THIRD FIVE-YEAR REVIEW REPORT FOR

PHOENIX-GOODYEAR AIRPORT (NORTH AND SOUTH AREAS) SUPERFUND SITE

GOODYEAR, ARIZONA

Prepared by

United States Corps of Engineers, Seattle District

for

U.S. Environmental Protection Agency

Region IX

San Francisco, California

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Date

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Executive Summary

This is the third Five-Year Review of the Phoenix-Goodyear Airport (PGA) (North and South Areas) Superfund Site (Site) located in Goodyear, Arizona, approximately 17 miles west of downtown Phoenix, Arizona. The purpose of this Five-Year Review is to review information to determine if the remedy is and will continue to be protective of human health and the environment. The triggering action for this Five-Year Review (FYR) was the signing of the previous FYR on September 29, 2010.

Land uses in the vicinity of the PGA site are a mix of residential, agricultural, commercial, and industrial. At PGAN, commercial and industrial properties lie to the north and south of the former Unidynamics Phoenix, Inc. (UPI) facility, agricultural land and a growing population of commercial and light industrial facilities are to the west, and residential and commercial property are across Litchfield Road to the east. At PGAS, commercial, industrial and some residential properties lie to the east of the airport and agricultural land is to the south and west. The nearest residences are approximately one-half mile west and northwest of the Site and less than one-quarter mile northeast and east of the Site.

The PGA Superfund Site has been subdivided into two areas: PGAN defined by an area of volatile organic compound (VOC) contaminated groundwater that encompasses approximately three square miles, and PGAS defined by an area of VOC contaminated groundwater that encompasses less than one square mile. Secondary contaminants have been identified – perchlorate at PGAN and chromium at PGAS – and are being addressed as well as VOCs.

In the 1987 Record of Decision (ROD), the U.S. Environmental Protection Agency (EPA) selected extraction and treatment by air stripping with a vapor-phase GAC system for Subunit A groundwater at PGAS followed by re-injection through a network of Subunit A injection wells.

In the 1989 ROD, the EPA selected extraction and treatment by air stripping with a vapor-phase GAC system for Subunit B/C groundwater followed by re-injection for both PGAN and PGAS to protect long-term human health and the environment. The objective of groundwater treatment was to reduce VOCs to levels equal or less than the Applicable or Relevant and Appropriate Requirements in order to protect the current and future uses of area Subunit B/C groundwater. The treated water was to be either re-injected into the shallowest groundwater, Subunit A, or beneficially reused such as for irrigation. Soil vapor extraction with vapor phase carbon was the selected remedy for treatment of soil at PGAN and PGAS The objective of soil treatment was to prevent migration of trichloroethylene (TCE) into Subunit A groundwater.

After the 1987 and 1989 RODs, five Explanation of Significant Differences (ESD) were issued that applied to both the PGAN and PGAS areas. In 2014, a ROD Amendment was signed for the PGAN only to provide for enhanced treatment at the PGAN source area for TCE along with perchlorate, a PGAN contaminant that was being addressed through a Removal Action Memo (RAM) but was not addressed in the 1989 ROD.

The remedy at PGA is functioning as intended; and the recent installation of extraction wells and monitoring wells at PGAN have improved capture and plume definition. The 2014 ROD amendment provides for enhanced treatment at the PGAN source area for TCE along with perchlorate, a PGAN contaminant that was not addressed in the 1989 ROD. The remedy at PGAS is functioning as intended by

the ROD. TCE plume concentrations in Subunit A at PGAS appear to have maintained a consistent downward trend since the previous Five Year Review in 2010.

Results from the monitoring program for the active production wells near the boundary of the plume has shown that the remedy is protective.

The MCL for arsenic has been lowered and therefore, the Site cleanup level is now higher than the federal MCL. There is a lack of recent data on trace metals other than chromium in groundwater. Metals such as cadmium, lead, arsenic, and nickel were identified in the 1989 ROD as contaminants exceeding ARARs. Toxicity factors for several COCs have changed since the ROD was issued; however, actual concentrations detected for these chemicals, chloroform and ethlybenzene, are within the protective risk range.

At PGAN, a restrictive covenant required on portions of the UPI property have not been implemented. The previous FYR also identified that a deed restriction was required for the chromium drying beds at PGAS. EPA is currently evaluating whether contamination contained within the cover of the sludge drying beds require property restrictions. The land use has not changed since the last five year review.

The remedy at PGAN is currently protective of human health and the environment because there is no complete exposure pathway to Site contamination. Soil contamination has been addressed and the vapor intrusion pathway is not complete. Monitoring of City of Goodyear (COG) production wells and Site sentinel wells continues to ensure that the public is not being exposed to groundwater contamination that exceeds the ARARs. In order for the remedy to be protective in the long-term, the following actions need to be taken: modify the sampling plans to include all COCs, assess the need for new cleanup level for arsenic, and determine the necessity of institutional controls.

The remedy at PGAS is currently protective of human health and the environment because there is no complete exposure pathway to contaminated groundwater or soil. Soil contamination has been addressed and the vapor intrusion pathway is not complete. Monitoring of COG production wells continues to ensure that the public is not being exposed to contaminated groundwater that exceeds the MCLs. However, in order for the remedy to be protective in the long-term, the following action needs to be taken: modify the sampling plans to include all COCs, assess the need for new cleanup level for arsenic, and determine the necessity of institutional controls.

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site Name: Phoenix-Goodyear Airport (North) and Phoenix-Goodyear Airport (South) Superfund Sites		
EPA ID: AZD980695902		
Region: 9	**State:** AZ	**City/County:** Goodyear / Maricopa

SITE STATUS	
NPL Status: Final	
Multiple OUs? Yes	**Has the site achieved construction completion?** No

REVIEW STATUS
Lead agency: EPA **If "Other Federal Agency" was selected above, enter Agency name:** Click here to enter text.
Author name (Federal or State Project Manager): Catherine Brown
Author affiliation: EPA Region 9
Review period: November 12, 2014 – September 29, 2015
Date of site inspection: February 25, 2015
Type of review: Statutory
Review number: 3
Triggering action date: September 29, 2010
Due date *(five years after triggering action date)*: September 29, 2015

Issues/Recommendations For PGA North and South

Issues and Recommendations Identified in the Five-Year Review:				
OU(s): PGAN and PGAS	**Issue Category: Remedy Performance**			
	Issue: There is a lack of recent data on trace metals other than chromium in groundwater.			
	Recommendation: Modify the existing sampling plans to test for all COCs at Site and COG wells or verify historic sampling and resolution to discontinue sampling for COCs other than primary and secondary ones.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA	01/2017
OU(s): PGAN and PGAS	**Issue Category: Remedy Performance**			
	Issue: The MCL for arsenic has changed since the ROD at PGAN and PGAS may not be protective of human health if there is any completed exposure pathway to groundwater.			
	Recommendation: Assess the need for new cleanup level for arsenic and document in a decision document			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA	01/2017
OU(s): PGAN	**Issue Category: Institutional Controls**			
	Issue: At PGAN, Institutional controls (ICs) were required in the 2006 Partial Consent Decree; restrictive covenants required on portions of the UPI property have not been implemented.			
	Recommendation: Determine the necessity of institutional controls (IC) per the 2006 Partial Consent Decree.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA	01/2017
OU(s): PGAS	**Issue Category: Institutional Controls**			
	Issue: At PGAS, ICs were recommended in the previous Five-Year Review for the residual chromium contamination; however, no chromium related ICs have been implemented at PGAS to date.			
	Recommendation: Determine the necessity of ICs.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA	01/2017

OU(s): PGA Sitewide	Issue Category: Monitoring			
	Issue: The MCLs for Arsenic have changed.			
	Recommendation: Evaluate any effect of the MCL change on the remedy			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA	01/2017

PGAN Protectiveness Statement(s)

Operable Unit: **North**	***Protectiveness Determination:*** **Short-term Protective**	***Addendum Due Date (if applicable):*** **Click here to enter date.**

Protectiveness Statement:
The remedy at PGAN is currently protective of human health and the environment because there is no complete exposure pathway to Site contamination. Soil contamination has been addressed and the vapor intrusion pathway is not complete. Monitoring of City of Goodyear (COG) production wells and Site sentinel wells continues to ensure that the public is not being exposed to groundwater contamination that exceeds the ARARs. In order for the remedy to be protective in the long-term, the following actions need to be taken: modify the sampling plans to include all COCs, assess the need for a new cleanup level for arsenic, and determine necessity of institutional controls.

PGAS Protectiveness Statement(s)

Operable Unit: **South**	***Protectiveness Determination:*** **Short-term Protective**	***Addendum Due Date (if applicable):*** **Click here to enter date.**

Protectiveness Statement:
The remedy at PGAS is currently protective of human health and the environment because there is no complete exposure pathway to contaminated groundwater or soil. Soil contamination has been addressed and the vapor intrusion pathway is not complete. Monitoring of COG production wells continues to ensure that the public is not being exposed to contaminated groundwater that exceeds the MCLs. However, in order for the remedy to be protective in the long-term, the following action needs to be taken: modify the sampling plans to include all COCs, assess the need for a new cleanup level for arsenic, and determine the necessity of institutional controls.

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List of Abbreviations

µg/L	micrograms per liter
ABS	Area Between the Sites
ACL	alternate concentration limit
ADHS	Arizona Department of Health Services
ADEQ	Arizona Department of Environmental Quality
ARAR	Applicable or Relevant and Appropriate Requirements
bgs	below ground surface
BHHRA	Baseline Human Health Risk Assessment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CD	Consent Decree
CFR	Code of Federal Regulations
CGMP	Comprehensive Groundwater Monitoring Plan
COC	contaminants of concern
COG	City of Goodyear
COPEC	contaminant of potential ecological concern
EPA	U.S. Environmental Protection Agency
ESD	Explanation of Significant Differences
FYR	Five-Year Review
GAC	granular activated carbon
gpm	gallons per minute
GTRC	Goodyear Tire and Rubber Company
GTS	groundwater treatment system
HHRA	Human Health Risk Assessment
IRIS	Integrated Risk Information System
LAU	lower alluvial unit
lbs/day	pounds per day
LGAC	liquid-phase granular activated carbon
MAU	middle alluvial unit
MCL	maximum contaminant level
MEK	methyl ethyl ketone
mg/kg	milligrams per kilogram
MTS	Main Treatment System
NPL	National Priorities List
O&M	operation and maintenance
OU	operable unit
PCE	tetrachloroethylene
PGA	Phoenix-Goodyear Airport (North and South areas)
PGAN	Phoenix-Goodyear Airport North
PGAS	Phoenix-Goodyear Airport South
RSL	regional screening level

RI/FS	Remedial Investigation / Feasibility Study
RID	Roosevelt Irrigation District
ROD	Record of Decision
SASFS	Source Areas, Soil, and Facility Structures
SOW	Scope of Work
SVE	soil vapor extraction
TBC	To Be Considered
TCE	trichloroethylene
TCLP	toxicity characteristic leaching procedure
UAU	upper alluvial unit
UPI	Unidynamics Phoenix, Inc.
UST	underground storage tank
VLEACH	vadose zone leaching
VOC	volatile organic compounds
WQARF	Water Quality Assurance Revolving Fund
WSRV	West Salt River Valley

Third Five-Year Review Report

for

Phoenix-Goodyear Airport (North and South Areas) Superfund Site

1. Introduction

The purpose of a Five-Year Review (FYR) is to evaluate the implementation and performance of a remedy in order to determine if the remedy will continue to be protective of human health and the environment. The methods, findings, and conclusions of FYRs are documented in these reports. In addition, FYR reports identify issues found during the review, if any, and document recommendations to address them.

The U.S. Environmental Protection Agency (EPA) prepares FYRs pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121 and the National Contingency Plan. 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.*"

EPA interpreted this requirement further in the National Contingency Plan; 40 Code of Federal Regulations (CFR) Section 300.430(f)(4)(ii), which 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 actions no less often than every five years after the initiation of the selected remedial action.*"

Because hazardous substances, pollutants or contaminants remain at the Site at levels above those that would allow for unlimited use and unrestricted exposure, EPA Region 9 conducted the FYR and prepared this report regarding the remedy implemented at the PGAN & PGAS Site in Goodyear, Maricopa County, Arizona. EPA is the lead agency for developing and implementing the remedy for the Site. Arizona Department of Environmental Quality (ADEQ), as the support agency representing the State of Arizona, has reviewed all supporting documentation and provided input to EPA during the FYR process.

This is the third FYR for the PGAS and the second for PGAN. The triggering action for this statutory review is the previous FYR which was issued in September 2010. The PGA Superfund Site was originally listed on the National Priorities List (NPL) in September 1983 as the Phoenix-Litchfield Airport Area Superfund Site. In the mid-1980s, the name was changed to Phoenix-Goodyear Airport Superfund Site. Later, the Site was divided into two areas: PGAN and PGAS. The first Five-Year Reviews for the Site addressed PGAS only. However, in the second FYR and this FYR, the areas are assessed in the same document.

This report evaluates the PGA remedy in light of the remedial action objectives stated in: the 1987 and 1989 Records of Decision (RODs); the five Explanation of Significant Differences (ESDs); the 1991 Chromium Removal Action Memorandum; the 2008 Perchlorate Removal Action Memorandum; and the 2014 ROD Amendment.

2. Site Chronology

The following tables list the dates of important events for PGAN and PGAS.

Table 2-1. Chronology of Site Events for PGAN

Event	Date
Research, development and manufacturing plant for defense and aerospace equipment established at the PGAN property (Unidynamics Phoenix, Inc. [UPI]).	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 Superfund Site (originally listed as the "Litchfield Airport Area Superfund Site") to the National Priorities List.	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 Administrative Order (Docket No. 84-03).	April 1984
Phase I Remedial Investigations began on the entire PGA area.	October 1984
Crane Co. purchases UPI.	1985
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 ROD that applied to both the PGAN and PGAS Sites. [the 1987 ROD was for PGAS only]	September 1989
Groundwater extraction and treatment system for Subunit A groundwater was 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 remedy specified in the 1989 ROD.	October 1990
EPA issued an ESD to the 1989 ROD (the first ESD)	January 1991
EPA issued a second ESD	May 1993
UPI facility manufacturing operations ceased.	1994
Full-scale soil vapor extraction (SVE) operations with thermal oxidation began at PGAN.	June 1994
Phase I groundwater treatment system for volatile organic compounds (VOCs), 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 was first detected in area monitoring wells.	August 1998
Crane Co. shut down SVE system due to operational difficulties.	October 1998

Event	Date
Trichloroethylene (TCE) and perchlorate were detected in several domestic supply wells southeast of the UPI facility.	2001
TCE was detected above the maximum contaminant level (MCL) for the first time in Subunit C monitoring well MW-20 (located north of the main manufacturing area).	May 2001
Reinjection stopped at the Main Treatment System (MTS) due to lack of perchlorate treatment. Treated groundwater was sent to the City of Goodyear (COG) Waste Water Treatment Plant for perchlorate treatability study.	2002
Effluent from the MTS continued to be sent to the COG Wastewater Treatment Plant for perchlorate treatment.	January 2002 through April 25, 2005
Well MW-20 was converted to a temporary extraction well connected to the Phase II / III groundwater treatment system for Subunit C groundwater treatment.	March 2002
EPA issued the fifth ESD [the third and fourth ESDs were for PGAS]	September 2002
EPA issued a Unilateral Administrative Order (Docket No. 9-2003-0001) to restart the SVE system with a granular activated carbon (GAC) treatment unit.	January 2003
TCE concentrations in COG production well COG-02 (located about ¼ mile east of the UPI facility) increased above MCL and forced closure of that well.	May 2003
EPA conducted the Phase II Source Area Groundwater Investigation that identified TCE and perchlorate levels in Subunits B and C in the source area.	2003
The SVE system was restarted using GAC treatment.	April 2004
A Scope of Work (SOW) was developed to comprehensively address the soil, and groundwater impacts attributed to PGAN.	2005
Perchlorate treatment using ion exchange unit was added to the MTS. Treated effluent re-injected into Subunit A groundwater.	April 2005
Implementation of the Year 1 Groundwater Investigation Work Plan to fully characterize PGAN groundwater contamination was initiated.	March 2006
A partial consent decree (CD) between the United States and Crane/UPI was entered by United States District Court of the District of Arizona. CD required Crane/UPI to comprehensively characterize and address the impacts of soil and groundwater contamination attributed to PGAN.	June 2006
The first Five-Year Review Report was completed.	September 2006
Municipal drinking water supply well COG-02 was abandoned due to TCE levels from PGAN.	December 2006
Treatment capacity of PGAN MTS was expanded along with the installation of extraction well EC-01 and injection well IA-06.	2007
The PGAN Phase I Source Areas, Soils and Facility Structures Investigation was completed.	2007

