INDIAN BEND WASH AREA

Record of Decision Operable Unit: VOCs in Vadose Zone

Abstract:
SITE HISTORY/DESCRIPTION:

The Indian Bend Wash Area site is located in the cities of Scottsdale and Tempe, Maricopa County, Arizona. Land use in the area is mixed industrial, commercial, and residential. In addition, a portion of the Salt River Pima-Maricopa Indian Community is located east of Scottsdale and north of Tempe, and Arizona State University is located to the east of the site. The site overlies four main, interconnected aquifers and contains the Salt River. Tempe currently receives its drinking water from the Salt River Project, not from wells within the Indian Bend Wash (IBW) study area. In 1987, EPA informally split the overall IBW study area: Indian Bend Wash Area-North (IBW-North) and Indian Bend Wash Area-South (IBW-South). The IBW-South contains approximately 70 locations of separate industrial and business properties. EPA believes that 30 of these locations are thought to be possible contamination sources. Onsite soil contamination has occurred by a variety of modes, including discharge of solvents or wastewater containing solvents through dry wells or into leach systems; direct discharge at land surface, leaking tanks, or pipes; and spills. In 1981, a State investigation revealed elevated levels of VOCs, including TCE, DCE, and PCE in onsite ground water. A 1988 ROD addressed partial remediation of the intermediate and deep ground water in the Scottsdale OU of IBW-North through a pump and treat remedy. A subsequent 1991 ROD addressed the shallow ground water and soil of IBW-North. This ROD addresses a final remedy for onsite soil contamination at IBW-South. Future RODs will address a final remedy for ground water at IBW-South. The primary contaminants of concern affecting the soil in the vadose zone are VOCs, including PCE and TCE.

SELECTED REMEDIAL ACTION:

The selected remedial action for this site includes treating VOC-contaminated soil above the water table onsite, using soil vapor extraction (SVE); using an off-gas system that may consist of vapor phase carbon or another adsorptive treatment, or catalytic or thermal oxidation to treat air emissions; and utilizing two innovative approaches: the "Presumptive Remedy," which allows EPA to presume that a remedial technology is appropriate in cases that it will be

effective, and the "Plug-in" approach, which allows similar, but separate, subsites to make use of the same remedy at different times. The estimated present worth cost for this remedial action ranges from $700,000 to $1,750,000, based on the number of SVE wells that will be installed.

PERFORMANCE STANDARDS OR GOALS:

The "Plug-in" approach utilizes a series of State and Federal performance standards, models, and risk-based criteria to determine cleanup goals. There are no chemical-specific cleanup goals provided for this remedial action.

INSTITUTIONAL CONTROLS:

Not provided.

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. [Para]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 EnvironmentalQuality, 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 not 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
Acting Regional Administrator	Date
EPA Region IX	

Remedy:

Text:
EPA

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
Section

Appendix

Figure

Table

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- inVadose-Zone Remedy." This ROD selects a remedy which includes both a remedial technology and a specialized process governing its application. The VOCs-inVadose-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. S 9601 et seq. as amended by the Superfund Amendments andReauthorization 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 ofEnvironmental 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 soil 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 not 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
× 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
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The remedy for this operable unit and other operable units at IBWSouth 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, bypolicy, 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.

II. DECISION SUMMARY

The Decision Summary summarizes the information and approaches used which led to EPA's decision on this remedy. It also establishes the remedy which EPA has selected. This remedy incorporates two innovative approaches that cause the format of this Record of Decision (ROD) to differ slightly from most RODs. The basis for using these approaches and the differences they imply are explained within the Decision Summary.

1. Site Name, Location, History, and Description

The Indian Bend Wash Superfund Site (IBW) consists of two study areas-Indian Bend Wash North (IBW-North) and Indian Bend Wash South (IBW-South)which lie within the cities of Scottsdale and Tempe, Maricopa County, Arizona. See Figures II-1 and II-2 for the location of the site and the study area boundaries, respectively. This ROD addresses remedial actions to be applied to the VOCs-in-Vadose-Zone Operable Unit of IBW-South. Other RODs address various operable units in IBW-North (see Section 1.7, History of EPA Involvement), and future RODs may address other operable units in IBW-South as well.

1.1. Site Discovery and Listing

The Indian Bend Wash Superfund Site was listed on the Superfund National Priorities List (NPL) in September 1983. In October 1981, the City of Phoenix detected volatile organic compounds (VOCs), primarily trichloroethylene (TCE) and perchloroethylene (PCE) in municipal groundwater production wells in the Scottsdale/Tempe area. The Cities of Scottsdale and Tempe and the Salt River Project, a local water purveyor, subsequently sampled their groundwater production wells and also found VOCs. Affected wells were shut down, and remain out of service to the present. One well, known as City of Scottsdale #6, is an exception and is being operated with treatment at the wellhead. EPA listed IBW as a multiple-source Superfund site based on these findings.

