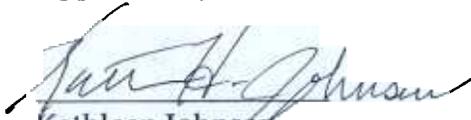


**FIVE-YEAR REVIEW REPORT**  
**FOR**  
**PHOENIX-GOODYEAR AIRPORT (NORTH)**  
**SUPERFUND SITE**  
**GOODYEAR, ARIZONA**

**September 2006**

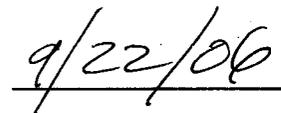
**Prepared for**  
**Contract No. 68-W-98-225/WA NO. 238**  
**United States Environmental Protection Agency**  
**Region 9**  
**75 Hawthorne Street**  
**San Francisco, California 94105**

**Approved by:**

  
Kathleen Johnson

**Chief, Federal Facilities and Site Cleanup Branch**  
**EPA, Region 9**

**Date:**

  
9/22/06

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# List of Acronyms

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ADSH	Arizona Department of Health Services
ARAR	Applicable or Relevant and Appropriate Requirements
bls	below land surface
CD	Consent Decree
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COG	City of Goodyear
COC	constituents of concern
EPA	United States Environmental Protection Agency
ESD	Explanation of Significant Differences
GAC	granular activated carbon
MAU	Middle Alluvial Unit
MCL	maximum contaminant level
MEK	methyl ethyl ketone
µg/L	micrograms per liter
mg/L	milligrams per liter
MTS	Main Treatment System
NCP	National Contingency Plan
NPL	National Priorities List
O&M	operation and maintenance
OU	Operable Unit
PGAN	Phoenix-Goodyear Airport-North Superfund Site
PGAS	Phoenix-Goodyear Airport-South Superfund Site
ppb	parts per billion
RCRA	Resource Conservation and Recovery Act
RI/FS	remedial investigation/feasibility study
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act

SOW	Scope of Work
SVE	Soil Vapor Extraction
TCE	trichloroethene
UAU	Upper Alluvial Unit
UPI	Unidynamics Phoenix, Inc.
VOC	volatile organic compound

# Five-Year Review Summary Form

SITE IDENTIFICATION	
<b>Site name :</b> Phoenix-Goodyear Airport (North) Superfund Site	
<b>EPA ID:</b> AZD980695902 <b>CERCLIS ID :</b> AZD980695902	
<b>Region:</b> IX	<b>State:</b> AZ <b>City/County:</b> Goodyear/Maricopa
SITE STATUS	
<b>NPL status:</b> X Final <input type="radio"/> Deleted <input type="radio"/> Other (specify) _____	
<b>Remediation status</b> (choose all that apply): X Operating <input type="radio"/> Complete	
<b>Multiple OUs?</b> X YES <input type="radio"/> NO <b>Construction completion date:</b> N/A Groundwater (OU3), Soil Gas (OU4) and Soil (OU5).	
Has site been put into reuse? X YES NO (some non-manufacturing portions of Site redeveloped)	
REVIEW STATUS	
<b>Reviewing agency:</b> X EPA <input type="radio"/> State <input type="radio"/> Tribe <input type="radio"/> Other Federal Agency _____	
<b>Author name:</b> Mary Aycock	
<b>Author title:</b> Remedial Project Manager	<b>Author affiliation:</b> EPA Region IX
<b>Review period:</b> March – August 2006	
<b>Date(s) of Site inspection:</b> Multiple	
<b>Type of review:</b> X Statutory <input type="radio"/> Policy <input type="radio"/> Post-SARA <input type="radio"/> Pre-SARA <input type="radio"/> NPL-Removal only <input type="radio"/> Non-NPL Remedial Action Site <input type="radio"/> NPL State/Tribe-lead <input type="radio"/> Regional Discretion	

**Review number:** X 1 (first)  2 (second)  3 (third)  Other (specify)

**Triggering action:**

Actual RA Onsite Construction at OU

X Actual RA

Previous Five-year Review Report

Construction Completion

Other (specify) \_\_\_\_\_

**Triggering action date:** 1990 (start of groundwater remediation at PGA-South [PGAS]). PGA-North (PGAN) remediation began in 1994 (full-scale operation of soil vapor extraction [SVE] system, and start of Phase I groundwater pump-and-treat system)

**Due date (five years after triggering action date):** 1995. This five-year review was triggered by the start of groundwater remediation at PGAS in 1990.

**Issues and Recommendations:**

**The following issues have been identified at PGAN:**

**1. Issue:**

Capture of contaminants and progress toward restoration of groundwater has not been demonstrated.

**Recommendation:**

Evaluate capture through installation of additional wells, update of groundwater flow model, and installation of additional extraction wells if needed.

**2. Issue:**

An ecological risk assessment has not been performed.

**Recommendation:**

Conduct a screening level ecological risk assessment.

**3. Issue:**

Nearby production wells may require wellhead treatment or alternative water supply.

**Recommendation:**

Continuously evaluate production well water quality and need for wellhead treatment or alternative water supply, as called for in SOW.

**4. Issue:**

There has not been a recent human health risk assessment that encompasses all issues at the Site, including the identification of additional COCs.

**Recommendation:**

Complete a risk assessment, as called for in the SOW.

**Protectiveness Statement:**

A protectiveness determination of the remedy at PGAN cannot be made at this time until further information is obtained. While remedial action is ongoing at the Site, EPA is implementing a supplemental RI to better characterize Site contamination and its extent and expects that there will be a supplemental FS to examine appropriate alternatives to treat contamination not being adequately addressed currently. It is expected that these actions will be completed by about 2011, at which time a protectiveness determination will be made.

Because PGAN and PGAS are implementing the same ROD, EPA wants to ensure that five-year reviews of the remedy implementation are on concurrent schedules. PGAS completed its first five-year review in September of 2005. Therefore, the next comprehensive five-year review for both Sites will be conducted by September 2010.

## SECTION 1.0

# Introduction

---

The purpose of the five-year review is to determine whether the remedy at a site is protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in Five-Year Review reports. In addition, Five-Year Review reports identify issues found during the review, if any, and identify recommendations to address them.

The Agency is preparing this Five-Year Review report pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) §121 and the National Contingency Plan (NCP). CERCLA §121 states:

“If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.”

The Agency interpreted this requirement further in the NCP; 40 CFR §300.430(f)(4)(ii) states:

“If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.”