Event	Date
Municipal drinking water supply well COG-10 was abandoned due to TCE contamination.	May 2007
Completion of Year 1 Groundwater Investigation Activities: Two middle alluvial unit (MAU) monitoring wells, five Subunit C wells, and eight Subunit A wells were installed to define the contaminant plumes.	October 2007
To address the Subunit A TCE impacts in groundwater located north-northeast of PGAN, two new groundwater treatment systems were installed (EA-06 groundwater treatment system [GTS] and EA-05 GTS).	2008
Monitoring well PZ-01 was converted to an extraction well and the treatment capacity of the PGAN MTS was increased.	October 2008
A Removal Action Memorandum was issued for perchlorate at PGAN.	October 2008
Completion of Year 2 Groundwater Investigation PGAN: ten Subunit A monitoring wells, and four Subunit C monitoring wells were installed.	April 2009
The Final Year 3 Groundwater Investigation Work Plan was approved at PGAN.	April 2009
Remaining UPI facility buildings and bunkers were demolished.	2009
The second Five-Year Review Report was completed PGAN & PGAS.	September 2010
Groundwater extraction well EA-07 was installed along with five injection wells IA-11, IA-12, IA-13, IA-14, IA-15 to aid plume containment along the northeast extent at PGAN.	2010
Maintenance to piping that conveys groundwater to the PGAN MTS was completed to increased pumping capacity.	May and June 2011
Crane Co. completed the Final Source Areas, Soil, and Facility Structure Investigation Report.	July 2011
Groundwater extraction well EA-08 was installed at PGAN.	2011
Crane Co. completed Final Source Areas, Soil, and Facility Structures Baseline Human Health Risk Assessment.	2012
Crane Co. completed Final Source Areas, Soil, and Facility Structures Screening Level Ecological Risk Assessment.	2013
Groundwater extraction well EA-09 was installed at PGAN.	2013
Crane Co. completed Source Area Remediation Focused Feasibility Study.	November 2013
The extraction-and-treatment system was expanded to re-inject treated groundwater at the northwest extent in wells IA-07 and IA-08.	2014
An amendment to the 1989 ROD was issued for PGAN.	September 2014

Table 2-2. Chronology of Site Events for PGAS

Event	Date
Goodyear Aerospace Corporation (later Goodyear Aircraft Corporation and the Goodyear Tire and Rubber Company [GTRC]), Arizona Division, began operations.	1942
The United States Navy established the Litchfield Naval Air Facility in Goodyear, Arizona as an Auxiliary Acceptance Unit.	1943
Oily and chrome-colored contamination was detected in a drainage ditch on the airport.	1951
The wastewater treatment plant was upgraded to reduce the emissions observed in 1951.	1952
Ownership of the airport property was transferred to the City of Phoenix.	1968
Arizona Department of Health Services (ADHS) discovered that groundwater in the Goodyear area was contaminated with solvents and chromium.	1981
EPA added the PGA Superfund Site (originally listed as the "Litchfield Airport Area Superfund Site") to the NPL.	September 1983
Phase I Remedial Investigations began on the entire PGA area.	October 1984
EPA issued 1987 ROD addressing PGAS Subunit A groundwater contamination (Section 16 Operable Unit [OU]).	September 1987
EPA enters CD with GTRC to implement 1987 ROD remedy and begin treating contaminated groundwater in Subunit A.	1988
A Leaking Underground Storage Tank was found to have leaked aviation gasoline at PGAS.	1988
EPA published a RI/FS that identified two areas of noncontiguous contamination (PGAN and PGAS).	June 1989
EPA issued the1989 ROD for Subunit B/C groundwater and soil (except for the sludge drying beds).	September 1989
GTRC implements groundwater extraction and treatment for Subunit A Groundwater.	1990
EPA issued the first ESD #1 to revise cleanup levels for acetone and methyl ethyl ketone (MEK).	January 1991
EPA entered a CD with GTRC and Loral Defense Systems to implement remedy selected in 1989 ROD pertaining to PGAS.	1991
EPA issued a Chromium Removal Action Memorandum for excavation, stabilization and monitoring of soil at former chromium sludge drying bed #2.	October 1991
EPA issued a Consent Order with GTRC implement the Chromium RAM and excavate and stabilize soil at former sludge drying beds.	January 1992
GTRC conducted a conduit well investigation at PGAS.	1992
Completion of removal of sludge drying beds and stabilization of contaminated soil. Soil at sludge drying beds was excavated and	June 1992 through January 1994

Event	Date
stabilized; stabilized soil was re-deposited in the excavation and covered with clean soil and gravel.	
EPA issued ESD #2.	May 1993
GTRC implemented SVE at Polygon 79.	September 1993 through January 1994
Northern Subunit B/C groundwater extraction and treatment system began operation.	February 1994
Southern Subunit B/C groundwater extraction and treatment system began operation.	September 1994
GTRC implemented SVE at Polygon 84.	September 1994 through January 1995
An air sparging pilot test was conducted for Subunit A groundwater.	1995
Installation of chromium treatment system at Well E-17.	1995
EPA issued ESD #3.	December 1995
SVE was implemented in Polygons 96, 27a, and 92.	March 1996 through April 1998
Air sparging was implemented in Polygons 96, 27a, 92, 81, and 100.	December 1996 through April 1998
EPA issued ESD #4.	March 1998
The chromium treatment system at E-17 was shut down due to operational problems.	2001
Air sparging in the airport infield was implemented for Subunit A groundwater.	November 2001 through January 2003
New North Subunit C extraction well E-102 was installed north of Yuma Road and connected to the treatment system.	2004
The First Five-Year Review Report for PGAS only was completed.	September 2005
Extraction well E-18 installed.	2006
GTRC completed Phoenix-Goodyear Airport South Site Screening Level Ecological Risk Assessment.	2008
Data associated with TCE rebound at well GAC-04 were determined to indicate an isolated source within the wellbore resulting from operational activities near the wellhead.	October 2008
Three additional monitoring wells (GMW-18UC, GMW-19LC, and GMW-20LC) were installed to better delineate the boundary of the 5 micrograms per liter (µg/L) TCE plume in Subunit C.	December 2008 through March 2009
GTRC recommended pulsed pumping to overcome hydraulic stagnation and to address the residual contaminant mass in Southern Subunit C groundwater.	May 2009
A work plan was submitted to install two additional wells (GMW-21UC and GMW-22UC) to monitor TCE concentration in production well GAC-04.	August 2009

Event	Date
Monitoring wells GMW-21UC and GMW-22UC were installed.	June 2010
The Second Five-Year Review Report was completed.	September 2010
Monitoring well GMW-23UC was installed.	January 2012
Abandonment of GAC-04	2012
Monitoring wells GMW-25LC and GMW-26LC were installed	March 2013
Five borings to collect Subunit C groundwater data were drilled	July 2013
GTRC completed Groundwater Model Update Report.	January 2014
A pipeline from Subunit C treatment system to the City of Goodyear's pipeline at the Bullard irrigation ditch was installed.	March 2014
A pipeline to connect E-103 was installed. E-103 was constructed to replace E-102.	August 2014
Completed a survey of burrowing owls to prepare for the Subunit A conveyance pipeline installation.	September 2014
Completed an NHPA-required Archeological Survey during installation of the conveyance pipeline.	September 2014
Monitoring wells GMW-27A and GMW-28A were installed.	September 2014
EPA completed the Evaluation of Groundwater Chromium issues at the Phoenix-Goodyear Airport South Superfund Site, Goodyear, Arizona.	November 2014
Extraction wells E-18,E-19, E-20 and a pipeline to convey groundwater to the Subunit A treatment system was installed. Subunit A TS controls were upgraded.	September – December 2014

3. Background

3.1. Physical Characteristics

The PGA Superfund Site has been subdivided into two areas: (1) PGAN is 55 acres of land, formerly UniDynamics Phoenix, Inc. and is currently owned by Crane Co and (2) PGAS is approximately 850 acres of land and is the location of the former Goodyear Aerospace Corporation facility owned by Goodyear Tire and Rubber (currently owned by JRC Goodyear Corporation) and the Litchfield Park Naval Air Facility, currently the Phoenix Goodyear Airport (Figure 3-1). The Site is located 17 miles west of downtown Phoenix, Arizona.

Major surface drainages in the area are the Gila River, located 2 to 3 miles south of the Site, and the Agua Fria River, located 1 to 2 miles east of the Site. The Agua Fria River is dry most of the year, and flows south into the Gila River, where flow is largely dominated by effluent from the 91st Avenue Wastewater Treatment Plant.

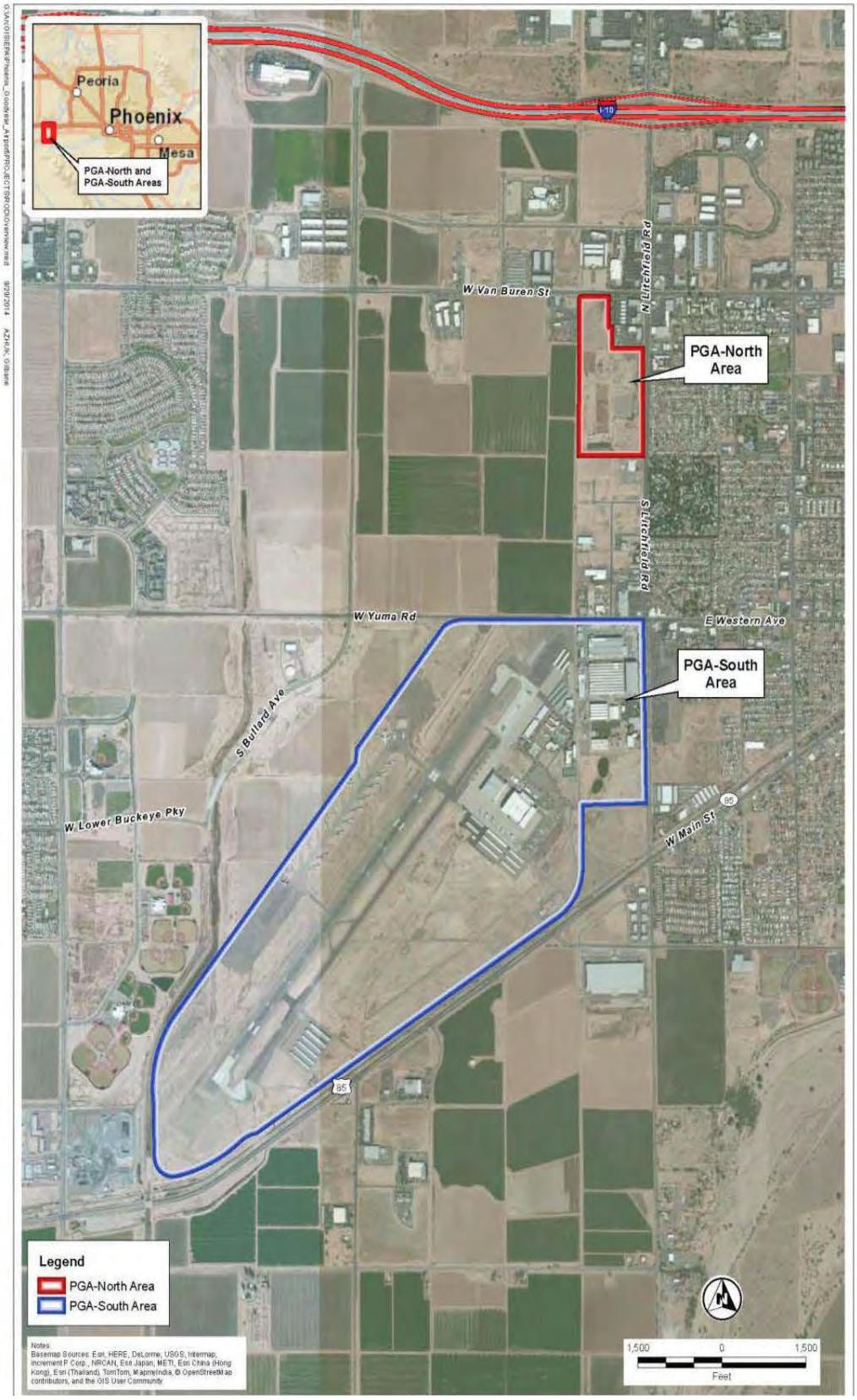


Figure 3-1. Location Map for the Phoenix-Goodyear Airport North and South

3.2. Hydrology

Important characteristics of the regional hydrogeology, local hydrogeologic conditions, and groundwater movement are summarized in the following subsections.

3.2.1. Regional Hydrogeology

The PGA Superfund Site lies within the Basin and Range physiographic providence, which consists of alluvial basins or plains separated by north- to northwest-trending mountain ranges. The Site is located within the West Salt River Valley (WSRV) sub-basin of the Salt River Valley, located in central Arizona. The regional geology of the WSRV consists of a deep alluvial basin bounded by bedrock mountain ranges consisting primarily of granitic, metamorphic, and volcanic rocks of Precambrian to Tertiary age. Mountain ranges surrounding the WSRV sub-basin include the Hieroglyphic Mountains, the Phoenix Mountains, South Mountain, the Sierra Estrella Mountains, the Buckeye Hills, and the White Tank Mountains. These surrounding mountain ranges form nearly impermeable barriers to groundwater flow. The WSRV alluvial sub-basin consists of thick basin-fill deposits (alluvial fan, playa, and fluvial deposits) of unconsolidated to semi-consolidated clastic sediments of Late Tertiary to Quaternary age.

The basin-fill deposits range in thickness from a few feet near the basin margins to over 10,000 feet in the central area of the sub-basin. The thickest basin-fill deposits in the WSRV occur near Luke Air Force Base, where the structure and lithology of basin-fill deposits have been influenced by a massive evaporite diapir referred to as the Luke Salt Body. The principal aquifers of the WSRV sub-basin are the alluvial units .The alluvial deposits generally increase in thickness and grain size toward the central areas of the sub-basin. The basin-wide alluvial deposits have been subdivided into three hydrogeologic units, designated in descending order as: (1) the upper alluvial unit (UAU), (2) the middle alluvial unit (MAU), and (3) the lower alluvial unit (LAU). The lithology of each alluvial unit is summarized below:

- UAU: Gravel, sand, and silt. Mostly unconsolidated with locally strong cementation near mountain fronts and major stream courses.
- MAU: Silt, siltstone, silty sand, and gravel. Mostly weakly consolidated, but moderately to well-cemented. Siltstone occurs locally, is most commonly present in the center of the basin, and typically pinches out toward basin boundaries. The majority of drinking water supply wells draw from the MAU.
- LAU: Clays, silts, mudstone, evaporites, sandstone, gravel, conglomerate, and andesitic basalt. The lower and older part of this unit is moderately to well-cemented. The upper part of this unit is weakly to well-cemented and contains interbedded sand, gravel, and conglomerate.

The UAU aquifer generally is hydraulically unconfined, while the MAU ranges from an unconfined to a semi-confined aquifer. The LAU aquifer ranges from semi-confined to confined conditions, but may be unconfined in areas where the MAU is not present. Natural recharge to the basin occurs as mountain-front recharge, along perennial and ephemeral streams, and as agricultural and urban irrigation.

3.2.2. Local Geologic and Hydrogeologic Conditions

Hydrostratigraphic Units

In the vicinity of the PGA Superfund Site, the UAU is approximately 350 feet thick, and the local stratigraphic sequence includes three subunits that represent divisions of the UAU: Subunit A, Subunit B, and Subunit C. The subunits of the UAU are described as follows:

- Subunit A generally is composed of interbedded sands, silty sands, and clayey sands that can locally contain sequences of gravel and cobbles. The predominance of sand and the presence of coarse-grained material suggest a medium- to high-energy depositional environment related to the braided stream deposits of the ancestral Agua Fria River and, to a limited extent, the ancestral braided drainage of Bullard Wash.

  Generally, these deposits are heterogeneous, anisotropic, and unconsolidated, although some cemented zones and well developed caliche have been identified locally in both the vadose and saturated zones. Subunit A typically extends from the ground surface to approximately 160-200 feet below ground surface (bgs) in the vicinity of the Site, and generally deepens to the north to depths of approximately 190-240 feet bgs. Approximately one-third to one-half of the lower portion of Subunit A is saturated and is considered an unconfined aquifer.

- Subunit B generally is composed of unconsolidated silt and clay deposits with interbedded lenses of fine to coarse sand with depths extending from approximately 110 to 160 feet bgs at PGAS, and 160 to 230 feet bgs at PGAN, and is fully saturated. The ubiquitous nature of Subunit B and the predominance of fine-grained material suggest low-energy deposits representing the distal facies of an alluvial fan depositional environment. Subunit B is thought to be continuous and effective as an aquitard at PGAS, but may not be laterally continuous at PGAN due to washouts from braided stream deposits related to the ancestral Agua Fria River channel. Subunit B generally has a variable thickness of 20-70 feet thick throughout the PGA site. However, in the vicinity of the PGAS plume the subunit may thin significantly to the southwest, based on Subunit A water levels. The integrity of Subunit B varies at the Site. In some areas, Subunit B generally is considered to be an aquitard, while at other areas Subunit B allows leakage of contamination to Subunit C.

- Subunit C is composed of unconsolidated and interbedded mixtures of silty sands, clayey sands, and fine- to coarse-grained sands suggesting mid-fan facies of an alluvial fan sequence with braided channels interbedded with overbank deposits. On average, Subunit C is approximately 150 feet thick and extends from approximately160 to 310 feet, bgs at PGAS, and 200 to 350 feet bgs in the vicinity of PGAN. Subunit C has been subdivided at PGAS and at PGAN south of I-10 into an Upper Subunit C, Middle Subunit C, and Lower Subunit C based on a series of fine-grained sequences (At PGAN north of I-10 there is not as much lithologic data to make this correlation with confidence). Generally, the deposits of the Upper, Middle, and Lower Subunit C are similar, generally consisting of interbedded mixtures of fine to coarse sand, silty sands, and clayey sands, with occasional lenses of silt/clay. Few gravel-dominant deposits are found within Subunit C. Subunit C is fully saturated and is considered to be a leaky to confined aquifer.