At the time of the NPL listing, the extent of contamination was not known. However, EPA established a study area as a frame of reference. This boundary covers 13 square miles, 10 square miles in Scottsdale and 3 square miles in Tempe. The study area boundaries are Scottsdale Road (Scottsdale)/Rural Road (Tempe) on the west, Pima Road (Scottsdale)/Price Road (Tempe) on the east, Apache Boulevard (Tempe) on the south, and Chaparral Road (Scottsdale) on the north. Part of the IBW-North study area lies within the Salt River Pima-Maricopa Indian Community (SRPMIC). The SRPMIC lands do not lie within the IBW-South study area.

1.2. Land Use and Demographics

Note on BoundariesAccording to the National Oil and Hazardous Substances Contingency Plan(NCP), the Superfund definition of "onsite" (i.e., the boundaries of a Superfund site) is "the areal extent of contamination and all suitable areas in very close proximity to the contamination necessary for implementation of theresponse action." This areal extent is generally discovered in the course of the remedial investigation. Therefore, the study area boundaries do not serve as the legal definition of "onsite." Should EPA discover contamination outside the study area boundaries, then the site and the study area would extend to incorporate it. Conversely, areas that prove to be uncontaminated within the study area are technically not within the site boundaries. The study area boundaries and the site boundaries are not identical.

IBW-South encompasses Sections 13 and 14 and the northern halves of Sections 23 and 24, Township 1 North, Range 4 East.

North of University Avenue. Land use north of University Avenue is primarily industrial or commercial. The area west of Hayden Road is strictly industrial and has a zero population. The area east of Hayden Road has a population of 112, and most residents live in mobile homes or trailers. Roughly 66 percent of this population are between the ages of 18 and 59. Nearly 24 percent are under 17 years of age, and the remaining 10 percent are over 60 years of age. Seven known active or inactive landfills exist east of Hayden Road along the Salt River. Businesses unrelated to landfills have operated on top of landfill material in this area.

South of University Avenue. Land use south of University Avenue is more than 80 percent residential, with the remaining land use for light industrial and commercial purposes, such as restaurants, shops, and service stations. The area east of McClintock Road is adjacent to Arizona State University and consists largely of the off-campus housing available to students. Eightysix percent of the population in this area are between 18 and 59 years of age. Three percent are over 60 years of age, and the remaining 11 percent are under 18 years of age. Seventy-five percent of the residents live in apartments or condominiums. The vacancy rate is 16 percent. In the area north of McClintock Road, 76 percent of the population are between the ages of 18 and 59; 6 percent are over 60 years of age, and the remaining 18 percent are under 18 years of age. Sixty-three percent of the residents live in apartments or condominiums. The vacancy rate is 15 percent.

There is one public elementary school and one private "day school" in IBW- South. The day school is in the southwest quadrant and has about 50 students, ages 1 to 10, enrolled year-round. A senior center is located in the southeast quadrant, adjacent to the elementary school. No high schools, hospitals, or nursing homes are located within IBW-South. More detail on land use and demographics may be found in the Interim Remedial Investigation Report, Admin. Rec. No. 1593.

1.3. Climate

The climate in the IBW-South area is semiarid to arid, but is influenced by a high degree of urban activity. The average daily maximum temperature is 85 F. and the average daily 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 twothirdsof 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 IBWSouth 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 IBWSouth 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.

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 todetermine 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 resourceand 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 PRPinstalled 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 bywhich 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 atthe 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.

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 after 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 throughthe source investigation, resulting in a smaller number of subsite requiring Focused RIs.

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 IBWSouth. 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.

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 S 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 todetermine 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 S 106 to PRPs in order to obtain Focused RIs. EPA chose not to use special notice procedures under CERCLA S 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.

EPA has issued information request letters pursuant to CERCLA S 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 more facilities for the Plug-in Process than are shown in 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

. 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 suchcontaminants, 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 Community 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 (800/2313075) 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 relationsactivities that EPA has conducted for IBW-South in order to comply with the public participation requirements of CERCLA S 113(k)(2)(B) and CERCLA S 117. Activities that were specific to IBW-North only are excluded from this list.

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 (1,1DCE) 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)
the water table to form a dense non-aqueous phase liquid (DNAPL)

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

dissolves the gas phase contaminants, which percolate to the water

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

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 thepresenceof 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 IBWSouth 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 IBWSouth 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 soilsampling. 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 (ug/l) of TCE and 1,500 ug/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 ug/l of PCE have been detected at the Unitog facility, and several hundred ug/l of TCE at the IMC Magnetics facility. Even surface soil gas levels on the order of 10 ug/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 ug/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 illustratesthe stratigraphy with approximate corresponding depths at IBW-South.

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 groundwaterrecharge 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.

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 conditionspresent 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 withminimal disturbance to structures and is proven to be effective with a minimum of disruption to urban environments. The SVE remedy removes the VOCsfrom 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 IBWSouth. 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 [IBWNorth 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 IBWNorth 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 IBWSouth, 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 includedTCE, 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 IBWNorth, 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 Decision. Therefore, following the prescribed process in the ROD completes the remedy for any particular subsite. The Plugin 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 Plugin 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 sitespecific. 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 thepublic 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 IBWSouth, 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 needs a remedy. However, as more has become known about IBW-South, it has become apparent that wherever a remedy is necessary, it is likely to be the same remedy. Therefore, before Focused RI work is completed at subsites, the remedial action for VOCs in soils can be presumed at most 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 one subsite is not in place until after 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 performinga 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 pluggedin 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 IBWSouth is collectively called the existing site profile.