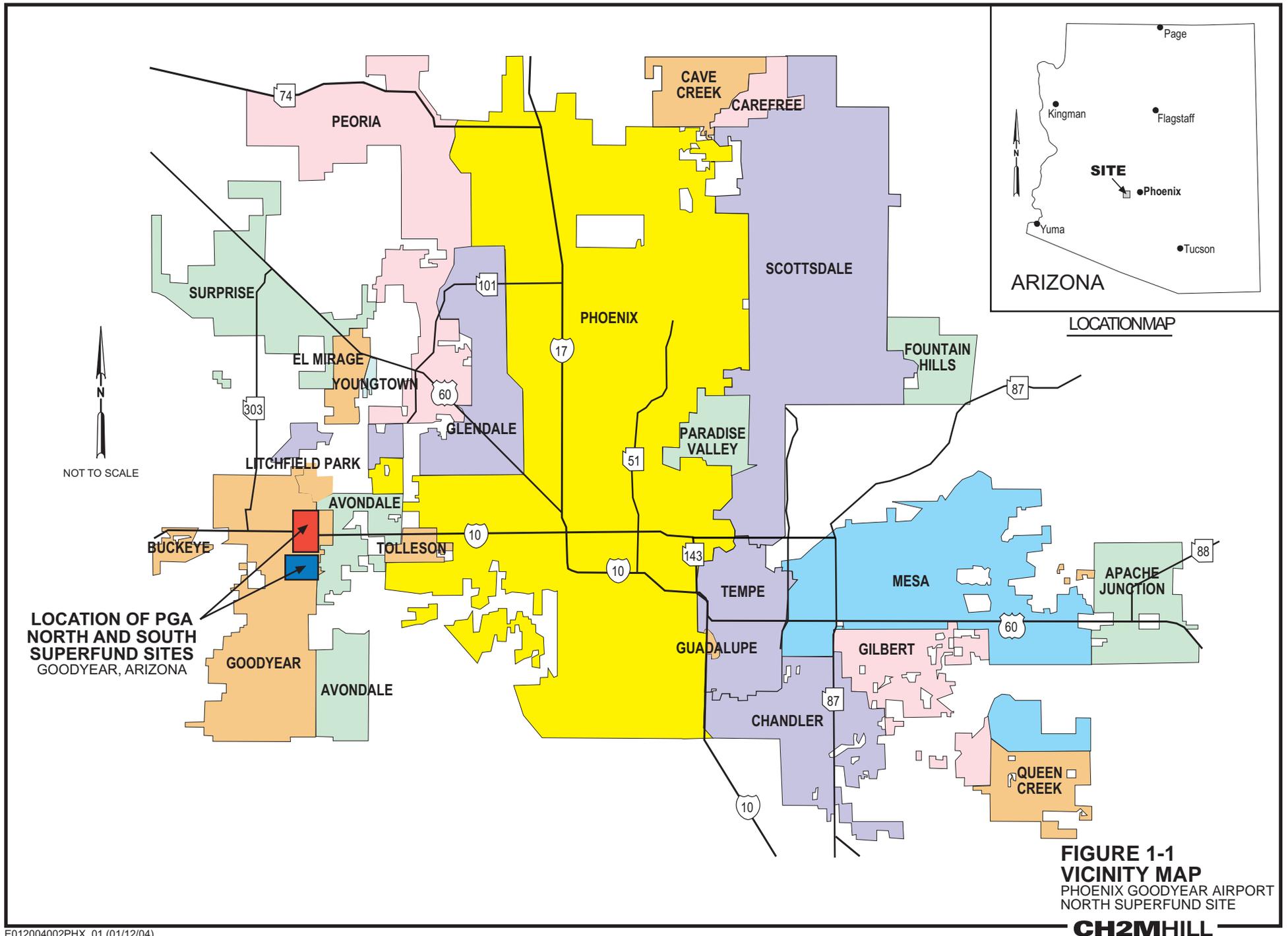
The United States Environmental Protection Agency (EPA) Region 9 completed a five-year review of the remedial actions implemented at the Phoenix-Goodyear Airport North (PGAN) Superfund Site. There are three Operable Units (OU) at PGAN: OU3 (groundwater), OU4 (soil gas) and OU 5 (soil). This five-year review reports on the status of all three OUs.

This five-year review is a statutory review because hazardous substances, pollutants, or contaminants remain at PGAN above levels that allow for unrestricted use and unlimited exposure during soil remediation activities and ongoing groundwater remediation activities (in accordance with Section 121 of CERCLA), and because the Record of Decision (ROD) was signed after October 17, 1986, the effective date of the Superfund Amendment and Reauthorization Act (SARA).

This is the first five-year review for the PGAN Site. The triggering action for five-year reviews is the start date of remedial action. PGAN and PGAS were originally listed on the National Priorities List (NPL) as one site in 1983. Since that time, it has been determined that

the Site is more accurately identified as two areas of noncontiguous contamination (PGAN and PGAS). The remedies at the two areas are being conducted separately. The start of groundwater remediation (1990) at PGAS serves as the trigger date for this five-year review. Relative locations of the Sites are shown in Figure 1-1. The first five-year review was conducted for PGAS in 2005. In the future, EPA will put the two portions of the Site on the same five-year review schedule. Thus, the next PGAN five-year review will be conducted in 2010.

1-1      **Figure**  
            **Vicinity Map**



**SECTION 2.0**

# Site Chronology

TABLE 2-1  
 Chronology of Events  
*Phoenix-Goodyear Airport (North) Superfund Site, City of Goodyear, Maricopa County, Arizona*

Event	Date
UMC, parent company of Unidynamics Phoenix, Inc. (UPI), established a research, development and manufacturing plant for defense and aerospace equipment at the PGAN property.	1963
Arizona Department of Health Services (ADHS) discovered that groundwater in the Goodyear area was contaminated with solvents and chromium.	1981
EPA added the PGA Site (originally listed as the "Litchfield Airport Area Superfund Site") to the NPL.	September 1983
EPA issued first of several orders to UPI "to conduct a comprehensive sampling and analysis program to support subsequent remedial actions." (Resource Conservation and Recovery Act [RCRA] Administrative Order (Docket No. 84-03).	April 1984
Phase I Remedial Investigations began on the entire PGA area.	October 1984
Phase II Remedial Investigations on the PGAN property.	1986
EPA published a Remedial Investigation/Feasibility Study (RI/FS) that identified two areas of noncontiguous contamination (PGAN and PGAS).	June 1989
EPA issued a ROD that applied to both the PGAN and PGAS Sites. For PGAN, the main ROD requirements were groundwater remediation of Subunits A and B/C using extraction and treatment, and soil remediation using soil vapor extraction (SVE) with granular activated carbon (GAC).	September 1989
Groundwater extraction and treatment system for Subunit A groundwater implemented at PGAS (trigger for five-year review for PGAS and PGAN).	1990
EPA issued an Amended Administrative Order (Docket No. 90-20) to UPI for Remedial Design and Remedial Action to implement the PGAN ROD remedy.	October 1990
EPA issued Explanation of Significant Difference (ESD) #1 to the 1989 ROD (see Section 4.1.2 for details).	January 1991
EPA issued ESD #2 (see Section 4.1.2 for details).	May 1993
UPI facility manufacturing operations ceased.	1994
Full-scale SVE operations began at PGAN.	June 1994
Phase I groundwater treatment system for volatile organic compounds (VOC), with onsite reinjection back into the Subunit A aquifer, began at PGAN.	September 1994
Phase II / III groundwater treatment system began operation at PGAN.	October 1996
Perchlorate first detected in area monitoring wells.	August 1998
UPI shut down SVE system due to operational difficulties.	October 1998
Trichloroethene (TCE) and perchlorate were detected in several domestic supply wells southeast of the UPI facility.	2001