3.2.3. Groundwater Movement

Subunit A

The overall groundwater flow direction in the vicinity of PGAS is towards the southwest with an estimated average hydraulic conductivity of approximately 5 feet/day. The contaminant plume flows from the east side of the former Loral property to the south-southwest under the airport property and is contained by extraction and re-injection of treated water at the southwest plume boundary.

Historically, the groundwater flow direction in Subunit A at PGAN was to the north-northwest, generally toward the Luke Sink pumping center and toward local irrigation and remediation extraction wells (i.e., the former Globe wells and extraction well 33A, respectively). Although a northern flow component still exists north of Interstate 10 (I-10; toward extraction well 33A), between approximately 2001 and 2006, a northeasterly groundwater flow component had developed in this region causing a divergence of groundwater flow in the area. The northeastern flow component is most likely caused by the abandonment of the former Globe wells which were no longer needed for agricultural irrigation and increased groundwater pumping from City of Avondale and Litchfield Park Service Company water supply wells.

In recent years, the operation of the extraction wells (EA-05, EA-06, and EA-07) and injection wells (IA-10 through IA-15) has created an effective hydraulic barrier west of Dysart Road between local water supply wells and the eastern/northeastern Subunit A TCE plume boundary, and has shifted the groundwater flow direction toward the west/northwest. The use of IA-15 began in 2014.

Recent groundwater monitoring data from PGAN indicate that the overall horizontal component of the hydraulic gradient in the Subunit A aquifer is variable. South of I-10, the flow direction is suggested to be uniform with variable gradients; and north of I-10, both the flow direction and hydraulic gradient appear to be variable. Generally, the hydraulic gradients for Subunit A groundwater in the area north of I-10 are smaller than in the area south of I-10. The groundwater hydraulic gradient ranges from 0.002 to 0.003 feet/foot in the area south of I-10, while it ranges from 0.0005 to 0.002 feet/foot north of I-10. The horizontal hydraulic conductivity of Subunit A north of I-10 is as high as 729 feet/ day. South of I-10, hydraulic conductivity can be as high as 133 feet/day.

Aside from the spatial variability, the hydraulic gradients also change seasonally more in Subunit C than in Subunit A. This variability can likely be attributed to the other regional and seasonal pumping influences from water supply wells in the area. The remedial extraction/injection systems in Subunit A at PGAN operate continuously and as a result, the hydraulic gradients and flow directions are fairly consistent throughout the year.

Subunit B

Only four monitoring wells at PGAN are screened in Subunit B and no wells are screened in Subunit B at PGAS, so it is not possible to determine a Subunit B groundwater flow direction and gradient. Additionally, since Subunit B generally is considered an aquitard, it is not considered a consistent zone of

horizontal groundwater flow, and groundwater flow direction is downward since Subunit A has higher water levels than Subunit C.

Subunit C

Overall, the groundwater flow direction in Subunit C at PGAN and PGAS generally is north to northwest, with local variations in flow and hydraulic gradient. In the area south of I-10, the groundwater hydraulic gradient is relatively flat (from approximately 0.00004 feet/foot in Upper Subunit C to 0.002 feet/foot in Lower Subunit C). Water levels exhibit substantial fluctuation in Subunit C, making it difficult to identify a primary groundwater flow direction. Because of the minimal head differential within the individual sub-layers in Subunit C across the Site, the groundwater flow direction appears to change often in response to outside hydraulic influences, such as pumping of local water supply wells. These frequent directional changes, coupled with the small magnitude of the gradient, indicate that overall groundwater movement in Subunit C is slow. At PGAN, the hydraulic conductivity values in Upper Subunit C, Middle Subunit C, and Lower Subunit C range from 3 to 47 feet/day, 1 to 56 feet/day, and 32 to 150 feet/day, respectively. At PGAS, the hydraulic conductivity values range from 80 to 130 feet/day.

Vertical Groundwater Movement

Vertically, groundwater generally flows from Subunit A to Subunit C through Subunit B. The changes in vertical hydraulic head over time are driven primarily by the seasonal fluctuations in water levels in Subunit C in response to the operation of nearby irrigation and water supply wells and, to a limited extent, by the operation of the groundwater extraction and injection remediation systems in Subunit A. The calculated differences in hydraulic head between the Subunit A and Subunit C monitoring well pairs show that the vertical gradient in hydraulic head appears to be greater in well pairs south of I-10. Additionally, the magnitude of the downward gradients generally decreases from south to north and near the remediation system extraction wells, and increases in the vicinity of the remediation system injection wells.

3.3. Land and Resource Use

Land uses in the vicinity of the Site are a mix of residential, agricultural, commercial, and industrial.

Groundwater is the primary source of water for all domestic, industrial, and irrigation water in the area. Numerous production wells and irrigation wells are located within one-half mile of the Site. These wells are used for municipal purposes by the City of Goodyear, City of Avondale, and City of Litchfield Park, as well as agricultural uses by various property owners.

3.3.1. PGAN

At PGAN, 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 (Figure 3-1). The groundwater contaminant plume at PGAN extends approximately 3 miles northward of the UPI facility, and beneath agricultural fields, a farm, housing developments with golf courses, and the Roosevelt Irrigation District (RID) Canal.

On site, there has been trials of various size plots of dryland crops such as rye grasses. Treated water from the MTS has been used experimentally for irrigation of the plots.

According to the 1989 ROD, groundwater in Subunit A is not a potential source of drinking water due to high levels of total dissolved solids and nitrates. However, drinking water wells and irrigation wells in the area draw water from Subunit C. Irrigation and supply wells located within or near the footprint of the PGAN TCE plume of Subunit A have mostly been abandoned (COG-04, COG-02, and COG-10) or are inactive (IR-27A, IR-27C, and IR-34B). Wells COG-04, COG-02, and COG-10 were abandoned in 1987, December 2006, and May 2007, respectively, due to TCE exceedances. Wells IR-27A and IR-27C were initially shut down due to TCE detections, but may be brought back online after modifications are made. Well IR-34B has been modified as a Subunit A monitoring well (since 2010). Well IR-3B on the edge of the TCE plume is still an active irrigation well used for irrigation of a golf course in a residential development. Well COG-3 is an active production well located east of PGAN. Although it is not within the plume footprint, it is near the PGA North plume and has had no detections of TCE (>0.19U) during the past five-year period.

Beginning in 2009, a portion of the treated groundwater from the Main Treatment System (MTS) was used for re-vegetation of two acres for dust control and aesthetics east of the MTS. Twelve more acres of vegetation plots were added north of the MTS beginning the second quarter of 2011. Near the northern most vegetation plot, perchlorate concentrations in three monitoring wells, MWs-03, -04 and -08, have increased dramatically. The increases in perchlorate concentrations are most likely related to infiltration associated with the vegetation plots.

In conjunction with the vegetation plots, as part of a MTS expansion program, a vadose zone infiltration gallery parallel to two existing vegetation plots was installed as a pilot-test to mainly achieve operational flexibility regarding management of treated groundwater from the MTS. Construction of the western-most trench began on January 28, 2015 and ended on February 17, 2015. The existing trench is being used as a pilot to determine the functionality of infiltration trenches in this area. Should it be determine functional, another trench would be installed next.

3.3.2. PGAS

At PGAS, commercial and industrial properties lie to the east of the airport; agricultural land is to the north and south; and agricultural, residential, and recreational land is to the west. The nearest residences are approximately one-half mile west of the Site and less than one-quarter mile northeast of the Site and generally upgradient or cross-gradient of the contaminant plumes.

Commercial and industrial buildings are located above portions of the Subunit A groundwater contaminant plume. A small portion of the area east of the PGAS is categorized as commercial. In this area, service-oriented businesses serve the surrounding area; typical users include convenience stores/gas stations, fast food chains, restaurants/cafes, and other personal convenience services.

The airport encompasses approximately 793 acres of land. In addition to the general aviation runway, the property accommodates smaller general aviation aircraft storage along with several airport businesses including two commercial flight schools and a dormitory which houses trainees. The north side of the runway is currently used for temporary storage of large aircraft. A runway safety area extends approximately 300 feet beyond airport property to the east of the runway (Coffmann Associates, Inc., 2007).Production wells located within or near the footprint of the PGAS TCE plume in Subunit C include active wells GAC-02 and inactive wells COG-05 and GAC-03. Although COG-05 and GAC-03 are inactive, they are regularly monitored for TCE, and there are currently no plans for abandonment of these wells. Modifications were made to GAC-03, and TCE is no longer detected at this well. Analytical results for TCE concentrations in GAC-02 ranged from 1.4 µg/L to 4.6 µg/L in the past five years. Analytical results for TCE concentrations in GAC-04 ranged from non-detect to 100 µg/L in the past five years. TCE contamination in GAC-04 was raised in the 2010 Five-Year Review as an issue with recommendation and as part of the explanation for the Protectiveness Determination. GAC-04 has now been abandoned and a replacement well has been drilled further south, outside of the PGAS plume boundary. Additional discussions of GAC-04 are included in Section 6.4.2.5.

3.4. History of Contamination

3.4.1. PGAN

The former UPI facility was established in 1963 as a research, design, development, testing, assembly and manufacturing plant for ordnance components and other related electromechanical devices. The products (fuses, switches, detonators, etc.) created at this facility were shipped off-site for integration into larger defense systems. Typically, these products contained small quantities of explosive or reactive chemicals. A variety of chemicals such as acids, explosives, tear gas, propellants, paints, glues, oils, solvents, and radioactive materials were used and tested at the facility. Additionally, UPI stored reactive chemicals and products, processed powder, and blended and processed propellants. More than 180 different chemicals and chemical mixtures were used over the course of the facility's operation. Several different chemicals, including solvents used for manufacturing electromagnetic devices, were reportedly disposed in the four dry wells located west of the main building from 1963 - 1980. In particular, TCE and perchlorate were known to have been disposed on the UPI facility (ARCADIS, 2007).

Historically, the former UPI property contained 24 fixed buildings, each of which housed a specific manufacturing process or research operation, and eight bunkers. The majority of the manufacturing equipment was removed when Pacific Scientific Energy Dynamics purchased UPI from Crane Co. and ceased facility operations in 1994. The buildings and bunkers were left vacant until their demolition was completed in 2009 (Matrix New World Engineering, Inc., 2010).

3.4.2. PGAS

Historical data indicate there were two primary contributors to contamination on PGAS: operations at the Goodyear Aerospace Corporation site and activities carried out by the Navy at the Litchfield Park Naval Air Facility (USEPA, 1987a).

Goodyear Aerospace Corporation purchased the facility located at 101 South Litchfield Road in 1949 and operated adjacent to (east of) the airport property until 1987. The facility adjacent to the airport was subsequently occupied by the Loral Corporation and remained in use by Lockheed Martin up until 2014. The property owner, JRC Goodyear, is currently seeking new tenants. The plant was involved in the development and manufacturing of aerospace related products including electronics equipment such as radar; transparent products such as aircraft and automobile windshields; and structural components such as MX missile transporter and aluminum-skinned shelters. Operations at the facility, including primary metal treatment processes such as plating, degreasing and etching, generated hazardous waste.

From 1949 until 1952, effluent from the preservation and activation process, consisting of waste streams from routine aircraft maintenance, cleaning, and degreasing, were discharged into the main drainage ditch. The sewer system eventually discharged into a marsh area south of the airport. These discharges continued until the on-site sewage treatment plant, which was constructed in 1951 to treat domestic sewage, was upgraded to receive and treat industrial waste.

There was a chromate treatment plant for rinse water in the 1970s (Ecology and Environment 1983). The manufacturing facility used solvents and acids and generated metal sludges, waste solvents, and waste acids from the metal treatment operations. Prior to 1980, most of these wastes were disposed on-site in sludge drying beds. There were one large and two small drying beds located at the southern portion of the facility. The contents of the beds, along with soil and rubberized fabric liner, were removed in 1980; further remediation of one of the beds was completed in 1993.

In 1988, a 25,000 gallon underground storage tank (UST) was removed from the airport property and found to have released aviation gasoline. The total volume released was estimated to be 57,000 gallons. The UST was located in the infield area south of the main runway. Corrective actions conducted by the City of Phoenix under a 1993 Administrative Consent Agreement with EPA included drilling of eight exploratory borings, installation of ten groundwater monitoring wells, free-product removal, and installation of an SVE system (which is no longer in operation). The leaking tank site is being managed by EPA's UST section. Regularly scheduled groundwater monitoring is ongoing. Because the spill is not related to the VOC and chromium contamination being addressed as part of PGAS remedial actions, it is not discussed further in this report.

3.5. Initial Response

3.5.1. PGAN

In 1984, a subsurface investigation at the former UPI facility revealed the primary source of contamination to be four dry wells located west of UPI's main building. 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. In 1990, the EPA issued an Amended Administrative Order for Remedial Design and Remedial Action for implementation of the 1989 ROD groundwater and soil vapor remedies at PGAN. In early 2000s, when sampling and analytical methods allowed for lower perchlorate detection limits, widespread perchlorate contamination was discovered at PGAN. Initial response was conducted through a treatability study conducted at the COG Waste Water Treatment Plant. In 2006, EPA

issued the Perchlorate Removal Action Memorandum and perchlorate treatment was added to the MTS. In 2013, EPA directed a Perchlorate Occurrence Technical Memorandum which determined that the extent of site-related perchlorate is within the footprint of the TCE groundwater plume.

3.5.2. PGAS

A preliminary investigation was conducted by Ecology and Environment, Inc. on behalf of EPA in September 1982. After sampling of wells in the area confirmed TCE contamination, the PGA Superfund Site was listed on the NPL on September 8, 1983. An RI was conducted in 1984 and 1985. The RI consisted of sampling sewers and outfalls on the former Goodyear Aerospace Corporation facility, installation of monitoring wells, completion of soil borings as piezometers, sampling of community wells, and collection of samples from surface soils and soil borings (USEPA 1989b).

Results from the RI showed that there was a small area within one-half mile of the Goodyear Aerospace Corporation facility in which production wells had TCE contamination in the range of 30 to 600 parts per billion (ppb). Soil at the Site was found to be contaminated with pesticides, chromium and other metals, and VOCs. Pesticides were present at levels that were considered consistent with background levels, while additional investigation and treatment was recommended for areas of metal and VOC contamination.

The 1983 site inspection identified three sludge drying beds located in the southern portion of the former Goodyear Aerospace Corporation facility. The material in the beds was removed in 1980, at which time one of the beds had a hard crust on top, but the deeper contents had not completely dried. Further remediation continued after the signing of the 1989 ROD and is discussed in section 4.2.2.

3.6. Basis for Taking Action

3.6.1. PGAN

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 MCL of 5 micrograms per liter (µg/L). During sampling conducted in 1984, the maximum concentration of TCE in soil was 5,586 milligrams per kilogram (mg/kg), and the maximum concentration in groundwater was over 100,000 µg/L. Other contaminants identified as specific targets for remediation include MEK and acetone.

Cleanup levels for groundwater were established in the 1989 ROD for 1,1-dichloroethene, 1,2-dichloropropane, chloroform, toluene, TCE, trichlorofluoromethane, carbon tetrachloride, methylene chloride, xylenes, antimony, arsenic, barium, beryllium, cadmium, chromium, lead, mercury, nickel, selenium, silver, and zinc. The cleanup criteria were selected to reduce contaminant exposure risk from groundwater extracted by the various production wells in the Site's vicinity.

3.6.2. PGAS

Chromium was detected in soil at concentrations greater than the ADHS-suggested health-based cleanup level of 1,500 mg/kg. Other metals were also detected above regulatory levels, including aluminum,

cadmium, and copper. TCE was detected in soil at levels greater than the ADHS-suggested soil cleanup level of 0.26 mg/kg. The highest health risks were determined to be from potential incidental ingestion of arsenic, chromium, cadmium, and nickel in surface soils associated with the sludge drying beds (USEPA 1989a).

TCE was discovered in the groundwater at PGAS at concentrations greater than the MCL of 5 µg/L. In addition, chromium was detected in several wells at levels above the MCL of 100 µg/L. At the time of the RI, the COG operated eight wells for its municipal water supply, seven of which were located within the PGA Superfund Site boundary (USEPA 1989a). Numerous other domestic and irrigation supply wells were also operating in this area. As a result, the primary human health risk posed was the potential for direct ingestion of contaminated groundwater.

4. Remedial Actions

4.1. Remedy Selection

Decision documents for selection of the Site remedy are: the initial 1987 ROD, known as the Section 16 OU ROD; the Site-wide ROD signed in 1989; the 1991 Chromium Removal Action Memorandum; five ESDs making changes to the remedy selected in the 1989 ROD; the 2008 Perchlorate Removal Action Memorandum; and the 2014 ROD Amendment for PGAN. The initial ROD in 1987 addressed chromium and VOCs in Subunit A groundwater within PGAS. The Site-wide ROD in 1989 addressed 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. The Chromium Removal Action Memorandum addressed chromium in soil at PGAS and set forth requirements for the excavation of the former sludge drying beds. The 2008 Perchlorate Removal Action Memorandum for PGAN addressed perchlorate extracted from wells as part of the Site treatment system and any impacted drinking water wells. The 2014 ROD Amendment selected in-situ treatment with ZVI, nZVI and ARD for the Source Area at PGAN. These documents are discussed below as they pertain to each site as well as a presentation of the Site's remedial action objectives and major system components of the selected remedy.

