleanup which assures protection of human health and the environment. Additionally, remedial actions conducted entirely onsite must comply with the applicable or relevant and appropriate requirements ("ARARS") of federal and state environmental laws.

Identification of ARARs must be made on a site-specific basis and involves a two-part analysis: first, a determination of whether a given requirement is applicable; then if it is not applicable, a determination of whether it is both relevant and appropriate.

Applicable requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that directly apply and specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site.

Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that, while not specifically "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well-suited to the particular site. If no ARAR addresses a particular situation, or if an ARAR is insufficient to protect human health or the environment, then non-promulgated standards, criteria, guidances, and advisories (referred to as "To Be Considered", or "TBCs") can be selected as requirements in order to provide a protective remedy.

ARARs by definition include only substantive requirements, and not administrative requirements. If an environmental law imposes a certain limit that is an ARAR while also requiring that one obtain a permit, EPA need meet only the limit (substantive), and would not have to obtain the permit (administrative) before taking the remedial action. However, response actions which take place offsite must comply with both administrative and substantive requirements of all laws applicable at the time the offsite activity occurs.

Five criteria must be met for a state requirement to be considered an ARAR:

1. It must be a promulgated standard, requirement, criterion, or limitation.
2. It must be more stringent than parallel federal standards, requirements, criteria, or limitations.
3. It must be identified to EPA by the State in a timely manner.
4. It must be structured so it does not result in a statewide prohibition on land disposal.
5. It must be consistently applied statewide.

If a state standard is determined to be "applicable" while a more stringent federal standard is "relevant and appropriate," the more stringent federal standard will govern.

A.2. Chemical-Specific ARARs and RCRA Threshold Values for Treatment-Derived Water

Neither EPA nor the State of Arizona have promulgated chemical-specific cleanup criteria for soils. Therefore, there are *no* chemical-specific ARARs for this remedy with regard to the degree of soil cleanup. Maximum Contaminant Levels under the Safe Drinking Water Act ("MCLs") are used in developing one basis for the Plug-in Criteria and Performance Standards under this remedy. Nonetheless, MCLs, as applied in situ to groundwater in the aquifer, are *not* ARARs, because this remedy applies to soils and does not directly address groundwater. The same is true of other chemical-specific standards that apply in situ to groundwater.

SVE systems at IBW-South may utilize an air/water separator, which removes water vapor from the soil gas before it is treated. This treatment-derived water may be subject to other requirements in this appendix, depending on whether it is a RCRA waste.

In accordance with the policy stated in the memo from Sylvia Lowrance, Director of EPA Office of Solid Waste, to Jeff Zelikson, Director of EPA Region IX Toxics and Waste Management Division, dated January 24, 1989, groundwater from CERCLA actions may be considered to be not a RCRA hazardous waste if it contains chemicals in concentrations below health-based levels selected by EPA Region IX. The health-based RCRA threshold values selected for this remedy at IBW-South are specified with the Performance Standards in Section 8.3.7 of this ROD.

Table A-1 lists compounds which, if present in concentrations above the health-based levels specified in Section 8.3.7, are:

1) RCRA listed wastes (the RCRA requirements listed in this section will be applicable to treatment-derived wastewater), or

2) Not known to be RCRA listed wastes (RCRA requirements in this section will be considered to be relevant and appropriate for the treatment-derived wastewater).

Table A-1

Acetone	trans-1,2-Dichloroethylene
Benzene	1,2-Dichloropropane
Benzyl Chloride	1,3-Dichloropropene
Bromodichloromethane	Dichlorotetrafluoroethane
Bromoform	Ethylbenzene
Bromomethane	Hexachlorobutadiene
Carbon Tetrachloride	Methylene chloride
Chlorobenzene	Methylethylketone
Chloroform	Styrene
Chloromethane	1,2,2,2-Tetrachloroethane
Dibromochloromethane	Tetrachloroethylene
1,2-Dibromoethane	Toluene
1,2-Dichlorobenzene	1,2,4-Trichlorobenzene
1,3-Dichlorobenzene	1,1,1-Trichloroethane
1,4-Dichlorobenzene	1,1,2-Trichloroethane
Dichlorodifluoromethane	Trichloroethylene
1,1-Dichloroethane	Trichlorofluoromethane
1,2-Dichloroethane	1,1,2-Trichloro-2,2,1-Trifluoroethane
cis-1,2-Dichloroethane	Vinyl Chloride
1,1-Dichloroethylene	Xylenes (Total)

A.3. Location-Specific ARARs

Location-specific ARARs for this remedy appear in Table A-2.