TABLE 2-1

## Chronology of Events

*Phoenix-Goodyear Airport (North) Superfund Site, City of Goodyear, Maricopa County, Arizona*

Event	Date
TCE is detected above the maximum contaminant level (MCL) for the first time in Subunit C monitor well MW-20 (located north of the main manufacturing area), and concentrations continue to increase over time.	May 2001
Reinjection stopped at the Main Treatment System (MTS) due to lack of perchlorate treatment. TCE-treated water sent to City of Goodyear (COG) Waste Water Treatment Plant for perchlorate treatability study.	October 2001
MW-20 converted to a temporary extraction well connected to the Phase II / III groundwater treatment system for Subunit C groundwater treatment.	March 2002
EPA issued ESD #5 (see Section 4.1.2 for details).	September 2002
EPA issued a Unilateral Administrative Order (Docket No. CERCLA 9-2003-0001) to restart the SVE system with a GAC treatment unit.	January 2003
TCE concentrations in City of Goodyear production well COG-02, located about ¼ mile east of the Site, increase above MCL and forced closure of that well.	May 2003
In response to elevated soil gas and groundwater concentrations in boring B-4 (CH2M HILL, 2004), located north of the UPI manufacturing buildings, indoor air samples are collected and analyzed in buildings in vicinity of these elevated levels.	September 2003
EPA conducts Phase II Source Area Groundwater Investigation that identified TCE and perchlorate levels in Subunits B and C in source area (perchlorate up to 200 parts per billion [ppb]) (CH2M HILL, 2004).	2003
SVE system restarted using GAC treatment.	April 2004
Development of draft Consent Decree Scope of Work (SOW) to comprehensively address the soil, soil gas and groundwater impacts attributed to the Site, and completion of SOW activities such as main dry wells investigation.	2005
A second round of indoor air samples is collected and analyzed in buildings located north of the UPI manufacturing buildings.	February 2005
Perchlorate treatment using ion exchange technology added to the MTS. Treated effluent reinjected into Subunit A groundwater.	April 2005
Partial Consent Decree (CD) between the U.S. and Crane/UPI entered by U.S. District Court of the District of Arizona. CD requires Crane/UPI to implement SOW.	June 2006

## SECTION 3.0

# Site Background

---

The Phoenix-Goodyear Airport-North (PGAN) Superfund Site (the Site) is defined by an area of VOC- contaminated groundwater that encompasses approximately two square miles (Figure 3-1). Groundwater contamination originated at the former Unidynamics Phoenix, Inc. (UPI) facility (the former UPI facility) located on Litchfield Road south of Van Buren Road. The Site is located 17 miles west of downtown Phoenix, Arizona.

## 3.1 Land and Resource Use

Land uses in the vicinity of PGAN are a mix of residential, agricultural, commercial, and industrial. Commercial and industrial properties lie to the north and south of the former UPI facility, agricultural land is to the west and residential and commercial property is across Litchfield Road to the east.

## 3.2 Geology/Hydrogeology

The Upper Alluvial Unit (UAU) is subdivided into three subunits, Subunit A, Subunit B and Subunit C in order of depth below land surface (bls). Subunit A, composed primarily of silty sands, extends from the surface to about 160 feet bls. Groundwater occurs under unconfined conditions at about 90 feet bls. Subunit B, composed primarily of sandy silt with clay, extends from about 160 feet bls to 230 feet bls and acts as a partial aquitard between Subunits A and C. Subunit C, composed primarily of silt, sand and gravel, extends from about 230 to 360 feet bls. The Middle Alluvial Unit (MAU) underlies Subunit C of the UAU. Many production wells in the area are screened at least partially in Subunit C and the MAU. Geology and hydrogeology of the Site is described in numerous Site reports, including most recently the *Groundwater Monitoring Fourth Quarter 2005 and 2005 Annual Report* (ARCADIS, 2006a).

## 3.3 History of Contamination and Initial Response

In 1981, the Arizona Department of Health Services (ADHS) discovered that groundwater in the PGA area was contaminated with trichloroethene (TCE) and other volatile organic compounds (VOCs). As a result, the EPA added the overall PGA site to the National Priorities List (NPL) in September 1983 as the Litchfield Airport Area Superfund Site.