4.1.1. Remedial Action Objectives

Remedial action objectives (RAOs), referred to as remedial response objectives (RRO) in the 1987 & 1989 RODs, are established for VOC-contaminated soil and groundwater. The RAOs for soil are to:

- Protect public health and the environment from exposure to VOC-contaminated soil
- Prevent migration of VOCs from soil to groundwater that would result in the groundwater contamination exceeding the requirements of the 1987 ROD and the requirements of the Sitewide 1989 ROD.

The RAOs for groundwater are:

- Protect public health and the environment from exposure to contaminated groundwater
- Eliminated further migration of contaminated groundwater

- Restore the quality of the Subunit B/C aquifer.

Additional RAOs were established in the 2014 ROD Amendment for PGAN. They are as follows:

- Achieve permanent contaminant mass reduction of at least 80 percent for TCE and perchlorate in Subunit A groundwater within the Source Area
- Achieve permanent TCE and perchlorate concentration reduction of at least 80 percent for Subunit A groundwater within the Source Area.

4.1.2. 1987 and 1989 Records of Decision

4.1.2.1 PGAN

The 1989 ROD addressed TCE, MEK, and acetone contamination in soil and groundwater in Subunits B and C of the UAU and the Subunit A groundwater. The selected remedy for treatment of groundwater at the Site included an extraction and treatment system using air stripping, vapor phase carbon, and GAC polishing to remove acetone and MEK. The treated water was to be either re-injected or incorporated into the potable water supply. SVE with vapor phase carbon was the selected remedy for treatment of soil at PGAN.

4.1.2.2 PGAS

The 1987 ROD addressed only contaminated groundwater in Subunit A, the upper portion of the UAU, at PGAS. Remedial determinations for Subunits B and C, and for contaminated soil at the Site, were not made at this time because investigations were still taking place. In addition to TCE and chromium, tetrachloroethylene (PCE), 1,1-dichloroethene, chloroform, carbon tetrachloride, and arsenic were identified in groundwater, the highest concentrations of which were found in Subunit A.

The selected remedy was an extraction and treatment system to remove contaminated groundwater from the aquifer. Contaminants were to be removed from the extracted water by an air stripping tower with treatment of the off-gas by a vapor-phase GAC system. Treated groundwater was then to be re-injected into the aquifer through a network of Subunit A injection wells.

The objectives of the Section 16 OU ROD were to stop lateral migration of contaminants beyond Section 16 in Subunit A, to stop contaminants from migrating vertically into Subunits B and C, and to reduce the volume and toxicity of the contamination in Subunit A. The extent of chromium in Subunit A groundwater, as well as VOCs and chromium in Subunits B and C, was not fully identified at the time of the 1987 ROD, and it was expected that treatment of these contaminants would be addressed in the final remedy.

The 1989 ROD addressed groundwater at the PGAS site in Subunits B and C of the UAU and VOC contamination of soil for the entire PGA Superfund Site (PGAS and PGAN). An extraction and treatment system using air stripping was the selected remedy for treatment of groundwater at the Site. The goal of groundwater treatment is to reduce VOCs to levels that meet the ARARs in order to protect the current and future uses of area groundwater in Subunit B/C. Treated water would then be provided to then current domestic water users. The 1989 ROD also selected use of an SVE system with vapor phase carbon

treatment of soil. The 1989 remedy addresses VOCs in the soil, but did not address chromium in the soil, which was addressed in the 1991 Action Memorandum.

4.1.3. Action Memorandum for Chromium at PGAS

A Removal Action Memorandum was issued in October 1991 to address chromium in soil at PGAS. The Removal Action Memorandum set forth requirements for the excavation of the former sludge drying beds. Any soil containing total chromium concentrations greater than 2,000 mg/kg or cadmium concentrations greater than 100 mg/kg was to be excavated and stabilized, with confirmation samples taken to ensure that the toxicity characteristic leaching procedure (TCLP) leachate did not exceed regulatory limits of 5.2 mg/kg for chromium and 0.066 mg/kg for cadmium. Stabilized soil was redeposited followed by capping with clean soil and gravel. Notably, TCLP sampling in 2008 confirmed the soil at the sludge bed area was non-detect for COCs.

4.1.4. Explanation of Significant Differences

4.1.4.1 PGAN and PGAS

The first ESD was issued in January 1991 (USEPA, 1991). There were five components to the ESD, four of which applied to PGAN. The four changes to the remedy were:

1) Revised the cleanup level for MEK in groundwater from 170 ppb to 350 ppb.
2) Set a cleanup level for acetone in groundwater of 700 ppb.
3) Clarified the target area and criteria for establishing cleanup goals for soil at PGAN.
4) Clarified that soil excavation is an approved option should the selected soil remedy be ineffective.

The second ESD was issued in May 1993 (USEPA, 1993). This ESD applied only to PGAN and changed the following components of the remedy:

1) Changed the emission control technology for the SVE system from vapor-phase GAC to treatment by thermal oxidation with wet scrubbing.
2) Changed the designated end use for treated Subunit C water to reinjection back into the Subunit C section of the aquifer with an option for future municipal use.
3) Suspended the remedial design and construction of the LGAC treatment requirement from the Subunit A groundwater remedy because ketones were no longer present in groundwater at levels above remediation levels.
4) Added the requirement that wellhead treatment be implemented at any private or municipal drinking water well in the vicinity of the PGA site with an occurrence of Site contaminants at levels in excess of the groundwater cleanup standards.
5) Established four additional groundwater cleanup standards: benzene (5 ppb), ethylbenzene (700 ppb), 1,1,2,2-tetrachloroethane (0.18 ppb) and PCE (5 ppb).

The third ESD, issued in December 1995 (USEPA, 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. The third ESD was optional for PGAN, and it has not been applied there.

The fourth ESD, issued in March 1998 (USEPA, 1998), updated the current groundwater cleanup 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 (barium, beryllium, cadmium, chromium, lead, nickel, and selenium).

The fifth ESD, issued in September 2002 (USEPA, 2002), applied only to SVE at PGAN. The fifth ESD changed the air emissions control technology for PGAN SVE to GAC from thermal oxidation with wet scrubbing.

4.1.5. Action Memorandum for Perchlorate at PGAN

EPA issued a Removal Action Memorandum in April 2008 to address the perchlorate in groundwater at PGAN that was being extracted by the remedial wells or domestic supply wells in the area. The Action Memorandum requires wellhead treatment of extracted groundwater where perchlorate levels exceed the Arizona Health-Based Guidance Level (HBGL) of 14 ppb. The Action Memorandum also set forth a process for ensuring ongoing provision of potable water where perchlorate impacts any domestic supply wells. An ion exchange system was added to the MTS treatment process to treat perchlorate.

4.1.6. 2014 PGA North ROD Amendment

EPA issued the 2014 ROD Amendment to provide for enhanced treatment in the PGAN source area for both TCE and perchlorate, a PGAN contaminant that was not addressed in the 1989 ROD. In addition to maintaining the existing extraction and treatment and soil vapor extraction for groundwater and soil remediation, respectively, the selected remedy is a combination of in-situ remediation technologies consisting of (1) chemical reduction using nano-scale zero-valent iron and zero-valent iron and (2) anaerobic reductive dechlorination using biostimulation and bioaugmentation, as well as an enhanced hydraulic barrier. The enhanced in-situ treatment is designed to aggressively reduce the mass and concentration of Site contaminants in the shallow groundwater (Subunit A) in the PGAN source area. This is intended to result in a reduced time frame to clean up the source area and limit contaminant contribution from the source area to the down-gradient dissolved groundwater plumes (Subunits A and C).

4.1.7. Cleanup Levels

The 1989 ROD set forth cleanup levels for the soil and groundwater at PGAN and PGAS. 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 at levels above the groundwater cleanup standards. While PGAS used a vadose zone leaching (VLEACH) analysis to show that it completed its soil gas remediation in 1999, soil gas remediation is ongoing at PGAN. For chromium and other metals in soil at PGAS, EPA set final cleanup levels through the 1991 Action Memorandum. The cleanup levels for soil are set such that remaining contamination will not contribute to groundwater contamination at levels above the groundwater cleanup levels.

The 1989 ROD groundwater requires restoration throughout the Site aquifer – including Subunits A and B/C – to Site-specific cleanup levels as listed in Table 4-1 of the 1989ROD. 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. Some of the cleanup levels established in the 1989 ROD were modified in the second and fourth ESDs. Original and current cleanup levels are listed in Table 4-1.

Table 4-1. Groundwater Cleanup Levels from 1989 Record of Decision and Updated Cleanup Levels from Subsequent Explanation of Significant Differences

Chemical Compound	1989 ROD Cleanup Level (µg/L)	Current Cleanup Level (µg/L)
1,1-Dichloroethene	7	7
1,2-Dichloropropane	1	1
Chloroform	100	100
Toluene	340	**1,000**
Trichloroethylene	5	5
Trichlorofluoromethane	1	1
Carbon Tetrachloride	5	5
Methylene Chloride	1	1
Methyl Ethyl Ketone	170	**350**
Xylenes	440	440
Antimony	1.46	1.46
Arsenic	50	50
Barium	1,000	**2,000**
Beryllium	0.0039	**0.004**
Cadmium	10	**5**
Chromium	50	**100**
Lead	50	**15**
Mercury	2	2
Nickel	15.4	**100**
Selenium	10	**50**
Silver	50	50
Zinc	5,000	5,000
Acetone		**700**
Benzene		**5**
Ethylbenzene		**700**
Tetrachloroethylene		**5**
1,1,2,2-tetrachloroethane		**0.18**
Perchlorate**		**14**

Values shown in bold were changed, or established, in ESD #4 which updated the groundwater cleanup levels such that all numerical Site standards are equal to the current drinking water MCLs. ESD # 4 incorrectly lists the MCL for beryllium as 0.004 µg/L. The correct MCL for beryllium is 4 µg/L.
** Perchlorate cleanup level established in 2008 Removal Action Memorandum as AZ HBGL.

4.2. Remedy Implementation

4.2.1. PGAN

4.2.1.1 Groundwater Treatment Systems

Groundwater treatment began at PGAN in 1994. Currently, five groundwater treatment systems are in operation at PGAN, including the MTS for Subunits A, B & C groundwater near the former UPI facility, a wellhead treatment system at Well 33A for Subunit A and B groundwater in a production well north of the former UPI facility, and four treatment systems (EA-05 EA-06 and EA-08) located in the northern portion of the dissolved plume to better control the TCE impacts in Subunit A groundwater. EA-10 has been added as part of the enhanced hydraulic barrier along Van Buren Street north of the source area.

Main Treatment System

The MTS treats groundwater from the Site's extraction wells in the PGAN source area, and consists of the following extraction wells: EA-01(Subunit A), EB-01 (Subunit B), EA-02 (Subunit A), EA-03 (Subunit A), EC-01 (Subunit C), PZ-01 (Subunit A/B), MW-20 (Subunit C), EA-09 and EA-10 (Subunit A). An ion exchange module was added to the system in 2005 to remove perchlorate from extracted groundwater. Extracted groundwater is conveyed using submersible pumps from the extraction wells into a surge tank. Extraction wells EA-02 and EC-01 bypass the surge tank because the perchlorate concentrations in each of these extraction wells are below the MCL. The recovered groundwater is then pumped from the surge tank through bag filters and the ion exchange vessels to remove perchlorate and then to the top of air-stripping columns that remove VOCs. Effluent air from the air-stripping columns is directed through two 10,000-pound vapor-phase GAC vessels in series, which remove VOCs from the process air. Treated effluent water is injected into the Subunit A aquifer through the network of six injection wells (IA-01 through IA-06) (Matrix, 2010).

In the Phase 1 MTS Expansion, PZ-01 was converted into an extraction well for the MTS system; the Phase 1 expansion was completed in October 2008. In 2010, the MTS Phase 2 Expansion was completed. In Phase 2, an upgrade to the booster pump and addition of the Phase 4 Air Stripper improved the treatment capacity of the system by approximately 25 percent. Upgrades to MTS are expected to continue as the system expands. In 2015, MTS expansion is underway to add capacity to treat water from the new extraction wells EA-09, EA-10 and EC-01.

Additionally, well MW-29 was converted into a Subunit C extraction well due to high levels of TCE detected in the vicinity. Extraction at MW-29 served as an interim measure while the TCE plume was being characterized; however it will be abandoned and replaced with EC-02.

Well 33A Groundwater Treatment System

Extraction Well 33A GTS extracts groundwater from Subunits A and B and conveys it to two parallel trains of two 20,000-pound liquid-phase GAC (LGAC). A bag filter vessel was installed in August 2006 to filter particulate matter from the process stream to prevent clogging of the LGAC vessels. Treated effluent water is used for irrigation at a local golf course and some is discharged to the RID Canal (Matrix 2010).

EA-05 Groundwater Treatment Systems

Extraction Well EA-05 GTS extracts groundwater from Subunit A and conveys it to a bag filter unit to remove particulates prior to sending it through two 20,000-pound LGAC vessels operated in series. Treated effluent water is injected into the Subunit A Aquifer through injection well IA-10. A sequestering agent is pumped from a 400- gallon tank by means of a metering pump to the effluent piping of the LGAC vessels to reduce scaling in the system components and injection well. Construction of the EA-05 GTS was completed in March 2008 (Matrix 2010).

EA-06 Groundwater Treatment Systems

Extraction Well EA-06 GTS extracts groundwater from Subunit A and conveys it to a bag filter unit to remove particulates before it goes through two 20,000-pound LGAC vessels operated in series. Treated effluent water is discharged to injection wells IA-11, IA-12, IA-13, and IA-15. Construction of the EA-06 GTS was finished in January 2008. By early 2009, in spite of the additional pumping of EA-06, groundwater monitoring showed inadequate plume capture in the eastern and northeastern portions of the contaminant plume in Subunit A north of I-10. This necessitated the planning and installation of additional extraction and injection wells. Beginning with well EA-07—which was installed in 2010 and is now included in the EA-06 GTS network (Matrix 2010). After finishing the necessary shakedown of well EA-07, the treated groundwater is conveyed to injection wells located along Dysart Road and at the Estrella Mountain Community College for re-injection to create a hydraulic barrier along the east/northeast plume boundaries to help reverse the groundwater gradient and contain the Subunit A TCE plume.

EA-08 Groundwater Treatment System

In 2011, the EA-08 groundwater pump and treat system was initiated to remediate and contain the Subunit A TCE plume in the north-central portion of the PGAN area. This treatment system also uses LGAC technology. The treated groundwater was initially discharged to the RID Canal. In January 2014, injection wells IA-7 and IA-08 were installed and brought on-line in June 2014.

EA-09 Extraction Well

In 2013, EA-09 was installed to enhance the groundwater remedy south of I-10. The groundwater extracted from this well is conveyed to the MTS for treatment and reinjection.

4.2.1.2 Soil Gas Treatment

The PGAN 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. In 2004, the SVE system was restarted with GAC treatment for air emissions.

The system restarted in 2004 and currently consists of ten extraction wells and piping, a VES5 Modular Vapor Extraction System blower assembly, and two in-line GAC vessels (two 1,000-pound and one 2,000-pound vessels) that operate in series. The performance of the SVE system is monitored on a weekly basis through the use of a photoionization detector (PID), pressure/vacuum gauges, thermometers, and air flow measurement devices. Air samples are collected on a monthly basis to calculate the amount

of VOC mass recovered from the subsurface. Operation of the SVE system is further explained in the Soil Vapor Extraction System Operations and Maintenance (O&M) Plan (ARCADIS, 2005).

Vapor Intrusion was investigated in City of Goodyear City Hall and Administrative buildings located on property north and east of the former Unidynamics property. Three buildings were sampled in February 2005 and all samples were non-detect. (Arcadis 2005).

In response to recommendation in the previous Five-Year Review, the system was optimized to include pneumatic well logging and performance testing of the SVE wells, SVE-01, SVE-02, SVE-03, SVE-04, SVE-05, and SVE-06, conversion of groundwater monitor well MW-07 to an SVE well, subsequent vapor monitoring of MW-07, and the installation and construction of a new soil vapor monitoring (SVM) well (SVM-16). This work, which represents Phase I plan to optimize the system, was completed in 2011 and is reported by Matrix (2013).

4.2.1.3 Source Areas, Soils, and Facility Structures Supplemental Remedial Investigation and Feasibility Study

The Source Areas, Soils, and Facility Structures (SASFS) Investigation began in 2007 and was completed with Phase I and Phase II Investigations (2011) . The activities for this Study are described below.

During the summer of 2007, ARCADIS conducted the Phase I SASFS investigation. The investigation included excavating and removing potential source structures such as drywells, sedimentation tanks, ponds, and vaults. During excavation and removal of these structures, soil samples were collected to determine if any COCs might have impacted the surrounding soils and groundwater.

While conducting the Phase I SASFS investigation, ARCADIS also summarized historical soil vapor evaluations, identified data gaps, and planned for the additional characterization of soil vapor in a Final Phase I Soil Gas Investigation Workplan (ARCADIS, 2008b).