Table A-2
Location-Specific ARARs for IBW-South

Location	Requirement	Prerequisite(s)	Citation	Comments
1. Within 100-year flood plain	Facility must be designed, constructed, operated, and maintained to avoid washout.	RCRA hazardous waste; treatment, storage, or disposal.	40 CFR 264.18(b) (R18-8-264)	Portions of the IBW-South site are located within a 100-year flood plain. A RCRA facility located in a 100-year flood plain must be designed, constructed, operated, and maintained to prevent washout of any hazardous waste by a 100-year flood.
2. Within flood plain	Action to avoid adverse effects, minimize potential harm, restore and preserve natural and beneficial values.	Action that will occur in a flood plain, i.e., lowlands, and relatively flat areas adjoining inland and coastal waters and other flood-prone areas.	Executive Order 11988, Protection of Flood plains (40 CFR 6, Appendix A)	Federal agencies are directed to ensure that planning programs and budget requests reflect consideration of flood plain management, including the restoration and preservation of such land as natural undeveloped flood plains. If newly constructed facilities are to be located in a flood plain, accepted floodproofing and other flood control measures shall be undertaken to achieve flood protection. Whenever practical, structures shall be elevated above the base flood level rather than filling land. As part of any federal plan or action, the potential for restoring and preserving flood plains so their natural beneficial values can be realized must be considered. Crossing of the IBW-South site with piping or location of wells in the 100-year flood plain will be designed to result in no impact to flood surface profiles. Any potential pipe or well breakage due to flooding will likely not introduce new contamination because of the regional nature of the UAU contamination.
3. Within area where action may cause irreparable harm, loss, or destruction of significant artifacts	Action to recover and preserve artifacts.	Alteration of terrain that threatens significant scientific, prehistoric, historic, or archaeological data.	National Archaeological and Historical Preservation Act (16 USC Section 469); 36 CFR Part 65	The IBW-South site is essentially completely developed. Artifacts have been located in areas near IBW-South.
4. Historic project owned or controlled by federal agency	Action to preserve historic properties; planning of action to minimize harm to National Historic Landmarks.	Property included in or eligible for the National Register of Historic Places	National Historic Preservation Act Section 106 (16 USC 470 et seq.); 36 CFR Part 800	The DCE Circuits Building is included in the National Register of Historic Places (Inventory No. 151).
5. Critical habitat upon which endangered species or threatened species depends	Action to conserve endangered species or threatened species, including consultation with the Department of the Interior.	Determination of endangered species or threatened species	Endangered Species Act of 1973 (16 USC 1531 et seq.); 50 CFR Part 200, 50 CFR Part 402	No endangered species are known to exist on the IBW-South site.

A.4. Action-Specific ARARs

Action-specific ARARs for IBW-South that are derived from the Resource, Conservation and Recovery Act ("RCRA") are presented in Table A-3. These RCRA ARARs, and action-specific ARARs derived from other laws, are discussed in the following subsections.

A.4.1. "Contained in" Interpretation

The EPA's "contained in" interpretation provides that an environmental medium (e.g., soil, groundwater, debris, surface water, sediment) that has been contaminated by a listed hazardous waste above a risk-based level or a level of concern must be managed as if it were a hazardous waste. Therefore, the RCRA regulations are relevant and appropriate to the management of contaminated environmental medium, if, at the IBW-South site, it is temporarily stored prior to treatment, disposed of, or stored elsewhere.