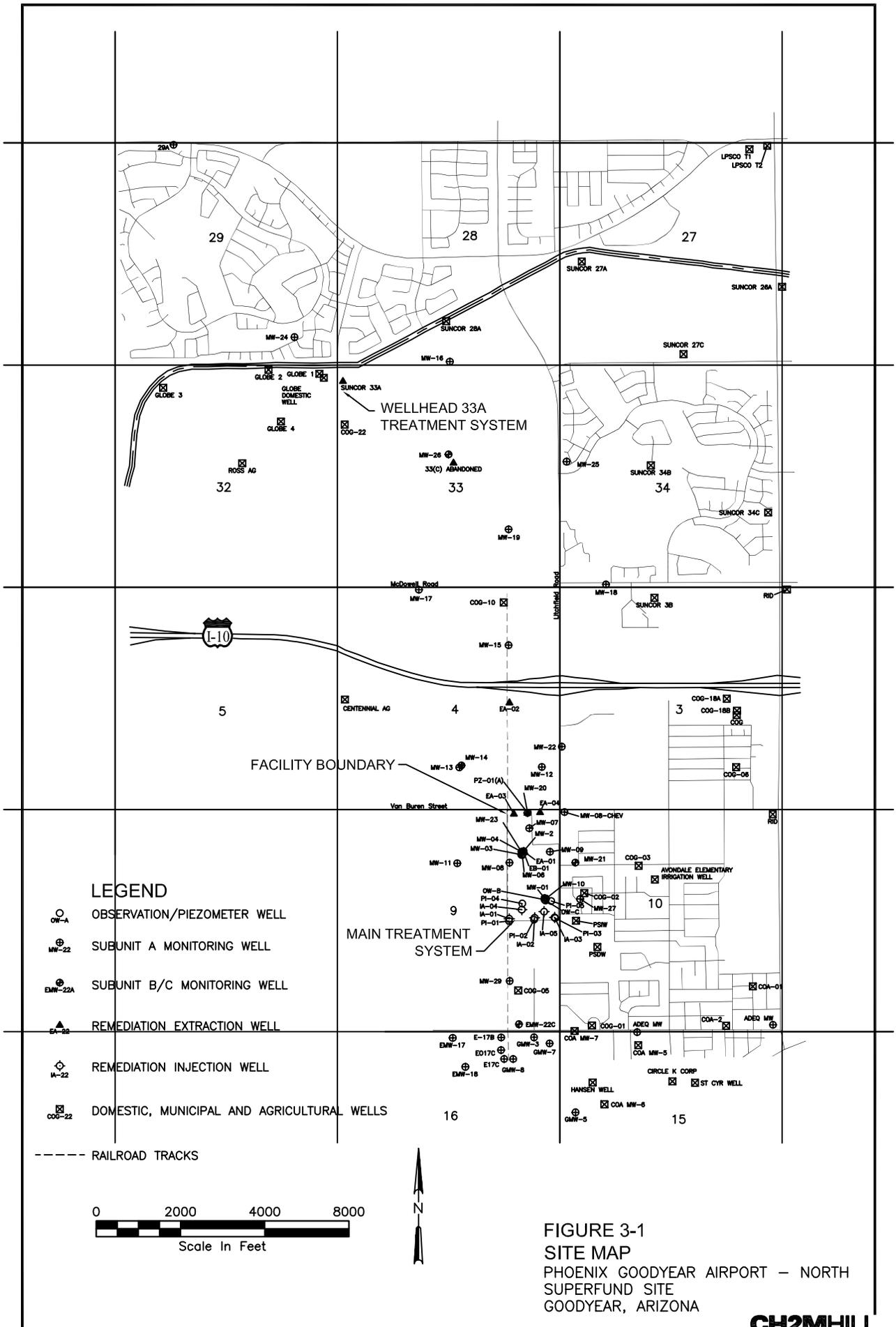
In 1984, UPI began a subsurface investigation at the former UPI facility. UPI's investigation identified the primary source of contamination to be four dry wells located west of UPI's main building. The dry wells were used for disposal of solvents from the former UPI facility from 1963 through 1980. A more thorough Remedial Investigation from 1985 through 1987 revealed that the groundwater plume extended more than one mile north of the former UPI facility. Additional investigation was conducted by EPA to complete the RI/FS for the Site, as described in the *Remedial Investigation/Feasibility Study Phoenix Goodyear Airport, Goodyear,*

*Arizona. Volumes I, III, and XII* (CH2M HILL, 1989). More recent investigation is addressed below in Section 4.4.1. Additional information on remedial investigations at the Site may also be found in the *Site Evaluation Report – Former Unidynamics/Phoenix Site* (ARCADIS, 2006c).

### 3.4 Basis for Taking Action

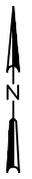
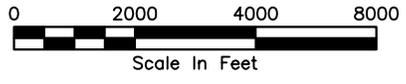
As described in the 1989 Remedial Investigation/Feasibility Study (RI/FS) (CH2M HILL, 1989), TCE was detected in soil at levels greater than the ADHS-suggested soil cleanup level of 0.26 milligrams per kilogram (mg/kg), and was detected in groundwater at levels greater than the Maximum Contaminant Level (MCL) of 5 micrograms per liter (µg/L). In sampling conducted in 1984, the maximum concentration of TCE in soil was 5,586 mg/kg, and the maximum concentration in groundwater was 86,000 µg/L. Other contaminants identified as specific targets for remediation include methyl ethyl ketone (MEK) and acetone. Cleanup levels were established in the 1989 Record of Decision ([ROD] EPA, 1989) for 1,1-dichloroethene, 1,2-dichloropropane, chloroform, toluene, trichloroethene, trichlorofluoromethane, carbon tetrachloride, methylene chloride, xylenes, antimony, arsenic, barium, beryllium, cadmium, chromium, lead, mercury, nickel, selenium, silver and zinc. Metals were contaminants of concern at PGAS, but not at PGAN.

**3-1**      **Area Map Showing Subunit A and C Wells and Treatment Systems**      **Figure**



**LEGEND**

- OW-A OBSERVATION/PIEZOMETER WELL
- ⊕ MW-22 SUBUNIT A MONITORING WELL
- ⊕ EMW-22A SUBUNIT B/C MONITORING WELL
- ▲ EA-25 REMEDIATION EXTRACTION WELL
- ◇ IA-22 REMEDIATION INJECTION WELL
- ⊠ COG-22 DOMESTIC, MUNICIPAL AND AGRICULTURAL WELLS
- RAILROAD TRACKS



**FIGURE 3-1**  
**SITE MAP**  
 PHOENIX GOODYEAR AIRPORT – NORTH  
 SUPERFUND SITE  
 GOODYEAR, ARIZONA

# Remedial Actions

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## 4.1 Regulatory Actions

EPA signed the Site ROD in 1989 (EPA, 1989), addressing the vadose zone and groundwater in Subunits B and C for both the PGAS and PGAN sites, as well as Subunit A groundwater at PGAN. EPA issued an Amended Administrative Order, Docket No. 90-20 (EPA, 1990), to UPI in October 1990 for UPI to implement the remedy specified in the ROD. EPA issued a total of five ESDs making changes to the remedy selected in the ROD.

### 4.1.1 Record of Decision

The 1989 ROD addressed TCE, MEK, and acetone contamination in soil and groundwater. The goal for treatment of soil was to prevent migration of TCE into Subunit A groundwater. Soil Vapor Extraction (SVE) with vapor phase carbon was selected for treatment of soil at the Site. The goal of treatment for groundwater was to protect the current and future uses of area Subunit B/C groundwater. The selected remedy for groundwater contamination was containment and treatment with air stripping, vapor phase carbon, and granular activated carbon polishing to remove acetone and methyl ethyl ketone (MEK). The treated water was to be either reinjected or incorporated into the potable water supply.

### 4.1.2 Explanations of Significant Difference

The first ESD was issued in January 1991 (EPA, 1991). There were five points to the ESD, four of which applied to PGAN. The four relevant points were intended to:

1. Revise the cleanup level for MEK in groundwater from 170 parts to billion (ppb) to 350 ppb
2. Set a cleanup level for acetone in groundwater at 700 ppb
3. Clarify the target area and criteria for establishing cleanup goals for soil at PGAN
4. Clarify the role of soil excavation as an option should the selected remedy be ineffective

The second ESD was issued in May 1993 (EPA, 1993). There were several goals of this ESD, of which five applied to PGAN:

1. Change the emission control technology for the SVE system from vapor-phase granular activated carbon (GAC) to treatment by thermal oxidation with wet scrubbing;
2. Change the designated end use for water treated by the Subunit C groundwater remedy from incorporation into the community potable water supply to reinjection back into the Subunit C section of the aquifer with an option for municipal use after 1994;
3. Suspend the remedial design and construction of the liquid-phase GAC treatment requirement from the Subunit A groundwater remedy because ketones were no longer present in groundwater above remediation levels;

4. Add the requirement that wellhead treatment be implemented at any private or municipal drinking water well in the vicinity of the PGA site that has an occurrence of Site contaminants at levels in excess of the groundwater clean-up standards, and;
5. Establish four additional groundwater clean-up standards: benzene (5 ppb), ethylbenzene (700 ppb), 1,1,2,2-tetrachlorethane (0.18 ppb) and tetrachlorethene (5 ppb).