At the end of 2009, AMEC Geomatrix started the Phase I soil gas investigation to address data gaps identified in the ARCADIS work plan (AMEC, 2011a). Six soil borings were completed and soil and soil vapor samples were collected at 10-foot intervals at sampling locations AB-1 through AB-6. Depth-discrete groundwater samples were also collected at each boring at approximate 10-foot intervals to approximately 120 feet bgs. Analytical results for depth-discrete groundwater samples collected are not summarized herein, but can be found in the original report

The Phase II Investigation was implemented to further characterize and delineate areas where COC exceedances occurred during the Phase I Investigation and to address any remaining data gaps identified. Additional samples were collected from nine of the previously identified Locations, 13 of the identified PSAs, and additional features identified during the Phase II Investigation. The Phase II Investigation also incorporated an evaluation of former facility structures and an inspection of sub-grade features identified during facility demolition activities conducted by Matrix New World Engineering, Inc.

Based on the analytical results from samples collected as part of the SASFS Phase II and associated addenda investigations, no additional sources of COCs were identified and additional investigation is not warranted at the Site.

4.2.2. PGAS

4.2.2.1 Subunit A Groundwater Treatment

Subsequent to the 1987 ROD, a pilot test for the air stripping and recharge system was conducted by GTRC. Based on the results of that pilot test, a full-scale treatment facility was constructed and began production in early 1990. At the beginning of operation, there were five extraction wells, one air stripper, and seven injection wells (Sharp 2005).

The off-gas from the air stripping tower was treated with vapor-phase GAC until 1995. At that time, GTRC showed that off-gas VOC concentrations were low enough that treatment was no longer required by the Maricopa County Air Pollution Control District emission standard of 3 pounds per day (lbs./day).

By 1995, the system had 12 Subunit A extraction wells and 14 injection wells, and the volume of water treated by the plant was as high as 436 million gallons per year in 2001. The treated volume has decreased since that time; in the first half of 2009, approximately 140 million gallons were treated (LATA, 2010). As shown schematically in Figure 4-1, the current treatment system consists of 12 extraction wells, each capable of producing between 20 and 120 gallons per minute (gpm); 16 injection wells; conveyance pipeline from extraction wells to the treatment system (influent); acid tanks for scale reduction; air stripping tower; and conveyance pipeline from the treatment system to the injection wells (effluent).

The Subunit A treatment system does not currently remove chromium from the extracted groundwater. The third ESD modified the groundwater remedy to include wellhead treatment for chromium. Pursuant to the third ESD, in the third quarter of 1995, a wellhead chromium treatment system was installed to treat water produced by Subunit A extraction well E-17, one of the wells with chromium concentrations above the MCL, prior to piping the water to the treatment plant for VOC removal by air stripping. The chromium treatment system used was an advanced affinity chromatography system which consisted of a chromatography column, prefilter, mechanical flow meter, regeneration system, sample ports, and containment pad (Sharp 2005). The treatment system had many operational problems and was shut down in 2001 and removed in 2003.

Air sparging was used twice on different areas of the PGAS to accelerate VOC removal.

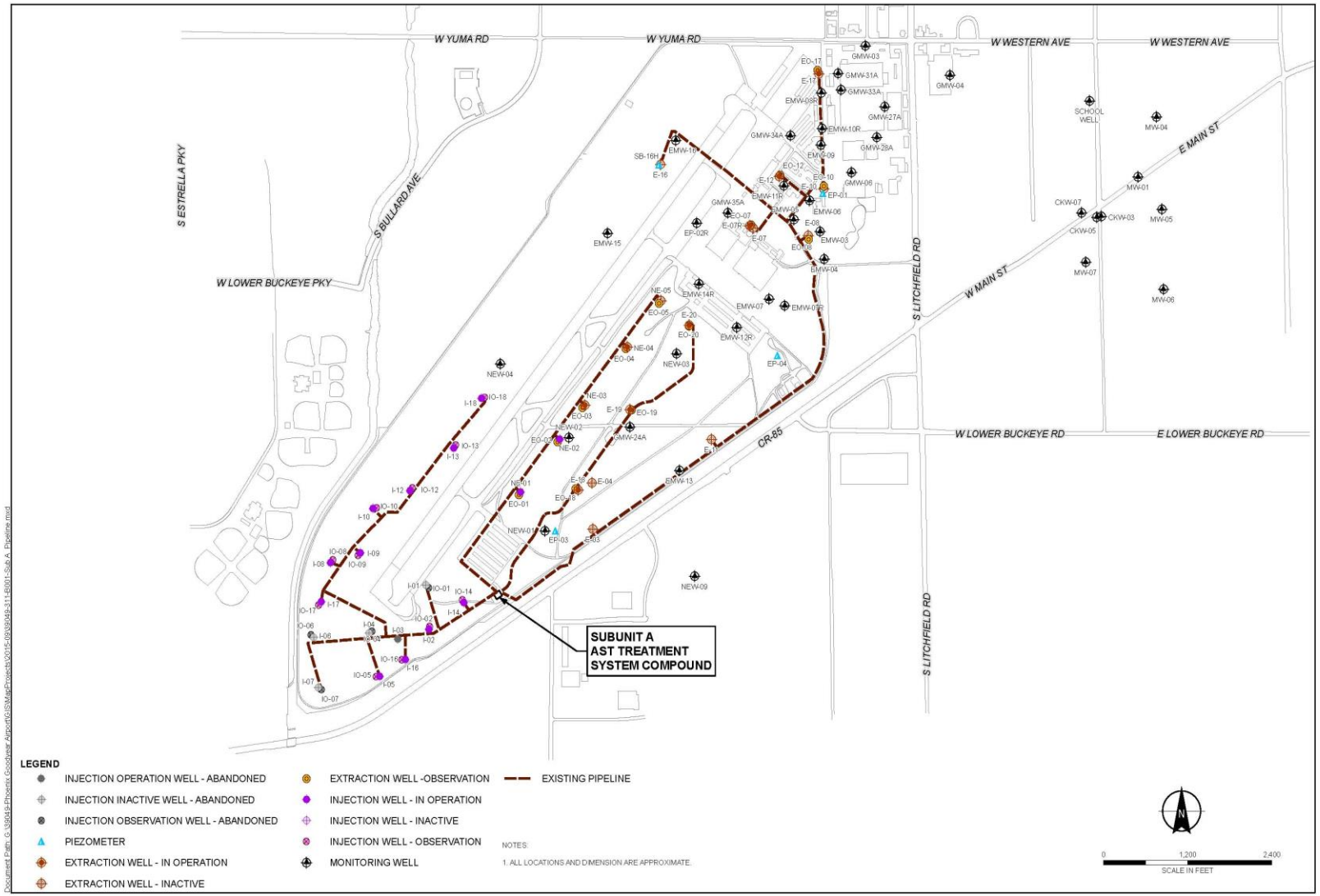


Figure 4-1. PGAS Subunit A Treatment System Diagram

4.2.2.2 Subunit B/C Groundwater

Northern Subunit C

There were originally three zones of contamination within Subunit C: the southern plume, the central plume, and the northern plume. Contamination is believed to have entered Subunit C from Subunit A through conduit wells. The known conduit wells were investigated in 1992 and were either abandoned or repaired. Initially, each of the three plumes had a separate extraction and treatment system. The northern system operated between February 1994 and December 2004 and consisted of one extraction well, one LGAC system, and two injection wells. The central system consisted of one extraction well and a reverse osmosis unit and operated for about 3 years. The southern system began operation in September 1994 and is still in operation.

The northern plume is believed to have entered Subunit C by conduit flow through well GAC-03, located near the southwest corner of the intersection of Yuma Road and Litchfield Road. GAC-03 was rehabilitated in 1992 to prevent further contaminant migration. Extraction well E-101, was installed near what was, at the time, the western edge of the plume. The northern treatment system began operation in February 1994 using well E-101 for extraction. Extraction from well E-101 was discontinued because it was not able to provide hydraulic containment of the plume, which had already migrated north of Yuma Road. A new extraction well, E-102, was installed in June 2003 and began operating in November 2004 to attain northern plume capture. Due to pump failure, E-102 was replaced with extraction well E-103 in April 2014. Extracted groundwater is treated by granular activated carbon (GAC) at the Southern Subunit C treatment system and then re-injected via Subunit C injection wells I-201, I-202, and I-203.

Central Subunit C

The central Subunit C plume appears to be localized around well GAC-04, because the plume was associated with conduit flow through this well. This well was rehabilitated in 1992 to stop the conduit flow. Between 1992 and 1995, this well was used as the primary water source for the Loral Corporation facility, with extracted water, treated it with a reverse osmosis system, and used it on site. Treatment was required until 1995, when the TCE concentration in GAC-04 was below the drinking water standard for 12 consecutive months. This well was used as a backup well for the Loral facility. When in use, extracted water was treated with a reverse osmosis system and a GAC filter. However, TCE has been detected at this well at concentrations above MCL since 2005, and since 2008 groundwater from this well has been pumped and piped into the Subunit A treatment system for TCE treatment.

Southern Subunit C

The Southern Subunit C system initially consisted of three extraction wells (E-201, E-202, and E-203) and three injection wells (I-201, I-202, and I-203), and began operating in September 1994. The Southern Subunit C extraction system was shut down in 2009 to initiate a pulsed pumping evaluation of the potential for TCE concentration rebound. Except for intermittent TCE concentrations slightly above the maximum contaminant level (MCL) at SB-06UC, monitoring wells within the footprint of the former Southern Subunit C plume have been non-detect or below the TCE MCL of 5 micrograms per liter (µg/L) since approximately May 2012.

4.2.2.3 Soil Gas Treatment

Several efforts were made to determine which areas of the Site would be most suited for SVE treatment. All efforts involved using soil or soil gas analytical data from different polygonal areas of the Site to predict the effect on TCE concentrations in groundwater below the polygons. In May 1992, a conservative total mass dissolution test was run on 143 polygons, of which 80 polygons failed; that is, test results predicted that groundwater would be impacted with TCE concentrations greater than 5 µg/L in 80 of the polygons. The VLEACH model and a mixing cell model were then run on these 80 polygons, resulting in 14 polygons failing; i.e., 14 polygons predicted to have TCE concentrations greater than 5 µg/L. Additional field data was collected in 1992 and 1993. Additional modeling took place, which resulted in selection of five polygons (79, 84, 96, 92, and 27a) that required remediation using SVE.

The SVE system consisted of five major components: extraction wells and piping; vapor inlet system; vapor treatment system; vacuum extraction module; and electrical control system and power distribution module. The number of extraction wells varied from one to three for each polygon. Flow from each well was piped through the vapor inlet system, which removed liquid from the inlet air and provided the opportunity to blend ambient air into the vapor stream to reduce the vapor concentration to below 25 percent of the Lower Explosive Limit, if needed. Off-gases were treated with two 2,000-pound vapor-phase GAC vessels installed in series and vented to the atmosphere.

Polygon 79 was the first to be treated with the SVE system. The SVE system, using four extraction wells to remove VOCs from the soil, operated at Polygon 79 from September 1993 through January 1994. After monitoring to detect any rebound concentrations, the polygon was officially closed by EPA on September 3, 1994. The same SVE system was moved to Polygon 84 in 1994, and operated between late 1994 and early 1995. The Polygon 84 system used three extraction wells to remove VOCs from the soil. Confirmation samples were collected on June 15, 1995, and the polygon was approved for closure.

In late 1995, the SVE system was moved to Polygons 96, 92, and 27a. A total of seven extraction wells were installed to remove VOCs from the soil: three in Polygon 96, three in Polygon 92, and one in Polygon 27a. The system operated from March 1996 through April 1998. The use of air sparging was approved in the third ESD, issued in December 1995. Air sparging was used to further reduce contamination in these three polygons and two adjoining polygons, numbered 81 and 100, between May 1996 and April 1998. During the operation of the SVE and air sparging systems at these five polygons, 1,768 pounds of VOCs were removed from the soil and groundwater. The TCE concentrations in groundwater prior to SVE treatment, estimated by VLEACH modeling, ranged from 6 µg/L in Polygon 27A to 27 µg/L in Polygon 96. The VLEACH-estimated TCE groundwater concentrations after SVE treatment were less than 1 µg/L for each of the polygons.

After using air sparging in Polygons 96, 92, 27A, 81, and 100, a work plan was submitted to use the same system to accelerate VOC removal in the airport infield, just south of the UST release. Three air sparging wells and four SVE wells were installed in 2001 near well PMW-15. The air sparging system operated between November 2001 and January 2003 and removed 138 pounds of TCE from the infield area (Sharp 2005).

4.2.2.4 Sludge Drying Beds

Work to remediate the two small sludge drying beds — a total area of about 100 feet by 140 feet — began in June 1992 and was completed in January 1993. The beds were excavated and the majority of the soil was disposed of off-site. Cleanup standards for metals in soil were set by the October 1991 Chromium Removal Action Memorandum which required stabilization of soil containing total chromium concentrations greater than 2,000 mg/kg or cadmium concentrations greater than 100 mg/kg prior to backfilling.

Before beginning excavation, the entire area was analyzed for chromium and cadmium levels, on a 25-foot grid system, using an X-Ray Fluorescence detector. This allowed field staff to delineate areas that required excavation. These areas were excavated and the soil was screened with an X-Ray Fluorescence detector to determine whether it needed to be stabilized. A total of 1,696 cubic yards of contaminated soil and 1,895 cubic yards of intermediately contaminated soil were removed from the former sludge drying beds.

Soil stabilization on-sight was achieved by mixing Portland cement with the contaminated soil. Samples were taken of the stabilized soil to confirm that the TCLP leachate would be less than 5.2 mg/kg for chromium and 0.066 mg/kg for cadmium, as specified in the 1991 Chromium Action Memorandum. Stabilized soil was compacted back into the excavated areas. The areas were covered with 6 inches of clean fill and a 3-inch layer of gravel. . Notably, TCLP sampling in 2008 confirmed the soil at the sludge bed area was non-detect for COCs.

4.3. Operation and Maintenance (O&M)

4.3.1. PGAN System Operations/O&M Activities

The Draft—Revised Main Treatment System Operations and Maintenance Plan (Matrix 2009) for PGAN was completed in October 2009 to meet the requirements set forth in Task 1.1 of the PGAN SOW dated April 19, 2005. Operation and maintenance of the EA-05 and EA-06 groundwater treatment systems are covered in the Final EA-05 and EA-06 *Groundwater Treatment Systems Operation and Maintenance Plan* ((ARCADIS, 2008b). The O&M for the new injection wells (IA-11 and IA-12) and extraction well (EA-07), are connected to the EA-06 treatment system. Amendments following February and May 2009 spills at the MTS have incorporated preventive maintenance check=lists tracking operating parameters such as flow and pressure rates for all extraction and injection wells as well as alarm and alert systems with backup. On an annual basis since 2011, the O & M Plans have been updated for the MTS, 33A, EA-05, EA-06 and EA-08. Most recent updates are from February through August 2015.

4.3.2. PGAS System Operations/O&M Activities

4.3.2.1 Subunit A

The PGA *Operable Unit Treatment Plant Operation and Maintenance Procedures Manual* (IFC Technology, 1990) was submitted in January 1990 and has been periodically updated as the system has been modified, most recently in 2015. The manual lists operating parameters such as flow rates for

extraction and injection wells, the pH range in influent and effluent water, and air flow rates through the air stripper. The Operation and Maintenance Manual for Subunit A was updated in 2015.

4.3.2.2 Subunit B/C

The *Operation and Maintenance Manual for the Northern Subunit B/C Groundwater Remediation System* was submitted for EPA approval in April, 1994 (Sharp 1994). Operation and maintenance of the southern Subunit B/C system is similar to the northern system and the Operation and Maintenance Manual was updated in 2015.

Currently, the northern Subunit B/C system is shut down because the northern plume (groundwater from well E-103) is being treated by the southern Subunit B/C treatment system and the northern system is used only once each month to collect a sample. The plan is to keep this system shut down indefinitely. Extaction well E-103currently provides containment of the northern Subunit B/C plume.

The wellhead treatment system for central Subunit B/C well GAC-04 (the central Subunit B/C plume) was removed, as the well was abandoned.

5. Progress Since the Last Five-Year Review

5.1. PGAN

5.1.1. Previous Five-Year Review Protectiveness Statement and Issues

The protectiveness statement from the 2010 FYR for the Phoenix-Goodyear Airport North Site stated the following:

> *The remedy at PGAN is not protective of human health and the environment. In Subunit A, the TCE plume is expanding to the northeast and the north. It is still uncertain if the Subunit A TCE plume is within the capture zones of MTS Subunit A extraction well system in the southeast. In Subunit C, recent detections in MW-29 indicate an unknown potential migration route from Subunit A to the drinking water aquifer, Subunit C. In addition, several issues that affect long term protectiveness have also been identified: the SVE remedy for soil gas has had diminished recovery over the past five years; and all of the institutional controls have yet to be implemented.*

The 2010 FYR included five issues and recommendations, which are listed in Table 5-1. Status of recommendations 4 and 5 is given in the table; status of recommendations 1 – 3 is discussed below.