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.

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 siteprofile, 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 II12. SVE is selected as the Presumed Remedial Alternative because it can beexpected 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.

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.

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 theRemedy 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- VandoseZone 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 riskassessment 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 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 Plugin 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.

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 availableemission 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.

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 thezone through which airflow is occurring.

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 extendedperiod 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.

Also included is a discussion of typical values of the parametersat 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 IBWSouth. A minimum of 500 to 1,000 pore volume exchanges of air is assumed to be needed, 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 IBWSouth. 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 theenvironment. By definition, subsites exceeding Plug-in Criteriafor 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.

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 lowlevel 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.

Compliance with ARARs

Because the ARARs for this remedy are primarily action-specific, rather than chemical-specific (see Appendix A), the No-Action Alternative maynot 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.

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
need for replacement equipment (components of this system are readily

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 NoAction Alternative.

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

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 the rereductions 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 treatmentderived 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 off-gas 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.

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 treatmentoptions.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. NoAction 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 constructionrelated 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 shortterm. 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 systems 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 nonhazardous, 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.

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 achievablein 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 predesign, 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 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 thathave been removed from the vadose zone
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 S 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 IBWSouth.

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 IBWNorth 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 twowell 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.

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 AcceptanceThe 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

Clean Air Act, and several of the VOCs in question are precursors to

- 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 VOCcontaminated 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.

  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
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.

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 impactsof 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, S 212 as capable of emitting 100 tons per year or
more of any air pollutant subject to regulation under the Clean Air
Act.

Rule 210, S 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 S 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, S 303 provides that sources emitting more than 150 pounds
per day are required to use best available control technology
per day are required to use best 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, S 301-Prohibits discharge of more than 15 pounds of

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

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

. Rule 330, S 304-If either of the limitations set forth in S 301 or S
302 is exceeded, the emissions must be reduced by incineration with a
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 toremove contaminants more efficiently. Enhancements are not separate remedies, but design options for the SVE remedy. Based on data seen to date, EPAdoes 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 asubsite
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.
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, anenhancement 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 Chapter3 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.

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.

Those subsites that EPA screens from further consideration prior torequiring 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.

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 30day 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 in conjunction with 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.

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 referredto 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 soilVOCs 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 stringentsource 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.

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 Plugin 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.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 eachsubsite 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
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
mass estimate of vadose zone contamination at the subsite
. Groundwater quality information obtained by sampling monitoring wells
installed at the subsite
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 anddepthspecific 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 surroundingthe sampling location.

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 thevadose 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 beconsidered 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 = E/Q [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 x A x F [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 = 0.7 to 1.0
for buildings with ventilated crawl spaces

The structure ventilation flow rate can be estimated as follows:

Q = ACH x V/3600s/hr [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 toestimate 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 Plugin 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 IBWSouth 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 evenlyover 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 S 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 thistreatment- 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?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 threedifferent 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.

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-inVadose-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 fromthe 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 1,1dichloroethylene (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 residentialscenario 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 eachsubsite 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.

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 ofmicroorganisms 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 andingestion 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 IBWSouth is returned to levels acceptable for drinking water use in areasonable 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 IBWSouth.

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 alternativetechnologies 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 nocomparison 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 subsitessituated 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 treatmentderived 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.

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 ug/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 theline is filled for that VOC.

Step 5: Add the values for all 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, 1.17x
10[-6] is rounded to 1 x 10[-6]).

Step 9: If the value in Line 10 exceeds 1 x 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.

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 ug/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 sumin 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 Line12b.

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.

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 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 theline is filled for that VOC.

Step 5: Add the values for all of the VOCs in Line 6 and enterthe sum in
Line 7. Round the value in Line 7 to one significant figure (for example, 1.17 x 10[-6] is rounded to 1 x 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 x 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.

Appendix A
APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

1) RCRA listed wastes (the RCRA requirements listed in this section will beapplicable 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 treatmentderived wastewater).

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 SR18-8-270.1) 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 SS 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.

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 setforth at 40 CFR Part 264, Subpart F, are applicable if the CERCLA remedialaction 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 S 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. Rep. 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 SS 264.1030 - 264.1034 and 40 CFR SS 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, althoughthey are not environmental protection standards and therefore are not ARARs.

A.5.1. The Occupational Safety and Health Act (29 U.S.C. S 651 et seq., 29 CFR S 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.

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 notadministrative 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 chemicalspecific 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 treatmentderived 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:

A.5.2. Standards for Transportation of Hazardous Waste (40 CFR S 263, 49CFR) 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.

Back to Indian Bend Wash Area Site Overview

MODIFICATIONS