A.4.2. Land Disposal Restrictions

The land disposal restrictions (LDRs), 40 CFR Part 268, and the general land disposal prohibition in absence of a permit (Ariz. Admin. Code §R18-8-270.1) will be applicable to discharges of RCRA wastes to land. Water removed by SVE may be disposed of within the site through discharge to soil. Treatment of the water may be necessary before land disposal is allowed. Where treatment is necessary, treatment levels required are set forth in Section 8.3.7 of this ROD as Performance Standards. For treatment-derived water that is a characteristic waste, the water will be treated to remove the hazardous characteristic before any discharge to soil will be allowed.

The remedial action at the IBW-South site includes removal of soil gas from the vadose zone, separation of water, treatment to reduce VOC content, then discharge to soil or to the sewer. This will trigger LDRs as ARARs if discharge is to the soil.

A.4.3. Storage

The RCRA substantive storage requirements, Ariz. Admin. Code §§R18-8-264.170 to 254.178, will be relevant and appropriate to the storage of contaminated treatment-derived wastewater for more than 90 days.

A.4.4. Treatment

Soil vapor extraction units and offgas thermal treatment units are miscellaneous RCRA units. Therefore, the substantive requirements of 40 CFR Subpart X, including any closure and postclosure care, will be relevant and appropriate. The remedy selected will be performed entirely onsite and will not require compliance with administrative requirements.

Table A-3
Action-Specific ARARs for IBW-South
From Resource, Conservation and Recovery Act (RCRA)

Action	Requirements	Prerequisites	Citation	Comments
Container Storage (Onsite)	Containers of hazardous waste must be:	RCRA hazardous waste (listed or characteristic) held for a temporary period before treatment, disposal, or storage elsewhere, (40 CFR 264.10) in a container (i.e., any portable device in which a material is stored, transported, disposed of, or handled).		These requirements are applicable or relevant and appropriate for any contaminated soil or groundwater or treatment system waste that might be containerized and stored onsite prior to treatment or final disposal. Groundwater or soil or soil gas containing a listed waste must be managed as if it were a hazardous waste so long as it contains the listed waste. (See "Contained-in" policy.)
	• Maintained in good condition		40 CFR 264-171 (R18-18-264.170, et seq.)	
	• Compatible with hazardous waste to be stored		40 CFR 264.172	
	• Closed during storage (except to add or remove waste)		40 CFR 264.173	
	Inspect container storage areas weekly for deterioration.		40 CFR 264.174	
	Place containers on a sloped, sufficiently impervious crack-free base, and protect from contact with an accumulated liquid. Provide containment system with a minimum capacity of 24-hour, 25-year storm plus 10 percent of the volume of containers of free liquids or the volume of the largest container, whichever is greater.		40 CFR 264.175	
	Remove spilled or leaked waste in a timely manner to prevent overflow of the containment system.		40 CFR 264.176	
	Keep containers of ignitable or reactive waste at least 50 feet from the facility's property line.		40 CFR 264.177	
	Keep incompatible materials separate. Separate incompatible materials stored near each other by a dike or other barrier.			
	At closure, remove all hazardous waste and residues from the containment system, and decontaminate or remove all containers, liners.		40 CFR 264.178	

Table A-3
Action-Specific ARARs for IBW-South
From Resource, Conservation and Recovery Act (RCRA)