Table 5-1. Status of Recommendations for PGAN from the 2010 FYR

Issues from previous FYR		Recommendations	Action Taken and Outcome	Date of Action
1	Groundwater quality monitoring trends indicate the TCE plume is expanding to the northeast and the north. In the southeast (near EPA MW-10A), it is still uncertain if the Subunit A TCE plume is within the capture zones of MTS Subunit A extraction well system.	Ensure capture of plume at all boundaries; including evaluating all northern area extraction/injection systems (EA05, EA06, 33a, EA07) optimizing injection/extraction of all systems, developing all injection/ extraction systems necessary to fully contain in N, NE and NW; and expanding capacity of MTS.	Installed extraction well EA-07 and injection wells IA-11 through IA-15 to enhance hydraulic capture in the northeast.	2010
			Extraction and treatment began at EA-08 in the north-central.	2011
			Capture Zone analysis complete. Description provided in under Recommendation 1 Status below.	2013
			Extraction well EA-09 installed to enhance capture south of I-10 Injection well IA-07 & IA-08 installed to enhance hydraulic control in NW	2013 2014
2	Recently increased detections of TCE at MW-29, located south of I-10 in the Subunit C, indicate an unknown potential migration route from Subunit A to Subunit C.	Investigate Subunit C contamination near MW-29 to determine source of Subunit A to Subunit C migration.	Ongoing investigation, see below for details.	—
3	Recent data indicates that the SVE system has been less effective in removing mass from the dry-well source area than in previous years.	Optimization of the SVE system should be evaluated.	Phase I optimization completed, Phase II rebound testing begun	2012 2014
4	Institutional controls (ICs) were required for Parcels B and C in the 2006 Partial Consent Decree; restrictive covenants required on portions of the UPI property have not been implemented.	Implement institutional controls (IC) as required in the 2006 Partial Consent Decree.	Further characterization may show that ICs are not required. No ICs have been implemented to this date.	—
5	Extracted groundwater with perchlorate at the Site is being addressed through the 2008 Perchlorate Removal Action. However, no restoration remedy for perchlorate contamination in the aquifer has been selected.	Remedial action to address perchlorate in the aquifer needs to be selected and documented in a decision document.	ROD Amendment selects in-situ remedy for perchlorate.	September 2014

Recommendation 1 Status

Since expanding the groundwater treatment system, a new capture zone analysis was completed (AMEC, 2013b). This report indicates that the operation of the groundwater treatment system has created an effective hydraulic barrier west of Dysart Road between local water supply wells and the eastern/northeastern Subunit A TCE plume boundary, and has shifted the groundwater flow direction toward the west/northwest. The groundwater capture analysis of Subunit A concludes that the TCE plume boundary generally provides hydraulic containment except for a small area in the northwest portion of the plume. As extraction well EA-08 continues to develop and reach steady-state conditions, it is expected that capture will be complete in the northwestern extent of the Subunit A TCE plume. IA-07 and IA-08 injection wells installed to enhance hydraulic capture in NW extent of the plume.

Recommendation 2 Status

There is an ongoing Subunit C investigation of the contaminant plume near MW-29 which will yield more data and results. The TCE plume in the area is currently suspected to be the result of horizontal migration from the up-gradient plume.

Recommendation 3 Status

Phase I Optimization of the SVE system was completed in 2012 (Matrix, 2013), as described in Section 4.2.1.2, with data review in Section 6.4.1.4. Tasks for optimization included pneumatic well logging and performance testing of six SVE wells, conversion of groundwater monitor well MW-07 to an SVE well, subsequent vapor monitoring of MW-07, the installation and construction of a new soil vapor monitoring (SVM) well (SVM-16). A Phase II work plan was included with the Phase I report and the Phase II rebound test began in 2014 and data evaluation is ongoing.

In September 2011, pneumatic well logging was conducted to test for soil permeability and contamination distribution within six SVE wells (Matrix, 2013). This testing aids in determining preferential flow paths, soil heterogeneity, and mass transfer constraints in the vadose zone. This test may help determine if TCE mass remains in the fine-grained soils of the vadose zone or if the soil gas contamination is predominately a result of volatilization from the underlying impacted groundwater. Pneumatic well logging was also used to generate data that could aid in predicting mass removal as a function of time.

Recommendation 4 Status

The 2006 Consent Decree requires institutional controls to be placed on Parcels B and C of the former UPI facility. Crane Co. indicated that, prior to placement of any ICs, it would attempt to make a showing that there is not contamination on those parcels. EPA has agreed that, at this juncture, that showing may be made prior to a determination whether ICs must be placed. However, should that property be transferred, ICs will be required regardless of whether further characterization has been conducted.

5.1.2. Work Completed at the Site During this Five Year Review Period

In 2010, extraction well EA-07 was installed to enhance the hydraulic capture of contaminated Subunit A groundwater in the northeast portion of PGAN. Groundwater from EA-07 has been conveyed to the EA-06 compound for treatment, and a new pipeline was constructed to convey treated groundwater from both EA-06 and EA-07 for reinjection through injection wells IA-11 through IA-15 along Dysart Road (initially, only injection wells IA-11 through IA-13 were used; IA-15 began in 2014).

In 2011, the EA-08 groundwater extraction-and-treatment system was initiated to remediate and contain the Subunit A TCE plume in the north-central portion of PGAN. This treatment system also uses LGAC technology. Beginning in July 2014, treated water from EA-08 GTS was discharged to injection wells IA-07 & IA-08 with discharge to RID as backup.

In 2013, extraction well EA-09 was installed to enhance the groundwater remedy south of Interstate 10 (I-10). The groundwater extracted from this well is conveyed to the MTS for treatment and reinjection.

In November 2013, the Source Area Remediation Focused Feasibility Study (SARFFS) was finalized for PGAN. The purpose of the SARFFS was to document the known nature and extent of the source area and to identify and evaluate potential remediation alternatives for that area. In addition to ongoing groundwater monitoring activities, the SARFFS investigation was an important source of information for establishing the need for enhancement to the source area remedy.

A capture zone analysis was conducted in Subunit A (AMEC, 2013b), following the 2012 pumping season that demonstrated the plume is controlled to the northeast area, but that additional work is needed in the north central to northwest areas.

In 2014, pipelines were installed that convey treated groundwater from the EA-08 extraction-and-treatment system to an area beyond the extent of contaminated Subunit A groundwater in the northwest portion of PGAN for reinjection in wells IA-07 and IA-08. This reinjected groundwater provides a hydraulic barrier to help contain the portion of the Subunit A TCE plume in the vicinity of extraction wells 33A and EA-08.

In the Subunit C capture Zone Analysis (AMEC, 2014) the majority of the Subunit C TCE plume is captured by the remediation extraction wells, however, there may be several gaps: 1) there appears to be a small area in the northern portion of the Middle Subunit C TCE plume (north of Celebrate Life Way) where there may not have complete capture due to the loss of extraction well MW-29; 2) there may be a lack of capture to the west of monitor well EPA MW-26C in Middle Subunit C; 3) In Upper Subunit C, the Subunit C extraction wells do not appear to be providing complete capture; 4) Evaluation of Lower Subunit C capture is difficult at this time due to the configuration of the monitor wells screened in Lower Subunit C, more wells are planned.

In 2015, extraction well EA-10 was installed along Van Buren Street north of the source area to replace non-functioning EA-04 and to enhance the hydraulic barrier north of the source area. The injection well IA-09 was installed east of the site to enhance protection of the municipal supply well COG-03.

5.2. PGAS

5.2.1. Previous Five-Year Review Protectiveness Statement and Issues

The protectiveness statement from the 2010 FYR for the Phoenix-Goodyear Airport South Site stated the following:

> *A protectiveness determination of the remedy at PGAS cannot be made until further information is obtained. While the TCE plume at PGAS has been mostly delineated with contaminants of concern (COCs) concentrations in the plume being stable or decreasing over the last five years, the northwestern edge of the northern subunit C plume is not completely defined. Vapor GAC air emission controls are not in use and may be required. Further information will be obtained by conducting a groundwater investigation of northern TCE plume in Subunit C and evaluating requirements for air emissions controls at PGAS. It is expected that these actions will take approximately four years to complete, at which time a protectiveness determination will be made for PGAS. In addition, several issues that affect long term protectiveness have also been identified: The source and extent of the TCE contamination in and around GAC-04 has not been determined. The continued occurrence of elevated chromium in the northern Subunit A plume has not been fully understood.*

The 2010 FYR included five issues and recommendations, which are listed in Table 5-2. Status of recommendations 2, 3, and 5 is given in the table; status of recommendations 1 and 4 are discussed below.

Table 5-2. Status of Recommendations for PGAS from the 2010 FYR

Issues from previous FYR		Recommendations	Action Taken and Outcome	Date of Action
1	Monitoring data suggests that an uncharacterized source may be resulting in contaminant migration at well GAC-04.	Continue to monitor ground water in vicinity of GAC-04; investigate source of recently detected contaminants	Installed monitoring wells GWM-21UC and GMW-22UC	June 2010
			Installed monitoring well GWM-23UC GAC-04 abandoned	January 2012 August 2012
2	ICs were recommended in the previous Five-Year Review for the residual chromium contamination; however, no chromium related ICs have been implemented at PGAS to date.	Implement ICs as required.	GTRC submitted analysis showing no residual contamination requiring ICs. Review of the technical analysis is ongoing and no ICs have been required.	—
3	The northern TCE plume in Subunit C is not fully defined.	Conduct GW investigation of area to gain more definitive understanding of northern Subunit C plume.	Installed monitoring wells GWM-25 and GMW-26	2013
4	The chromium concentrations in the northern Subunit A plume have not shown improvement in response to the remedial actions taken.	Evaluate the ground water monitoring data to gain better understanding of chromium levels over time.	See discussion below.	—
5	Although the use of vapor GAC air emission controls is part of the remedy for this site, air emission controls were removed at PGAS in 1995 with concurrence of Maricopa Air Quality Department. A 2007 letter to ADEQ from Maricopa Air Quality Department indicates that the Department has a different current interpretation of its Rule 330 that may require air emissions controls at sites where they were previously not required.	Evaluate requirements for air emissions controls at PGAS in light of the 2007 Maricopa Air Quality Department letter.	The concentrations associated with air stripping are lower than the requirements for permitting (3lbs) per Maricopa County APCD.	—

Recommendation 1 Status

Groundwater analytical results obtained from well GAC-04 during 2006-2007 indicated TCE concentrations above the MCL of 5 µg/L. These data were inconsistent with the 1992-1995 results obtained following the mechanical rehabilitation on GAC-04 in 1992. Two Subunit C monitoring wells, GMW-21UC and GMW-22UC were installed in June 2010 in areas down-gradient and up-gradient of well GAC-04. TCE sample results from GMW-21UC and GMW-22UC have been below 1 µg/L or non-detect for over a year. However, TCE concentrations in GAC-04 samples continued to be elevated, especially after extended periods of non-pumping of GAC-04. In January 2012, monitoring well GMW-23UC was installed in the upper Subunit C, approximately 84 feet south-southeast of GAC-04, within the apparent radius of groundwater influence. Groundwater samples collected from GMW-23UC since January 2012 contained TCE at concentrations of less than 0.5 µg/L, well below the MCL for TCE.

Results of several historical and recent rebound tests indicate that production well GAC-04 may be a conduit for migration of TCE-impacted groundwater between Subunit A and Subunit C. Following discussions with the EPA and ADEQ, it was agreed that GAC-04 should be abandoned to remove the potential conduit. Abandonment of GAC-04 was completed in August 2012.

Recommendation 2 Status

GTRC worked with ADEQ to determine the appropriate IC for the former sludge drying beds; however, the purported requirement for use of an engineering control versus an institutional control stalled those discussions. During that time, GTRC submitted to EPA a technical analysis indicating that no contamination remains in the former sludge drying bed areas. EPA will complete evaluation of this report prior to determining the requirement for an IC.

Recommendation 4 Status

Chromium concentrations within several Subunit A active extraction wells has shown little change within the last five years (Haley & Aldrich, Inc., 2014). In 2014, the USEPA completed a study of chromium at the PGAS site to determine if the contamination was natural or anthropogenic in nature. The study concluded that the chromium present was primarily in the form of hexavalent chromium, and that it was likely anthropogenic in origin (Gilbane, 2014). It should also be noted that the report determined some elevation in chromium concentrations due to turbidity.

5.2.2. Work Completed at the Site During this Five Year Review Period

Beginning in 2013, groundwater sampling was conducted using the HydraSleeve® method. A side-by-side study comparing the low-flow method to the HydraSleeve® was conducted at PGAS between February through August 2011. It was concluded that the two methods produced comparable analytical results, and that HydraSleeve® sampling was a viable alternative to low-flow at the site (ITSI Gilbane, 2012).

In March 2013, EPA approved a Comprehensive Groundwater Monitoring Plan (CGMP) to provide guidance for conducting routine groundwater monitoring activities at the Goodyear Tire & Rubber

facility. This CGMP was prepared as a replacement to the previous CGMP in order to update the locations, frequency, and methods for sampling at PGAS.

In January 2014, EPA approved an update to the 2005 PGAS groundwater model in conjunction with an updating of the PGAN groundwater model. This model will provide the basis for optimizing the remediation systems at PGAS. The new model revises the general head boundaries, production history, changes to recharge, and modifications to the hydraulic conductivity arrays.

In 2013, Goodyear Tire and Rubber Company began an investigation of chromium in Subunit C and TCE down gradient of the contaminant plume in the northern area of the PGAS.

5.3. Phoenix-Goodyear Airport Sitewide

5.3.1. Previous Five-Year Review Protectiveness Statement and Issues

The protectiveness statement from the 2010 FYR for the Phoenix-Goodyear Airport Sitewide stated the following:

> *The remedy at PGAN and PGAS is not protective. At PGAN, the contaminant plume is expanding along several of its boundaries. There is an unknown conduit of TCE contamination from the Subunit A to the Subunit C. At PGAS, the extent of contamination is not fully defined in the northern plume. There is also an undefined source of TCE contamination at GAC-04 in the Subunit C zone. Production wells tap into the Subunit C zone in the area known to have PGAN and PGAS contamination.*

The 2010 FYR included the two issues and recommendations listed in Table 5-3. Each recommendation and its current status is discussed below.

Table 5-3. Status of Recommendations for PGA Sitewide from the 2010 FYR

Issues from previous FYR		Recommendations	Action Taken and Outcome	Date of Action
1	The separate evaluation of the PGAN and PGAS data may not be providing a complete picture of possible threats to the City of Goodyear wells.	Conduct GW investigation of area between PGAN and PGAS to gain understanding of groundwater sitewide.	Investigations and outcomes are described below.	2011 and 2012
2	At PGAN, PGAS, and the Western Avenue Water Quality Assurance Revolving Fund (WQARF) site, ground water sampling and water level measurement events are not conducted on a coordinated schedule. There is also a question about whether the water level data between the PGAN, PGAS, and Western Avenue WQARF site are comparable.	Twice per year, parties conduct GW gauging and sampling at same time for wells at all three sites.	Wells across three sites were sampled at the same time.	2011 and ongoing

Recommendations 1 and 2

To resolve these issues, EPA took the following actions in the Area Between the Sites (ABS) as described in a Technical Memorandum to EPA Region 9 (ITSI Gilbane, 2013):

- Key wells were resurveyed so that water levels for all three sites would be comparable and could be shown on the same map.
- Groundwater contouring maps using data from four quarters of monitoring were constructed to show the groundwater flow directions and gradients for both Subunit A and Subunit C in the ABS to better understand groundwater conditions.
- Key wells were sampled for geochemical analysis, as well as oxygen and hydrogen isotopes to help distinguish (1) Subunit A water from Subunit C water in the ABS, (2) Subunit A water from the three sites, and (3) Subunit C water from PGAN and PGAS sites.
- An evaluation of historical contaminant concentrations for the ABS was completed.

EPA determined that:

1) In Subunit A, groundwater from the Western Avenue Water Quality Assurance Revolving Fund (WQARF) Site primarily flows to the west toward the PGAS Site, and a portion of groundwater flows north toward the southeast area of the PGAN Site.
2) Reinjection of treated groundwater near the PGAN Main Treatment System results in groundwater mounding in the injection well field. This mounding changes groundwater flow in all directions in Subunit A in the vicinity, and results in a portion of clean, treated groundwater in Subunit A flowing towards the PGAS extraction system. In addition, a small area of groundwater in the southeast of the injection mounding is contaminated with TCE due to accidental injection of untreated water during the period of 1998 to 2001. The ongoing injection of clean, treated groundwater will force the contaminated groundwater to flow north and northeast, some of which may flow toward extraction well COG-3. EPA approved installation of extraction well EA-10 and injection well IA-09 to address the southeast area of the plume. In addition, installation and operation of infiltration galleries located north of the MTS were approved by EPA to reduce the injection mounding south of the MTS.
3) Subunit C groundwater flows northwest for both PGAN and PGAS. However, Subunit C wells for the two areas are cross-gradient of one another and therefore the TCE plumes are not commingled. There are no Subunit C monitoring wells for the Western Ave WQARF Site.
4) At the southeast area of the PGAN Site, the detectable PCE in groundwater has different origins than the TCE. This conclusion is based on multiple lines of evidence, including evaluating four quarters of groundwater quality sampling results, geochemical and isotope analysis, ground water flow contours, and historical contaminant concentrations which depict when the two contaminants arrived at certain key wells.
5) Geochemical and environmental isotope analyses shows that Subunit A groundwater has significantly different characteristics from Subunit C groundwater in most areas and that Subunit A groundwater for Western Avenue is different from PGAN and PGAS. Where there is not a significant difference, vertical groundwater migration is suggested.
6) The source of TCE and chromium in Subunit C at PGAS is most likely the result of conduit action at GAC-02 and GAC-03.