The third ESD, issued in December 1995 (EPA, 1995), allowed for air sparging to accelerate soil cleanup and modified the groundwater remedy for chromium-contaminated Subunit A groundwater to include the use of wellhead treatment systems. ESD #3 was optional for PGAN, and it has not been used.

The fourth ESD, issued in March 1998 (EPA, 1998), updated the current groundwater clean-up standards for both Subunit A and Subunit B/C to be consistent with the Safe Drinking Water Act MCLs adopted in October 1996. Primary contaminants affected by this ESD were toluene and seven metals.

The fifth ESD, issued in September 2002 (EPA, 2002), applied only to PGAN. ESD #5 required the restart of the SVE system. Because there was no longer MEK or acetone in the area, the air emissions control technology was able to be changed to GAC from thermal oxidation with wet scrubbing, as had been required by ESD #2.

### 4.1.3 Administrative Orders

On October 10, 1990, the EPA issued an Amended Administrative Order, Docket No. 90-20 (EPA, 1990) requiring UPI to implement the remedy specified in the ROD. On January 2, 2003, EPA issued a second administrative order (EPA, 2003) requiring Crane to develop an SVE Redesign Work Plan, collect appropriate data to redesign the SVE system, and implement SVE as required by the ROD and ESD #5.

### 4.1.4 Partial Consent Decree

Following initial investigation of uncontrolled contamination and new constituents of concern (COC) at PGAN, EPA and Crane (UPI's parent company) signed a Partial Consent Decree (CD) (EPA, 2006) in April 2006 that includes a detailed Scope of Work (SOW) to address necessary additional Site characterization and remedial action. The SOW calls for extensive investigation to fully characterize the extent of soil, soil gas, and groundwater contamination, and for expanded remedial action to address that contamination. The SOW is currently being implemented at the Site as the roadmap for full characterization and cleanup. The Partial CD was entered by the U.S. District Court in June 2006.

## 4.2 Remedial Action Objectives

The 1989 ROD set forth cleanup levels for the soil and groundwater at PGAN. The goal for remediation of VOCs in soil is to remove contaminants from the soil until EPA determines that the levels remaining will not cause or contribute to contamination of the groundwater above the groundwater cleanup standards. While PGAS used a VLEACH analysis to show that it completed its soil gas remediation in 1999, additional soil gas remediation is ongoing at PGAN. The cleanup levels for soil are set such that remaining contamination will not contribute to groundwater contamination above the groundwater cleanup levels.

Pursuant to the remedy selected in the 1989 ROD, groundwater throughout the aquifer – including Subunits A and B/C (hereafter referred to as Subunit C) - must meet Site-specific cleanup levels which are listed in Table 2-5 of the ROD. Subunit C and the MAU are domestic water supply sources for the area and thus must meet MCLs. Although Subunit A is not a potential source of drinking water, pursuant to Arizona state law, cleanup must achieve the maximum protection of drinking water. Thus, MCLs apply to Subunit A groundwater unless treatment is not cost-effective, is not reasonable or necessary to protect human health or the environment, or is inconsistent with other aspects of Arizona water law. Some of the cleanup levels established in the ROD were modified in ESD #2 and ESD #4. Original and current cleanup levels are discussed in Section 7.2 and listed in Table 7-1.

### 4.3 Remedy Description

An SVE with vapor phase carbon was selected for treatment of soil at the Site. The selected remedy for groundwater was containment and treatment with air stripping, vapor phase carbon, granular activated carbon polishing to remove acetone and MEK, with treated water either reinjected or incorporated into the potable water supply.

### 4.4 Remedial Action Implementation

Groundwater treatment began at PGAN in 1994. Treatment systems include the Main Treatment System (MTS) for Subunits A and C groundwater near the former UPI facility and a wellhead treatment system at Well 33A for Subunit A and B groundwater in a production well north of the former UPI facility. Groundwater is treated at the MTS using air stripping for VOC removal, and in 2005, ion exchange was added for perchlorate removal. Treated water is injected into Subunit A through five injection wells. Current operation of the MTS is further detailed in the *Groundwater Treatment Systems Operation and Maintenance Plan* (Groundwater O&M Plan) (ARCADIS, 2005a). The wellhead treatment system at 33A uses liquid-phase GAC for VOC removal, and, because there is not perchlorate contamination above levels of concern, includes no perchlorate treatment. Treated groundwater was delivered to an offsite pond at a nearby golf course for irrigation until May 2006, when it was directed to the adjacent Roosevelt Irrigation District canal. Operation of the Well 33A Groundwater Treatment System is further described in the Groundwater O&M Plan.

Over the past several years, it has become apparent that the extraction and treatment system is not sufficient to contain the PGAN groundwater plume. Operational malfunctions at the MTS from 1997 to 2001 caused untreated water to be reinjected into the aquifer to the southeast of the facility (Geomatrix, 2001). Also, several conduit wells appear to have drawn contamination into the lower aquifers. Additionally, the extraction system as currently designed does not necessarily address the changed pumping influences in the area. Finally, the system was developed to address VOC contamination and not necessarily to treat contaminants like perchlorate. Current investigation is intended to fully characterize the extent of contamination, both vertically and horizontally, in order to optimize the Subunit A treatment systems, to formalize a Subunit C treatment system, and to formalize a remedy for perchlorate. It is expected that this process could result in additional and differently distributed extraction wells and treatment systems at the Site.

The *Groundwater Monitoring Fourth Quarter 2005 and 2005 Annual Report* (ARCADIS, 2006a) provides an overview of current remedial action implementation at the Site.

The Site's soil gas remedy is an SVE system addressing vadose zone soil gas near the former UPI main drywells area. The original SVE system was constructed in 1994 with thermal oxidation for air emissions and operated until 1998 removing approximately 10,000 pounds of TCE. The SVE system remained shut down until 2004 when it was restarted with GAC treatment for air emissions. The system currently consists of nine extraction wells, a 250 standard cubic feet per minute blower, and three in-line GAC vessels. Flow to the SVE system alternates between extraction wells to optimize the removal efficiency. Operation of the SVE system is further explained in the *Soil Vapor Extraction System Operations and Maintenance Plan* (SVE O&M Plan) (ARCADIS 2005b).