Action	Requirements	Prerequisites	Citation	Comments
Soil Vapor Treatment	RCRA standards for control of emissions of volatile organics	RCRA hazardous waste.	40 CFR 264 Subpart AA & BB	The proposed standard requires reduction of VOC emissions from "product accumulator vessels," and leak detection and repair programs.
	Control of air emissions of volatile organics and gaseous contaminants	Emissions of VOCs or gaseous air contaminants.	40 CFR 61	
Treatment (Miscellaneous)	Standards for miscellaneous units (long-term retrievable storage, thermal treatment other than incinerators, open burning, open detonation, chemical, physical, and biological treatment units using other than tanks, surface impoundments, or land treatment units) require new miscellaneous units to satisfy environmental performance standards by protection of ground water, surface water, and air quality, and by limiting surface and subsurface migration.	Treatment of hazardous wastes in units not regulated elsewhere under RCRA (e.g., air strippers).	40 CFR 264 (Subpart X)	The substantive portions of these requirements will be applicable or relevant and appropriate to the construction, operation, maintenance, and closure of any miscellaneous treatment unit (a treatment unit that is not elsewhere regulated) constructed on the IBW-South site for treatment and or disposal of hazardous site wastes.
	Treatment of wastes subject to ban on land disposal must attain levels achievable by best demonstrated available treatment technologies (BDAT) for each hazardous constituent in each listed waste.	Treatment of LDR waste.	40 CFR 268 (Subpart D)	The substantive portions of these requirements are applicable to the disposal of any IBW-South site wastes that can be defined as restricted hazardous wastes.
	BDAT standards are based on one of four technologies or combinations: for wastewaters (1) steam stripping; (2) biological treatment; or (3) carbon adsorption (alone or in combination with (1) or (2); and for all other wastes (4) incineration. Any technology may be used, however, if it will achieve the concentration levels specified.			The substantive portions of these requirements are relevant and appropriate to the treatment prior to and disposal of any IBW-South site wastes that contain components of restricted wastes in concentrations that make the site wastes sufficiently similar to the regulated wastes. The requirements specify levels of treatment that must be attained prior to land disposal.
	Regulations for land-based corrective actions at RCRA facilities.	Land-based remedial action.	40 CFR Subparts (Revised)	

A.4.5. Groundwater Monitoring and Groundwater Protection Standards

EPA does not expect that creation of RCRA disposal units will be necessary as part of this remedy. However, groundwater monitoring requirements set forth at 40 CFR Part 264, Subpart F, are applicable if the CERCLA remedial action involves creation of a new disposal unit when remedial actions are undertaken at existing RCRA units, or where disposal of RCRA hazardous wastes occurs as part of the remedial action. Treatment and disposal of water removed during the SVE process is an element of the remedy; therefore, the groundwater monitoring requirements are applicable if the water is a RCRA waste and it is disposed of onsite.

In the above situation, the requirements of 40 CFR §264.94 establish three categories of groundwater protection standards that are relevant and appropriate: background concentrations, RCRA MCLs, and Alternative Concentration Limits (ACLs). The MCLs under the SDWA are relevant and appropriate for the site. In complying with SDWA MCLs, cleanup will also be consistent with RCRA MCLs. When no MCL has been established, a remediation level that is the equivalent of a health-based ACL under RCRA will be relevant and appropriate.

A.4.6. Groundwater Use Requirements

Portions of the Arizona Revised Statutes for cleanup of hazardous substances related to contaminated groundwater ("Arizona Superfund," Ariz. Rev. Statute Section 49-282, et seq.) and implementing regulations (Ariz. Admin. Code §R18-7-109, et seq.) are applicable or relevant and appropriate for the IBW-South site. The implementing regulations incorporate by reference state law provisions that (1) establish that all definable aquifers are drinking water aquifers unless they qualify for an aquifer exemption, and (2) establish water quality standards for these aquifers. Finally, the Arizona Superfund statute and regulations require that, to the extent practicable, IBW-South remedial actions provide for the control or cleanup of hazardous substances so as to allow the maximum beneficial use of the waters of the State.

The State aquifer classification system, identifying all aquifers as drinking water aquifers unless specifically exempt, is more stringent than the federal aquifer classification scheme, and therefore is relevant and appropriate. Federal and State MCLs, applied in situ to groundwater in the aquifer, are ***not*** ARARs for this remedy, because this remedy addresses soils and not contamination already in groundwater. However, because the State drinking water aquifer classification is an ARAR, an objective of this source-control remedy, in conjunction with a future groundwater remedy as determined necessary, is to return groundwater to health-based levels. Accordingly, EPA has used the MCLs as one basis for its Plug-in Criteria and has set other Plug-in Criteria so as to meet this goal.

A.4.7. Corrective Action

The proposed 40 CFR Part 264, Subpart S, corrective action regulations are ARARs for land-based remedial actions undertaken at the IBW-South site.