7) In the ABS, perchlorate in Subunit C wells likely results from conduit action, most probably at COG-5.
8) The most recent monitoring data (August 2012) show that PCE concentrations in monitoring wells are below the MCL (5 µg/L). These low levels of PCE at comparatively shallow depths are not likely to put COG-3 (screened in Subunit C and the MAU) at risk. However, PCE concentrations in the monitoring wells do vary at times and should continue to be monitored to ensure COG-3 is not at risk.

5.3.2. Work Completed at the Site During this Five Year Review Period

In 2013 the USEPA completed the ABS report, as described above.

6. Five-Year Review Process

6.1. Administrative Components

EPA Region 9 initiated the FYR in September 2014 and scheduled its completion for September 2015 The EPA review team was led by Catherine Brown of EPA, Remedial Project Manager (RPM) for the Phoenix Goodyear Airport Superfund Site (Site), and also included the EPA site attorney. In November 2014, EPA held a scoping call with the review team to discuss the Site and items of interest as they related to the protectiveness of the remedy currently in place.

6.2. Community Involvement

On March 10, 2015, a public notice was published in the West Valley View announcing the commencement of the Five-Year Review process for the Phoenix-Goodyear Airport (North and South Areas) Site, providing Catherine Brown's and Carlin Hafiz's contact information, and inviting community participation. The press notice is available in Appendix B.

EPA and ADEQ also discussed the FYR with members of the Community Advisory Group (CAG) through monthly phone calls and at public meetings held on March 17th and 19th.

The Five-Year Review report will be made available to the public once it has been finalized. Copies of this document will be placed in the designated public repository:

Goodyear Branch Library,
14455 West Van Buren Road, Suite C-101,
Goodyear AZ 85338

Superfund Record Center
Mail Stop SFD-7C
95 Hawthorne Street, Room 403
San Francisco, CA 94105

6.3. Document Review

This FYR included a review of relevant, site-related documents including the ROD, remedial action reports, and recent monitoring data. A complete list of the documents reviewed can be found in Appendix A.

6.3.1. ARARs Review

There has been one change to selected Site ARARs that would call into question the protectiveness of the Site remedy. The MCL for arsenic has been lowered from 100 µg/L to 10 µg/L, and arsenic levels at the Site range up to 17 µg/L. This change will need to be addressed in the Site remedy.

The 2010 Five Year Review identified the lack of a remedial cleanup standard for perchlorate. This was addressed in the ROD Amendment issued for PGAN which selected an in-situ perchlorate cleanup standard for PGAN.

There have been no other changes at PGAN or PGAS or changes with chemical standards for Site contaminants that have occurred in the past 5 years that would impact remedy protectiveness.

6.3.2. Human Health Risk Assessment Review

6.3.2.1 PGAN

A human health risk assessment was completed for the Site as part of the Baseline Human Health Risk Assessment (BHHRA) presented in the 1989 ROD, and the 2012 Final Source Areas, Soil, and Facility Structures Baseline Human Health Risk Assessment (HHRA) (AMEC 2012). The BHHRA identified the following as exposure pathways at PGAN:

- Domestic use of groundwater from private wells for potable water supply.
- Inhalation of VOCs from potable water.
- Dermal contact with potable water.

The 2014 ROD Amendment summarizes the findings of the BHHRA, HHRA, and the September 2005 Air Sampling Report (ARCADIS 2005). It concludes that the identified exposure pathways remain incomplete, and that no significant risk was identified for subsurface to indoor air exposure. It also indicates that, in general, the conclusions associated with the 2012 HHRA were consistent with the following BHHRA findings from the 1989 ROD and the 2005 indoor sampling results:

- Source area groundwater is being actively remediated and the baseline evaluation of this hypothetical worst-case exposure scenario suggests that in-site groundwater is not currently suitable for use as tap water because TCE and perchlorate concentrations exceed the cleanup levels identified.

- Predicted exposures to volatile chemicals in indoor air of future buildings, using data collected from 2005 to 2011, are within or below the acceptable risk range and below the acceptable hazard index for future indoor commercial/industrial workers. This indicates that the SVE system has been successful at reducing potential health risks (predicted risk and hazard indexes) in the source area.

- Predicted exposure to soil is within CERCLA risk management range ($1x10^{-4}$ to $1x10^{-6}$) for potential trespassers, future construction workers, and future outdoor commercial/industrial workers.

Conditions at PGAN have not changed since the 2014 ROD Amendment was completed.

Vapor Intrusion: Vapor Intrusion was investigated in City of Goodyear City Hall and Administrative buildings located on property north and east of the former Unidynamics property. Three buildings were sampled in February 2005 and all samples were non-detect. (Arcadis 2005).

Toxicity values: EPA's Integrated Risk Information System (IRIS) has a program to update toxicity values used by the Agency in risk assessment when newer scientific information becomes available. In the past five years, there have been a number of changes to the toxicity values for certain contaminants of concern at the Site. EPA's Regional Screening Levels (RSLs) are chemical-specific concentrations for individual contaminants that correspond to an excess cancer risk level of $1x10^{-6}$ (or a Hazard Quotient of 1 for non-carcinogens), and they have been developed for a variety of exposures scenarios (e.g., residential, commercial/industrial). The RSLs are not de facto cleanup standards for a Superfund site, but they do provide a good indication of whether actions may be needed. Comparing the ROD remediation standards to RSLs can be helpful in determining whether response actions may be needed to address potential human health exposures. RSLs are determined using the most recent toxicity values. 6.41 illustrates how toxicity value changes may affect protectiveness for COCs at the PGA Superfund Site.

Table 6-1. Summary of Groundwater Regional Screening Levels (January 2015) for COCs at PGAN.

Contaminant of Concern	Current Cleanup Level (µg/L)	EPA RSLs, Residential Tapwater, all pathways (µg/L)			Federal MCL (µg/L)	Current Cleanup Level Within Risk Range?
		Cancer	Protective Cancer Risk Range	Non-Cancer		
1,1-Dichloroethene	7	—	—	280	7	Yes
1,2-Dichloropropane	1	**0.44**	0.44 - 44	8.3	5	Yes
Chloroform	100	**0.22**	0.22 – 22	**97**	80[a]	**No**[c]
Toluene	1,000	—	—	1,100	1,000	Yes
Trichloroethylene	5	**0.49**	0.49 – 49	**2.8**	5	Yes
Trichlorofluoro-methane	1	—	—	1,100	—	Yes
Carbon Tetrachloride	5	**0.45**	0.45 – 45	49	5	Yes
Methylene Chloride	1	11	11 – 1,100	110	5	Yes
Methyl Ethyl Ketone	350	—	—	5,600	—	Yes
Xylenes	440	—	—	**190**	10,000	Yes
Antimony	1.46	—	—	7.8	6	Yes
Arsenic	50	**0.052**	0.052 – 5.2	**6**	10	**No**[d]
Barium	2,000	—	—	3,800	2,000	Yes
Beryllium	0.004	—	—	25	4	Yes
Cadmium	5	—	—	9.2	5	Yes
Chromium	(total) 100	(III) – (VI) **0.035**	(III) – (IV) 0.035 – 3.5	(III) 22,000 (VI) **44**	(total) 100	Yes
Lead	15	—	—	15	15	Yes
Mercury	2	—	—	**0.63**	2	Yes
Nickel	100	—	—	390	—	Yes
Selenium	50	—	—	100	50	Yes
Silver	50	—	—	94	—	Yes
Zinc	5,000	—	—	6,000	—	Yes
Acetone	700	—	—	14,000	—	Yes
Benzene	5	**0.45**	0.45 – 45	33	5	**No**[c]
Ethylbenzene	700	**1.5**	1.5 – 150	810	700	Yes
Tetrachloroethylene	5	11	11 – 110	41	5	Yes
1,1,2,2,-Tetrachloroethane	0.18	**0.076**	0.076 – 7.6	360	—	Yes
Perchlorate	14	—	—	14	b	Yes

[a] There is no federal MCL for chloroform. The listed MCL is for Total Trihalomethanes, a class of chemicals that includes chloroform.
[b] There is no federal MCL for perchlorate. EPA is in the process of developing an MCL for perchlorate under the Safe drinking Water Act.
[c] The MCLs for chloroform (trihalomethanes) and ethylbenzene have been lowered by EPA; Although Site cleanup levels have not been updated from 1989 ROD, all monitoring data is non-detect for those compounds.
[d] The MCL for arsenic has been lowered by EPA since Site cleanup levels were set; background levels of arsenic should be determined for the Site (see Issues).
Note: Values shown in **bold** are lower than the current cleanup level.

As shown in Table 6-1, current cleanup levels are above tap water multi-pathway RSLs for eleven COCs: 1,2-dichloropropane, chloroform, TCE , carbon tetrachloride, xylenes, arsenic, chromium, mercury, benzene, ethylbenzene, and 1,1,2,2,-tetrachloroethane. Of all the RSLs established by EPA, the applicable RSLs for PGAN are for tap water multi-pathway because the exposure pathways identified for PGAN are all related to potable water (i.e., tap water) and are concerned with several exposure pathways (ingestion, inhalation, dermal contact).

For cancer risk, EPA uses a lifetime excess cancer risk range between 10^{-4} and 10^{-6} for assessing potential exposures. Cleanup levels for nine of the COCs are above their respective cancer RSL; however, cleanup levels for five of those COCs are still within EPA's protective excess cancer risk range of 10^{-4} to 10^{-6} and are therefore considered protective. The cleanup levels for the other four COCs (chloroform, arsenic, chromium, and ethylbenzene) are above the upper bound of EPA's protective excess cancer risk range, and are discussed in more detail below.

For non-cancer risk, six COCs have cleanup levels that exceed the associated non-cancer RSL. Any concentration below the non-cancer RSL indicates that no adverse health effect from exposure is expected. Concentrations above the non-cancer RSL may indicate an increased potential of non-cancer effects. Although the cleanup level set for these six constituents are above the non-cancer RSL, EPA considers their respective MCL for each constituent as promulgated under the Safe Drinking Water Act to be protective for non-cancer effects. Four of the COC's above their non-cancer RSL have current cleanup levels equal to or below their respective MCL, and therefore are considered protective. Cleanup levels for the remaining two constituents (chloroform and arsenic) are above their respective MCLs and are discussed in more detail below.

Chloroform. According to IRIS, the toxicity data for chloroform was last updated in 2001. Both the cancer (0.22 µg/L) and non-cancer (97 µg/L) RSLs for chloroform are less than the current cleanup level (100 µg/L). Furthermore, the cleanup level exceeds both the acceptable excess cancer risk range of 0.22 to 22 µg/L and the surrogate federal MCL (80 µg/L).

Since 2010 (the last FYR), chloroform has been predominantly non-detect (64% of 5,879 samples). The maximum detected concentration of chloroform was 14 µg/L (reported in 2010). This concentration is below the cancer risk threshold and the current surrogate federal MCL. Although the current cleanup level is outside EPA's acceptable risk range, the remedy is still protective because concentrations are well below the risk range.

Arsenic. According to IRIS, the toxicity data for arsenic was last updated in 1995. Both the cancer (0.052 µg/L) and the non-cancer (6 µg/L) RSLs for arsenic are less than the current cleanup level (50 µg/L). Furthermore, the cleanup level exceeds both the acceptable excess cancer risk range of 0.052 to 5.2 µg/L and the federal MCL (10 µg/L). EPA will assess the need for a new cleanup level for arsenic.

Groundwater sampling results from 2008 show that arsenic concentrations range from 6.5 to 12 µg/L, which is below the current MCL cleanup level for PGA.

Chromium. There is currently no MCL specific for hexavalent chromium; however, there is a federal MCL for total chromium at 100 µg/L (ppb). This total chromium MCL assumes that the majority of chromium in drinking water is in the hexavalent state. In 2010, EPA updated its RSLs for hexavalent chromium. The current hexavalent chromium RSL for tap water ingestion is 0.035 µg/L (ppb). The U.S. EPA IRIS program is conducting its own re-assessment of the toxicity of hexavalent chromium and EPA has committed to revise the chromium MCL upon completion of the IRIS re-assessment.

Recent groundwater sampling as part of SASFS reported chromium as nondetect and therefore the remedy is protective.

Ethylbenzene. According to IRIS, the toxicity data for ethylbenzene was last updated in 1991. The cancer RSL (1.5 µg/L) is below the current cleanup level (700 µg/L); however, the non-cancer RSL (810 µg/L) is not. Furthermore, the cleanup level exceeds the acceptable cancer risk range of 1.5 to 150 µg/L.

Since 2010, ethylbenzene has been almost entirely non-detect (99.8% of 5,572 samples). The maximum detected concentration of ethylbenzene was 72 µg/L (reported in 2014). This concentration is below the cancer risk threshold and the current MCL. Therefore, the change in toxicity for ethylbenzene does not affect protectiveness.

6.3.2.2 PGAS

A human health risk assessment was completed for the Site as part of the 1989 ROD. The risk assessment identified the exposure pathways at PGAS as the following:

- Groundwater; Current Residential Ingestion and Inhalation
- Groundwater; Future Residential Ingestion
- Air; Current and Future Occupational Inhalation

The overall future residential risk resulting from groundwater exposure could be as much as 4×10^{-3} to 9×10^{-4} based on the maximum-reported and average concentrations of carcinogens detected in groundwater at the site. For PGAS, the estimated excess life-time cancer risk as a result of groundwater ingestion could go as high as 1×10^{-4} based on the maximum reported TCE concentration in groundwater. Also for PGAS, the daily intake of chromium in groundwater exceeded the acceptable intake-chronic, reference dose, and/or acceptable intake-subchronic values for ingestion exposures, assuming chromium is in the hexavalent species.

<u>Vapor Intrusion</u>: EPA's understanding of contaminant migration from soil gas and/or groundwater into buildings has evolved over the past few years leading to the conclusion that vapor intrusion may have a greater potential for posing risk to human health than was assumed when the ROD was prepared. The potential for vapor intrusion is evaluated following a "multiple lines of evidence" approach consistent with EPA's June 2015 "*Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air*"

A vapor intrusion assessment was completed for PGAS in September 2007. The assessment used soil gas data from 1993 through 1999 to model vapor intrusion at PGAS. The modeling identified six areas that could have potential concentrations of TCE in soil gas above the risk-based concentrations (RBCs) calculated to a target cancer risk of 1×10^{-5}. After the six areas were identified more specific modeling was

performed that included specific information, such as actual building size, soil type and sampling depth. This modeling demonstrated that there were no areas that exceeded the RBC for TCE. In reviewing the results, EPA disagreed with the modeling approach and some of the assumptions incorporated into the model, and requested a Site inspection to identify areas and buildings of potential concern.

In April 2007, a site inspection was conducted and various buildings were inspected. In general, the inspection included visual observations of the location, use, and the HVAC system configuration for each building. Observations from the site inspection generated both situational observations of the Site characteristics and specific challenges to the model used to assess the potential for vapor intrusion. The primary issues identified during the Site inspection were:

1) Most of the HVAC units do not provide fresh make-up air to building interiors. The lack of make-up air creates exchange rates that are much lower than those used in the previous modeling, indicating that the model underestimated the potential for buildup of vapors inside buildings.
2) Other buildings are either passively ventilated or unoccupied, reducing the potential for exposure to vapors. These buildings may need to be re-evaluated if their uses or configurations change in the future.
3) Some of the buildings may be under a slight negative pressure, which could draw vapors into the buildings.
4) Use of HVAC systems varies during the year, including cooling during the summer, heating during the winter, and minimal use during fall and spring. The air exchange rates likewise vary depending on the amount of HVAC use and the amount of make-up air.
5) The configuration of HVAC systems for older buildings to include make-up air is not enforceable, so any solution or assessment must not rely on HVAC adjustments. In addition, some building occupants control their own ventilation and may not maintain fresh air intake.
6) Building 1/2 was modeled as a single structure, but it is actually made up of several smaller spaces within the large hangar building. The different types of occupied spaces require more detailed modeling than has been performed to date.

As a result of the Site inspection an indoor air quality investigation was performed at buildings and included a sampling program based on Site conditions, including building size, use and occupancy; current HVAC configuration and use; seasonal variation in HVAC use; and other factors. Sampling for TCE, cis-1,2-dichloroethene and vinyl chloride was performed at 5 buildings. Results from sampling were compared to ambient air data and RBCs. TCE was only detected in and around the southwest corner of Building 1/2. All concentrations were below EPA Region 9 PRG Screening Levels. In June 2015, EPA finalized its guidance to identify and consider key factors for assessing the potential for vapor intrusion, *OSWER Technical Guidance for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air* (OSWER Publication 9200.2-154).

Toxicity values: The same COCs and toxicity values apply for PGAS as for PGAN; see Table 6-1 which illustrates how toxicity value changes may affect protectiveness for PGAS as well as PGAN.

The toxicity discussion presented for PGAN provides further detail on the toxicity analysis, which resulted in four COCs (chloroform, arsenic, chromium, and ethylbenzene) requiring further discussion.

Toxicity information for these chemicals is also detailed in the previous section; only information specific to PGAS is presented below.

Chloroform. During the period January – June 2014, 139 groundwater samples were collected at PGAS were analyzed for chloroform. Of these 48 (35%) were non-detect, and the average detected concentration was about 0.8 µg/L. The maximum detected concentration was 23 µg/L, however the second highest concentration was 1.6 µg/L. All chloroform concentrations, except the one maximum concentration, are well below the cancer risk range and the surrogate federal MCL, and the maximum concentration is only slightly above the cancer risk range and still well below the surrogate federal MCL. Although the current cleanup level is outside EPA's acceptable risk range, the remedy is still protective because concentrations are well below the risk range.