## 4.5 Operation and Maintenance

A revised and expanded groundwater treatment O&M manual was updated in 2005 to include the ion exchange process treatment details (ARCADIS, 2005d). The MTS operated routinely during 2005, with short periods where the system was shut off for maintenance. Also, the new ion exchange system for perchlorate treatment was installed during 2005. There were several issues with the extraction wells, primarily electrical problems, flow meter problems, and damaged pumps. These problems appear to have been addressed and resolved. More specific information on the treatment systems can be found in the *Annual Groundwater Remediation Operation and Maintenance Report – Year 2005* (ARCADIS, 2006b) and the Groundwater O&M Plan.

### 4.5.1 Operation and Maintenance Activities

The Site's treatment systems are intended to perform continually. Routine maintenance is required to keep the groundwater wells, soil vapor wells, and treatment systems operating. Operation and maintenance requirements for the groundwater and soil vapor treatment systems and wells are described in (ARCADIS, 2005a) and (ARCADIS, 2005b).

According to (ARCADIS, 2006b), the wellhead treatment system at 33A was relatively trouble-free during 2005. The MTS had maintenance issues typical of groundwater treatment systems, and these were addressed, as called for in the O&M manual (ARCADIS, 2005d).

Maintenance issues were generally rectified in a timely manner, with proper reporting when process water was released from pipes or tanks.

According to the third and fourth quarter *Summary of Soil Vapor Extraction Operations* (ARCADIS, 2005c and ARCADIS 2006d), the system operated about 67 percent of the time during the third quarter of 2005 and 86% of the time during the fourth quarter. Reasons for system shut down included unknown causes believed to be power service failure, particularly during the third quarter, and quarterly sampling, which takes about 14 days. The system alternates which extraction wells are in service, and wells generally exhibit a decline in VOC concentrations after being put into service. (ARCADIS, 2005c).

## 4.5.2 Operation and Maintenance Costs

According to a summary of annual costs provided by Crane (Crane, 2005), approximately \$650,000 was spent during calendar year 2005 on operation, monitoring and maintenance of the groundwater extraction and treatment systems. An additional \$365,000 was spent to upgrade and operate the SVE system.

**SECTION 5.0**

# **Progress Since Last Five-Year Review**

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This is the first five-year review for the Site.

## SECTION 6.0

# Five-Year Review Process

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## 6.1 Administrative Components

The five-year review for PGAN was directed by Mary Aycock of EPA, the Remedial Project Manager for the Site, with support from CH2M HILL. The review was conducted between April 1, 2006 and September 8, 2006 and included community involvement, document review, and Five-Year Review Report development and review.

## 6.2 Community Involvement

Members of the Community Action Group (CAG) were notified of the PGAN five-year review during numerous meetings, with the most recent ones held on February 9, 2006, June 15, 2006, and September 14, 2006. Most recently, Fact Sheets were issued October 2004 and June 2006 to update the community on progress at the Site. Fact Sheets typically contain a summary of work performed, as well as expectations for future work, results and decisions. A Fact Sheet that presents the results of this five-year review will be issued in October 2006.

## 6.3 Documents Review

This five-year review consisted of a review of selected relevant documents including O&M records and monitoring data. Applicable groundwater cleanup standards, as listed in the 1989 ROD and all ESDs were reviewed. All reviewed documents are listed in Section 12.0, References.

## 6.4 Data Review

Most of the data reviewed for this report was obtained from ARCADIS' quarterly and annual groundwater and SVE monitoring reports.

### 6.4.1 Subunit A Groundwater

As of the fourth quarter 2005, TCE concentrations in Subunit A ranged from non-detect in some perimeter wells to 2,300 µg/l at MW-12, and perchlorate concentrations ranged from non-detect to 36.8 µg/l at MW-27. Increasing TCE concentrations in Subunit A monitor wells suggest that there is not adequate plume capture. This may be due to an insufficient number of Subunit A extraction wells and low flow rates in the wells that are in place. The current Site groundwater investigation is designed to better characterize the groundwater in the area aquifer. Additional monitoring and plume delineation is necessary to the north and northeast to demonstrate plume capture. The *Groundwater Monitoring Fourth Quarter 2005 and 2005 Annual Report* for the Site (ARCADIS, 2006a) reports increasing concentrations of TCE in MW-15, -16, -18 and -25, four monitoring wells located north of Interstate 10 (monitor well locations are shown on Figure 3-1). This increase may be due to lack of

capture in light of increased pumping of SunCor Well 3B drawing the plume in a more easterly direction, and/or due to decreased pumping from the west following closure of several Globe Corporation irrigation wells. There are no Subunit A sentinel monitoring wells east or northeast of these wells yet. However, the plume appears to be stable to the west/northwest as evidenced by TCE concentrations below the MCL in perimeter wells MW-17 and MW-24.

Plume delineation is also an issue to the east and southeast of the former UPI facility, particularly in the area of COG-2, COG-3, and PSDW. The monitor well closest to these locations is MW-27, which contained TCE at a concentration of about 140 µg/L during 2005. TCE concentrations in the interior of the Subunit A plume have been unstable, but appear to be mostly contained horizontally by the extraction well network.

Perchlorate in Subunit A appears primarily to be limited to a narrow, L-shaped plume extending east and north of the former UPI facility. The perchlorate to the east of the former UPI facility is likely a result of the intermittent injection of untreated water between 1997 and 2000. Groundwater in this area is moving to the northwest toward extraction well EA-04. Perchlorate-impacted groundwater north of the former UPI facility is in the projected capture zone for extraction well EA-02.

#### 6.4.2 Subunit C Groundwater

As of the fourth quarter 2005, TCE concentrations in Subunit C ranged from non-detect in some perimeter wells to 160 µg/L at MW-20, and perchlorate concentrations ranged from non-detect to 7.0 µg/L at MW-20. The TCE concentrations in Subunit C have increased in some areas, particularly in the immediate vicinity of the former UPI facility, and the plume has encroached on a number of City of Goodyear (COG) production wells, resulting in closure of COG-2. The TCE concentrations in COG-02 ranged from 4.1 to 6.6 µg/L between June 2003 and June 2004, when it was taken out of service. Perchlorate concentrations in Subunit C groundwater appear to be relatively stable, with no offsite wells currently above the HBGL of 14 µg/L. The only offsite well to exceed the HBGL in the past three years was PSDW, which contained levels as high as 130 ppb in 2002, a value of 16.4 µg/L in January 2005, and levels at 2 and 3 µg/L since that time.

Historically, contamination in Subunit C at the Site was understood to be limited, if at all. Increased contamination in several domestic supply wells screened in Subunit C and the MAU during the last five years indicated that this is not the case. EPA's Phase II Groundwater Investigation better characterized the extent of Subunit C contamination in the immediate facility area. The groundwater investigation, currently ongoing, is expected to provide more information as to the appropriate configuration of any Subunit C remedy. Currently only a single well is being used for extraction in Subunit C, and it does not appear to be providing full plume capture, particularly to the north of the former UPI facility. Also, there is not a sufficient number of monitor wells to delineate the plume to the north and west.