A.4.8. Air Monitoring for Process Vents and Equipment Leaks

The substantive requirements of 40 CFR Part 264, Subparts AA and BB, are applicable. Operation and maintenance of the SVE units will be conducted entirely onsite. Therefore, permit applications, recordkeeping requirements, and other administrative procedures are not required. However, the design, performance, and operation and maintenance of the unit must fully comply with the substantive requirements of these ARARs, which include 40 CFR §§264.1030 - 264.1034 and 40 CFR §§264.1050-264.1063.

A.4.9. Air Emissions Requirements

The Clean Air Act ("CAA") has been implemented through a series of regulations (40 CFR Parts 50-99) that define the air quality management programs used to achieve the CAA goals. CERCLA remedial actions conducted entirely onsite must comply with the substantive requirements of the CAA and its related programs. Under the CAA, the State of Arizona is responsible for preparation of a State Implementation Plan ("SIP"), which describes how the air quality programs will be implemented to achieve compliance with primary air standards. Once EPA approves the SIP (and subsequent changes to it), the requirements in the SIP become potential federal ARARs.

The following Maricopa County Air Pollution Control Division ("MCAPCD") rules are applicable to this remedy because they are included in the State of Arizona approved SIP:

Regulation III, Rule 21	Source Air Emissions
Regulation III, Rule 30	Visible Emissions
Regulation III, Rule 31	Particulate Matter
Regulation III, Rule 32	Odors and Gaseous Emissions
Regulation III, Rule 34(f)-(k)	Organic Solvents
Regulation III, Rule 35	Incinerators

MCAPCD now has established new rules which supercede the rules listed above. However, the new rules have not yet been incorporated into the approved SIP. Therefore, the new rules are *not* ARARs. Nonetheless, EPA has used most of the new rules as "To-Be-Considered Criteria" and has selected Performance Standards in this ROD which comply with them. A discussion of these rules, and the selected Performance Standards, is set forth in Section 8.2.4 of this ROD.

National Primary and Secondary Ambient Air Quality Standards (NAAQS) (40 CFR 50) are established for criteria pollutants. The current list of NAAQS includes sulfur oxides (SO_2), nitrogen dioxide (NO_2), ozone (reactive organic gases (ROG) and NO_x are precursors to ozone formation), carbon monoxide (CO), lead, and particulate matter less than 10 microns in diameter (PM10). Primary standards for these pollutants have been established by the SIP at levels necessary to protect human health with an "adequate margin of safety."

NAAQS are not ARARs. However, the Arizona SIP establishes the primary standards based on the NAAQS, and provides for how the standards will be attained. Under the CAA, upon meeting the primary standards, an Air Quality Control Region (AQCR) would be classified as "in attainment." If an area fails to meet any of the primary standards, it is classified as a "nonattainment area." Currently, the IBW-South site is located in a non-attainment area due to noncompliance with CO, ozone, and PM10 primary standards. MCAPCD rules require that Reasonably Available Control Technology ("RACT") be applied in non-attainment areas. While this requirement is not an ARAR, EPA believes that the emission control (offgas treatment) methods incorporated in this remedy nonetheless meet the RACT definition.

A.5. Additional Legal Requirements

Additional legal requirements are applicable to the IBW-South site, although they are not environmental protection standards and therefore are not ARARs.

A.5.1. The Occupational Safety and Health Act (29 U.S.C. §651 et seq., 29 CFR §1910.120)

The Occupational Safety and Health Act (OSHA) requirements for worker protection, training, and monitoring are applicable to remedial actions at the IBW-South site, and will also be applicable to the operation and maintenance of any treatment facilities, containment structures, or disposal facilities remaining onsite after the remedial action is completed.

OSHA regulates exposure of workers to a variety of chemicals in the workplace, and specifies training programs, health and environmental monitoring, and emergency procedures to be implemented at facilities dealing with hazardous waste and hazardous substances.

A.5.2. Standards for Transportation of Hazardous Waste (40 CFR §263, 49 CFR) and U.S. DOT Hazardous Material Transportation Rules

These standards are applicable to wastes that are transported offsite. The transportation standards define the types of containers, labeling, and handling required for shipment of hazardous wastes or regulated materials over public roads or by common carriers. Any action or waste management occurring offsite is subject to full regulation under federal, state, and local law.