#### 6.4.3 MAU Groundwater

The PGAN remedy did not anticipate contamination in the MAU. Thus, there are very few monitoring points for determining the water quality of the MAU. The wells that are

screened in this unit are irrigation and domestic production wells, which tend to have very large wells screens and some of which are also screened in the lower Subunit(s) of the UAU. However, well COG-10, screened in the MAU only, contains TCE above 5 µg/L and accordingly has been shut down for use as a production well. The TCE concentrations in COG-10 reached as high as 61.7 µg/L in April 2005. Without monitoring wells screened in the MAU, plume delineation is difficult. In accordance with the SOW, two MAU monitoring wells will be installed during the groundwater investigation, which started in 2006. The cause of the vertical migration of contaminants into the MAU is still unclear, but is likely related to conduit wells and vertical migration resulting from the downward hydraulic gradients in the study area.

#### 6.4.4 Vadose Zone Soil

Soil gas data was obtained from recent SVE operation summaries (ARCADIS, 2005c) and from the Summary and Analysis of Historical Soil Gas Data and Soil Vapor Extraction (SVE) System Operations Data from the Unidynamics Facility (CH2M HILL, 2002). Comparing data for the SVE system monitoring wells following restart of the system in April 2004, reveals that overall soil gas concentrations have decreased since the system was installed. TCE concentrations in SVE system influent ranged from 131 to 3,600 µg/L between 1993 and 1998, while results from the third quarter 2005 sampling event range from 77 to 110 µg/L (ARCADIS 2005c). Concentrations of TCE in soil gas monitoring wells ranged from non-detect to 8,450 µg/L in April 2004, prior to system startup.

Because of the presence of TCE in soil gas, EPA required that summer and winter indoor air quality sampling events be conducted at three commercial office buildings located at the southwest corner of Litchfield Road and Van Buren Street (adjacent to and northeast of the Unidynamics site). The summer sampling event was conducted in September 2003 and the winter sampling event was conducted in February 2005. The results from both sampling events are presented in the *Air Sampling Report, Phoenix-Goodyear Airport North Superfund Site* (ARCADIS, 2005e). The results indicate that occupants in the three buildings are not exposed to indoor air concentrations above acceptable levels.

The ROD established groundwater cleanup levels, but the additional vadose zone and indoor air sampling events described above were conducted to evaluate if other human exposure pathways were present.

## 6.5 Site Inspection

Site inspections are routinely carried out as part of the remedial action oversight being conducted at the Site. EPA representatives are generally onsite in an oversight capacity on a monthly basis, or more frequently, depending on the nature of activities being performed by Crane. No additional Site inspection was performed for this review.

## 6.6 Interviews

Interviews with site personnel are routinely carried out as part of the remedial action oversight conducted at the site and as part of ongoing community relations meetings. EPA representatives are generally onsite or speaking with Crane and community representatives

on a monthly basis, or more frequently, depending on the nature of activities being performed by Crane. No additional interviews were performed for this review.

# Technical Assessment

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## 7.1 Functioning of the Remedy as Intended by Decision Documents

The remedy is currently not functioning as intended by the decision documents. The Site ROD requires capture and aquifer restoration as well as lowering of soil gas levels to protect the groundwater. The current groundwater remediation extraction well and monitor well networks do not provide complete plume capture or delineation. For example, TCE was detected above the MCL in COG-10 during April 2005, and the TCE concentration in monitor wells to the northeast and southeast of the plume are increasing.

Additional activities to fully implement the remedy as intended, as well as address contamination not anticipated in the ROD, are set forth in the Site SOW being implemented pursuant to the CD. The activities being conducted include additional plume delineation, wellhead treatment and alternative water supply evaluation, and investigation of source area drywells, soil gas, air quality, possible additional source areas, structures and soils. The SOW and CD also require the implementation of Institutional Controls (ICs) where necessary. ICs specifically identified in the CD for possible implementation include restrictions on access to the site; the type of use or redevelopment of the property; use of the water at the site; grading, excavations or other removal of soils; and an easement for access to conduct activities related to remedial actions.

## 7.2 Current Validity of Assumptions Used During Remedy Selection

### 7.2.1 Changes in Land Use

Although land use in much of the area has changed from agricultural to residential and commercial, the exposure pathways have remained the same. The soil has been partially remediated and is located in industrial areas, and the groundwater is not accessible to residents as long as the production wells are protected through monitoring and groundwater treatment. Changes in land use do not affect the appropriateness of the remedy.

There have been no changes in the physical conditions of the site that would affect the protectiveness of the remedy.

### 7.2.2 Changes in Standards and To Be Considered

Past and current chemical-specific Applicable or Relevant and Appropriate Requirements (ARAR) are summarized in Table 7-1. The changes in chemical-specific ARARs resulted from changes in MCLs over the remedial action period, as documented in ESD #1, ESD #2

and ESD #4. None of the ARARs requiring that cleanup achieve MCLs for COCs at PGAN have gone down since selection of the Site remedy.

### 7.2.3 Changes in Toxicity Values.

A risk assessment has not been conducted for PGAN, so toxicity values in 1989 were not available for review. Table 7-1 lists current contaminant toxicity values that could be used as part of a risk assessment to further evaluate the protectiveness of the remedy. In 2001, the EPA released a draft toxicity evaluation for TCE following the current cancer guidelines and incorporating current data and physiological/biochemical understanding. This review concluded TCE was “highly likely to produce cancer in humans.” With this determination, a range of cancer slope factors were developed, some of which would result in more stringent cleanup levels than the current MCL. This toxicity evaluation is under review by several external scientific panels. This issue will need to be updated in subsequent five year reviews

### 7.2.4 New Contaminant or Contaminant Sources

Since issuance of the ROD, perchlorate has been detected in Site area groundwater. Because detection limits for perchlorate were very high at the time of the ROD, perchlorate was not identified as a Site COC. However, Site investigations are ongoing to characterize the extent of perchlorate contamination at the Site and appropriate treatments. Additional compounds that were used at the Site include 1,4-dioxane, radionuclides and explosives (CH2M HILL, 2004). The SOW calls for evaluation of these additional potential COCs during ongoing characterization of soil and groundwater.

## 7.3 Recent Information Affecting the Remedy

A screening level risk assessment has not been completed

TABLE 7-1  
 Changes in Chemical-Specific ARARs  
 Five-year Review Report for Phoenix-Goodyear Airport (North) Superfund Site, Goodyear, Arizona

Compound	Original Cleanup Level (µg/L)	Revised Cleanup Level (µg/L)	2005 MCL (µg/L)	Source of Cleanup Level	Ingestion Exposure		Inhalation Exposure		Preliminary Remediation Goals (PRGs)			
					RfDo mg/kg/day	SFo (mg/kg/day) <sup>-1</sup>	RfDi mg/kg/day	SFi (mg/kg/day) <sup>-1</sup>	Residential Soil (mg/kg)	Industrial Soil (mg/kg)	Ambient Air (µg/m <sup>3</sup> )	Tap Water (µg/L)
1,1-Dichloroethylene	7	7	7	1989 ROD	0.050	----	0.057	----	120	410	210	340
1,2-Dichloropropane	1	1	5	1989 ROD	0.0011	0.068	0.0011	0.068	0.34	0.74	0.099	0.16
Chloroform	100	100	100	1989 ROD	0.01	----	0.081	0.014	0.22	0.47	0.83	0.17
Toluene	340	1,000	1,000	1998 ESD #4	0.20	----	0.11	----	520	520	400	720
Trichlorethylene	5	5	5	1989 ROD	0.00030	0.4	0.01	0.4	----	----	----	----
Trichlorofluoromethane	1	1	----	1989 ROD	0.3	----	0.2	----	390	200	730	1300
Carbon Tetrachloride	5	5	5	1989 ROD	0.00070	0.13	0.00070	0.053	0.25	0.55	0.13	0.17
Methylene Chloride	1	1	5	1989 ROD	0.06	0.0075	0.86	0.0016	9.1	21	4.1	4.3
Methyl Ethyl Ketone	170	350	----	1991 ESD #1	0.6	----	1.4	----	5,300	47,000	3100	2,000
Xylenes	440	440	10,000	1989 ROD	0.2	----	0.029	----	270	420	110	210
Antimony	1.46	1.46	6	1989 ROD	0.0004	----	----	----	31	410	----	15
Arsenic	50	50	10 (Proposed)	1989 ROD	0.00030	1.5	----	15	0.39	1.6	0.00045	0.045
Barium	1,000	2,000	2,000	1998 ESD #4	0.070	----	0.00014	----	5,400	6,700	0.52	2,600
Beryllium	0.0039	0.004	4	1998 ESD #4	0.0020	----	0.0000057	8.4	150	1,900	0.00080	73
Cadmium	10	5	5	1998 ESD #4	0.00050	----	----	6.3	37	450	0.0011	18
Chromium	50	100	100	1998 ESD #4	----	----	----	4.2	210	450	0.00016	----
Lead	50	15	15 (Action Level)	1998 ESD #4	Varies	Varies	Varies	Varies	400	800	----	----
Mercury	2	2	2	1989 ROD	0.00030	----	----	----	23	310	----	11
Nickel	15.4	100	100	1998 ESD #4	0.020	----	----	----	1,600	2000	----	730
Selenium	10	50	50	1998 ESD #4	0.0050	----	----	----	390	5,100	----	180
Silver	50	50	----	1989 ROD	0.0050	----	----	----	390	5,100	----	180
Zinc	5,000	5,000	----	1989 ROD	0.30	----	----	----	23,000	100,000	----	11,000
Acetone	----	700	----	1991 ESD #1	0.90	----	0.90	----	14,000	54,000	3,300	5,500
Benzene	----	5	5	1993 ESD #3	0.0040	0.055	0.0086	0.027	0.64	1.4	0.25	0.35
Ethylbenzene	----	700	700	1993 ESD #3	0.10	----	0.29	----	400	400	1100	1,300
Tetrachloroethylene	----	5	5	1993 ESD #3	0.010	0.54	0.010	0.021	0.48	1.3	0.32	0.10
1,1,2,2,-Tetrachloroethane	----	0.18	----	1993 ESD #3	0.060	0.20	0.060	0.20	0.41	0.93	0.033	0.055

Notes:

- µg/L = micrograms per liter,
- mg/kg = milligrams per kilogram
- µg/m<sup>3</sup> = micrograms per cubic meter
- mg/kg/day = milligrams per kilogram per day
- MCL = Federal Maximum Contaminant Level
- RfDo = Reference dose, oral
- SFo = cancer slope factor, oral
- RfDi = Reference dose, inhalation
- SFi = cancer slope factor, inhalation

Toxicity data obtained from the EPA Region 9 Preliminary Remediation Goals (PRG) Table, as updated October 2004.

---- = Not Established

## SECTION 8.0

# Issues

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TABLE 8-1

Issues Affecting the Protectiveness of the Remedy

*Five-year Review Report for Phoenix-Goodyear Airport (North) Superfund Site, Goodyear, Arizona*

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<b>Issue</b>	<b>Currently Affects Protectiveness (Y/N)</b>	<b>Affects Future Protectiveness (Y/N)</b>
Capture of contaminants and progress toward restoration of groundwater has not been demonstrated.	Y	Y
An ecological risk assessment has not been performed.	Y	Y
Nearby production wells may require wellhead treatment or alternative water supply.	Y	Y
There has not been a recent human health risk assessment that encompasses all issues at the Site, including the identification of additional COCs.	Y	Y

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SECTION 9.0

# Recommendations and Follow-up Actions

Table 9-1 lists recommendations for the issues identified above. Additional information can be found in the SOW attached to the CD.

TABLE 9-1  
 Recommendations and Follow-Up Actions  
*Five-year Review Report for Phoenix-Goodyear Airport (North) Superfund Site, Goodyear, Arizona*

Issue	Recommendations/ Follow-up Actions	Party Responsible	Agency Oversight	Milestone Date
Capture of contaminants and progress toward restoration of groundwater has not been demonstrated.	Evaluate capture through installation of additional wells, update of groundwater flow model, and installation of additional extraction wells if needed.	Crane	EPA	TBD
An ecological risk assessment has not been performed.	Conduct a screening level ecological risk assessment.	Crane	EPA	TBD
Nearby production wells may require wellhead treatment or alternative water supply.	Continuously evaluate production well water quality and need for wellhead treatment or alternative water supply, as called for in the SOW.	Crane	EPA	TBD
There has not been a recent human health risk assessment that encompasses all issues at the Site, including the identification of additional COCs.	Complete a risk assessment, as called for in the SOW.	Crane	EPA	TBD

Note:

TBD = to be determined. However the Partial Consent Decree and associated Scope of Work (EPA, 2006) include scope and schedule requirements for these items.

SECTION 10.0

# Protectiveness Statement

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A protectiveness determination of the remedy at PGAN cannot be made at this time until further information is obtained. While remedial action is ongoing at the Site, EPA is implementing a supplemental RI to better characterize Site contamination and its extent and expects that there will be a supplemental FS to examine appropriate alternatives to treat contamination not being adequately addressed currently. It is expected that these actions will be completed by about 2011, at which time a protectiveness determination will be made.

**SECTION 11.0**

# Next Review

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Because PGAN and PGAS are implementing the same ROD, EPA wants to ensure that five-year reviews of the remedy implementation are on concurrent schedules. PGAS completed its first five-year review in September 2005. Therefore, the next comprehensive five-year review for both sites will be conducted by September 2010.

## SECTION 12.0

# References

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