Arsenic. Only one groundwater sample that was tested for arsenic was available for this review period. This was collected in February 2012 and had a concentration of 17 µg/L. This concentration is above the cancer risk range and above the federal MCL. A revised cleanup level for arsenic may be needed to ensure the protectiveness of the selected remedy.

Chromium. In 2014, the USEPA prepared a technical memorandum summarizing the chromium groundwater study at PGAS (Gilbane, 2014). This report concluded that chromium at PGAS is predominantly in the form of hexavalent chromium, except in a few wells with high turbidity where chromium was predominantly trivalent.

From January-June 2014, 85 groundwater total chromium samples were collected at PGAS. Of these only 3 were non-detect (4%). The maximum concentration detected was 1,300 µg/L and a total of 24 samples (representing 9 of 37 sampled wells) were above the cleanup level and MCL of 100 µg/L. A revised cleanup level for chromium may be needed to ensure the protectiveness of the selected remedy.

Ethylbenzene. Ethylbenzene has been entirely non-detect in recent years (data available from February through December 2012, and July 2013 through June 2014). Therefore, the remedy is still protective.

6.3.3. Ecological Review

6.3.3.1 PGAN

In 2013, Crane Co. conducted an ecological risk assessment review, which is documented in the Final Source Areas, Soil, and Facility Structures Screening Level Ecological Risk Assessment (AMEC, 2013a). A summary of this assessment is presented below.

No complete exposure pathways exist for untreated groundwater, so exposures to untreated groundwater were not evaluated. For soil vapor, 21 VOCs were detected but all were below their corresponding ecological screening values and so were not identified as contaminants of potential ecological concern (COPECs). For soil, 63 analytes were detected within ecologically accessible soil (0-6 ft. depth). These were screened based on background concentrations, established screening levels for ecotoxicity, and frequency of detection. Following this screening, 11 analytes were identified as COPECs. Two of these 11 COPECs were removed from further consideration based on low hazard quotients from the initial ecological risk evaluation. The remaining nine COPECs were retained for a refined ecological risk

evaluation which resulted in low hazard quotients. An analysis of uncertainties in the refined risk evaluation found that estimations of exposure and potential toxicity were based on conservative assumptions of exposure concentration, bioavailability, bioaccumulation, and toxicological threshold. Therefore, it was concluded that the resulting hazard quotients likely overestimated the potential for risk to ecological populations and therefore the conditions at PGAN do not represent a potential for ecological risk.

Conditions at the Site have not changed since this ecological risk assessment was completed.

6.3.3.2 PGAS

In 2008, GTRC completed *Phoenix-Goodyear Airport South Site Screening-Level Ecological Risk Assessment* (TRC, 2012). Five areas at PGAS were identified as needing an ecological risk evaluation: the former chromium sludge drying beds, the airport drainage ditch near Outfall 001, the former sewer treatment plant, the former paint tent area, and the hangar apron area. The hangar apron is completely paved, therefore no complete exposure pathways for terrestrial receptors are present, and therefore no further assessment was completed for this area. Contaminants evaluated for potential ecological risk were cadmium and chromium. The initial screening, using maximum soil concentrations, resulted in possible cadmium exposure risk for avian and mammalian insectivores, and possible chromium exposure risk for avian and mammalian insectivores, avian herbivores, and mammalian carnivores. The initial screening was then refined using mean soil concentrations and refining the exposure routes. The refined screening concluded that no significant potential risks to ecological receptors were identified at the five areas of concern for both cadmium and chromium.

In 2014, a survey of burrowing owls – due to their status as 'Threatened' under Endangered Species Act (ESA) – was conducted at PGAS. During the two field surveys in August and September, a total of 14 burrowing owls were observed (10 adult and 4 juvenile) and 12 active burrows were identified. As a result, the treatment system piping trench was realigned do allow for a 100 foot buffer around each burrow identified as required by ESA.

6.4. Data Review

6.4.1. PGAN

6.4.1.1 Groundwater Quality Monitoring

Data review for the PGAN site is based on the draft Groundwater Monitoring Report - Fourth Quarter 2014 and 2014 Annual Report, dated January 2015, and the Second Five-Year Review Report, 2010. Groundwater samples are collected at the PGAN site in accordance with the Final Groundwater Monitoring Work Plan (Matrix 2009). Currently, groundwater quality is monitored for 20 target volatile contaminants of concern and perchlorate identified in the ROD, subsequent ESDs, and the amended ROD, dated September 2014. On-going monitoring at PGAN is primarily focused on TCE and perchlorate. Metals such as cadmium, lead, arsenic, and nickel were identified as COCs in the 1989 ROD. However, there is a lack of recent data on trace metals other than chromium in groundwater.

6.4.1.2 Subunit A

Potentiometric contours for groundwater in Subunit A at PGAN are based on data from the fourth quarter of 2014 and include any effects from the groundwater extraction and injection operations associated with the ongoing remedy. The groundwater flow direction in Subunit A north of Interstate-10 tends toward the northeast due to pumping at local supply wells but groundwater pumping at extraction well 33A creates a localized groundwater flow to the northwest. The groundwater in Subunit A south of I-10 flows toward the north. A groundwater capture analysis (AMEC, 2013b) demonstrated that the TCE plume is being captured in all but one section of Subunit A. The northern extent of the PGAN Site appears to have a small gap in capture between extraction wells EA-08 and 33A. Continuing development of EA-08 to steady-state conditions may achieve full capture of the northwest section of Subunit A. In addition, reinjection of groundwater using new injection wells IA-07 and -08 provides a hydraulic barrier to help contain the portion of the TCE plume near extraction wells 33A and EA-08.

Figure 6-1 compares the TCE plume in Subunit A at the time of the previous Five-Year Review at PGAN with the 2014 TCE plume. The TCE plume contains two areas where concentrations exceed 100 µg/L, one, which is located north of I-10 and the other south of I-10. North of I-10, the footprint of the plume greater than 5 µg/L appears to have migrated to the southwest by 1000 feet away from production wells, and the plume south of I-10 has widened to the east by 1500 feet since the last five-year review. Plume footprints representing TCE concentrations greater than 100 µg/L have also changed since the last five-year review. The plume of TCE with concentrations greater than 100 µg/L north of I-10 is now smaller by approximately half the size. Some of these apparent plume changes are due to the significant number of new monitoring wells in use since the last Five-Year Review. In the southern part of the plume, south of I-10, TCE results have decreased significantly likely due to the proximity of EA-09. For example, TCE concentrations in well MW-12 have decreased from 1,900 µg/L in 2009 to 190 µg/L in 2014. However, a significant increase from 860 µg/L (field duplicate) in 2009 to 4,320 µg/L in 2014 has been shown in well MW-07. This increase may be a result of a shift of the plume axis to the east, but the 2014 values are lower than historical values. The plume footprint representing TCE concentrations greater than 100 µg/L has migrated northward by approximately 2000 feet.

A comparison of the perchlorate plume in Subunit A at the time of the previous Five-Year Review at PGAN with the 2014 perchlorate plume is shown in Figure 6-2. In 2014, perchlorate in Subunit A remained limited to a narrow plume extending east and north of the former UPI facility. The plume appears to be decreasing and migrating to the west. Perchlorate concentrations have increased since the last Five-Year Review in the certain wells from which data is used to define the plume; the average concentration at well MW-03 increased from an estimated concentration of 2.2 µg/L in 2009 to 92 µg/L in 2014. Peak concentration at well EA-01 was 76 µg/L in 2014 with sampling from this well in 2009 showing concentrations from 8.9-9.1 µg/L. It is understood that the increases in perchlorate concentration in on-sight wells may be the result of the irrigation and infiltration field.

The plume representing TCE concentrations greater than 100 µg/L in the north has shrunk likely due to the influence of EA-05, and a separate high TCE concentration plume, located south and across I-10, has migrated northward. The overall perchlorate plume size in Subunit A has decreased and migrated to the west.

6.4.1.3 Subunit B, C, and MAU

Groundwater flow direction fluctuated from north to northeast for 2013 through 2014. The fluctuation in flow direction can be attributed to the extraction of groundwater from wells. The variability of groundwater flow directions at any given time within Subunit C is a reflection of the aquifer dynamics that are related to the pumping schedules of nearby water supply wells.

Typically, the groundwater elevations in Subunit A are higher than groundwater elevations in Subunit C. This, in addition to other lines of evidence such as geochemical data, suggests that Subunit B is present across the Site and impedes the vertical flow of groundwater.

Samples were collected at 149 locations during the December 2013 through November 2014 period. These wells included monitoring wells, remediation system extraction wells, domestic supply wells, and irrigation supply wells.

Figure 6-3 depicts the TCE plume in Subunit B, C, and MAU at the time of the previous Five-Year Review at PGAN while Figure 6 – 4 depicts the 2014 TCE plumes. The footprint of the plume with TCE concentrations greater than 5 µg/L has decreased in size since the last Five-Year Review. The 2014 plume did not otherwise indicate migration since 2009. Some of these apparent plume changes are due to the significant number of new monitoring wells in use since the last Five-Year Review. The western extent of the Subunit C plume is not yet fully defined and additional Subunit C monitoring wells are planned. TCE results were as high as 760 µg/L in 2014 at this location. EPA MW-6C is directly south of EPA MW-3C and had TCE concentrations ranging from 11-13 µg/L. Well COG-11 is located approximately 0.75 miles southwest of EPA MW-6C. At this point there does not appear to be any risk to Well COG-11. A Mann-Kendall test for trend of the groundwater TCE at this well determined a stable short-term trend. Activities are planned to define the western extent of the Subunit C plume. A new well (EPA MW-25C) is planned west of EPA MW-11C in the *2015 Addendum to the Final Remaining Wells Groundwater Investigation work plan* by AMEC Foster Wheeler dated April 17, 2015.

Figure 6-5 depicts the perchlorate concentrations in Subunit B, C, and MAU at the time of the previous Five-Year Review at PGAN while Figure 6-6 and Figure 6-8 depict the 2014 perchlorate concentrations. The presence of perchlorate in Subunit C in concentrations slightly greater than 14 µg/L have been observed in one well in 2014 (EPA MW-3C) and in one well (MW-29) in the previous five-year review.

Well COG-3 is not at risk at this time for TCE and PCE (ITSI Gilbane, 2013). A review of the monthly analytical results for this well shows non-detect for TCE, and PCE concentrations between non-detect and 3.1 µg/L, from 2001 to 2013. The recent increases in TCE concentrations at EPA wells MW-7A and EPA MW-10A make it critical to continue monitoring the TCE plume movement in this area and evaluating the risk of contamination reaching COG-3. (ITSI Gilbane, 2013)

6.4.1.4 Soil Vapor Extraction Operations

A Phase I Soil Gas Investigation was conducted in January 2010 in six soil borings, AB-1, AB-2, AB-3, AB-4, AB-5, and AB-6 (AMEC Geomatrix, Inc., 2011). The borings are located on the north side of the former Unidynamics Phoenix Inc. facility. Of the 53 depth-discrete soil gas samples collected for

analysis of VOCs during the Phase I Soil Gas Investigation, TCE was detected in soil gas samples from all six borings. However, detected concentrations of TCE in soil gas generally increased with depth and were highest near groundwater. This suggests that the extent of soil gas contamination is limited to off-gassing of contaminants from the impacted groundwater at the Site.

In September 2011, pneumatic well logging was conducted to test for soil permeability and contamination distribution within six SVE wells (Matrix, 2013). See Recommendation Status No. 3 in Section 5.1.1 for additional information. Based on evaluation from rebound testing, EPA concluded that:

- Continued operation of the SVE system at the Site has resulted in a steady decline in the mass removal rates of TCE,
- Mass removal has also been observed as the result of remaining VOC mass being isolated in low permeability areas of the vadose zone or areas where contaminated groundwater underlie active SVE and is subject to removal being restricted by limitations associated with molecular diffusion.
- The Site is highly constrained from cleanup by mass transfer limitations.

6.4.2. PGAS

6.4.2.1 Groundwater Quality Monitoring

A data review for PGAS is based on the First Semiannual Groundwater Monitoring Report – 2014 (Haley & Aldrich, Inc., 2014), First Semi-Annual 2010 Groundwater Monitoring Report (Los Alamos Technical Associates, 2010), and the technical memorandum, Groundwater Investigation for the Area Between the Phoenix-Goodyear Airport North and South Areas and the Western Ave Water Quality Assurance Revolving Fund Site (ITSI Gilbane, 2013). Metals such as cadmium, lead, arsenic, and nickel were identified as COCs in the 1989 ROD. However, there is a lack of recent data on trace metals other than chromium in groundwater.

6.4.2.2 Subunit A

Hydraulic control in Subunit A is maintained by pumping groundwater from the extraction well network. Pumping rates for these wells typically range from 20 gpm to 100 gpm. Since the groundwater extraction and treatment process began, the TCE isoconcentration contours and potentiometric maps have demonstrated that the TCE plume in the PGAS area is no longer migrating, and that the remediation to date has been effective in reducing the both concentrations and contaminant mass. The plume boundary has historically been well defined from analytical results derived from perimeter monitoring points.

Potentiometric contours for Subunit A at PGAS for the 2014 first semi-annual reporting period are shown in Figure 6-8. These measurements include any effects from the groundwater extraction and injection operations associated with the ongoing remedy. Long-term water levels show declining trends in Subunit A monitoring wells EMW-13, EMW-15, GMW-4, and NEW-01 of approximately 15 to 25 feet from maximum observed water levels in 1993, likely due to a combination of groundwater extraction and long-term drought conditions. Some Subunit A monitoring wells, in particular NEW-1 and EMW-13, exhibit

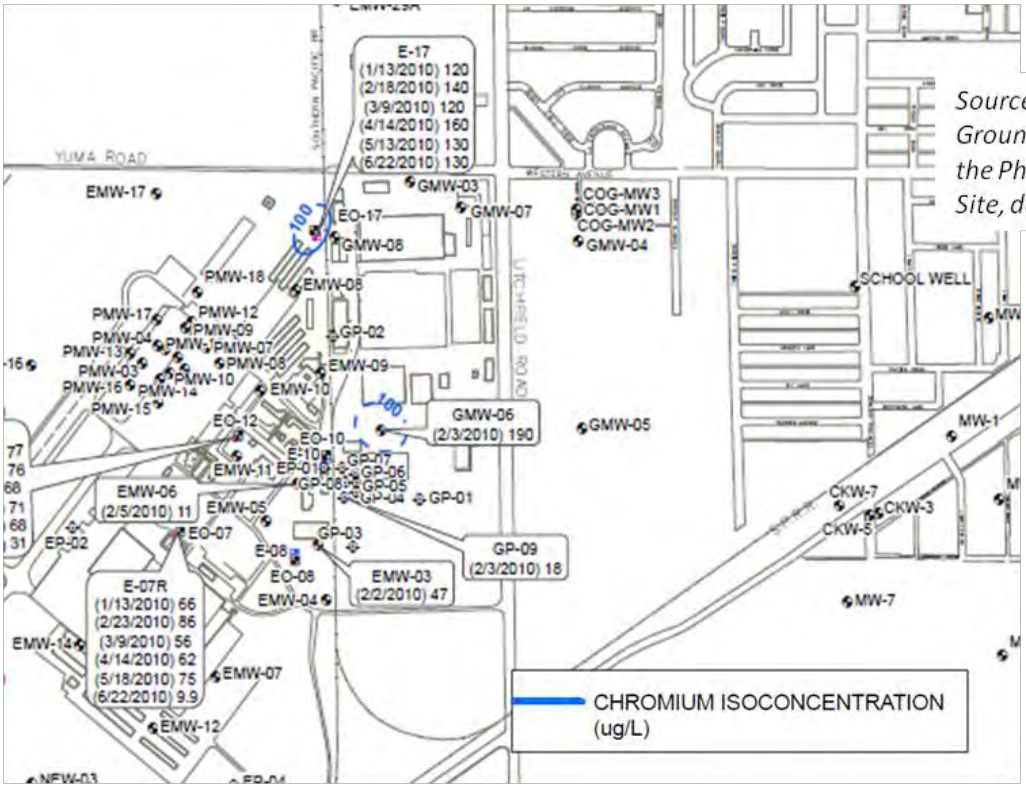
seasonal fluctuations ranging up to 10 feet, possibly due to the influence of groundwater production wells located south of PGAS that are screened across both Subunit A and Subunit C.

Groundwater contour maps, along with geochemical and isotopic evidence, suggest that the PGAN and PGAS Subunit C TCE plumes are not commingled in this area. In the Area between the Sites, Subunit A groundwater flows from the Western Avenue Plume WQARF Site (1) to the west toward PGAS, and (2) to the north toward PGA. Some of the injection water from the MTS Subunit A injection well field flows south to PGAS (ITSI Gilbane, 2013).

Figure 6-9 depicts the TCE plume in Subunit A at the time of the previous Five-Year Review at PGAS and the 2014 TCE plume. In 2014, the 5 µg/L plume remains stable as compared to 2010. With the addition of wells EMW-08R and EMW-10R, the 50 µg/L contours has been redefined further northeast as compared to 2010. Figure 6-10 shows a time history of TCE concentrations in select wells screened in Subunit A.

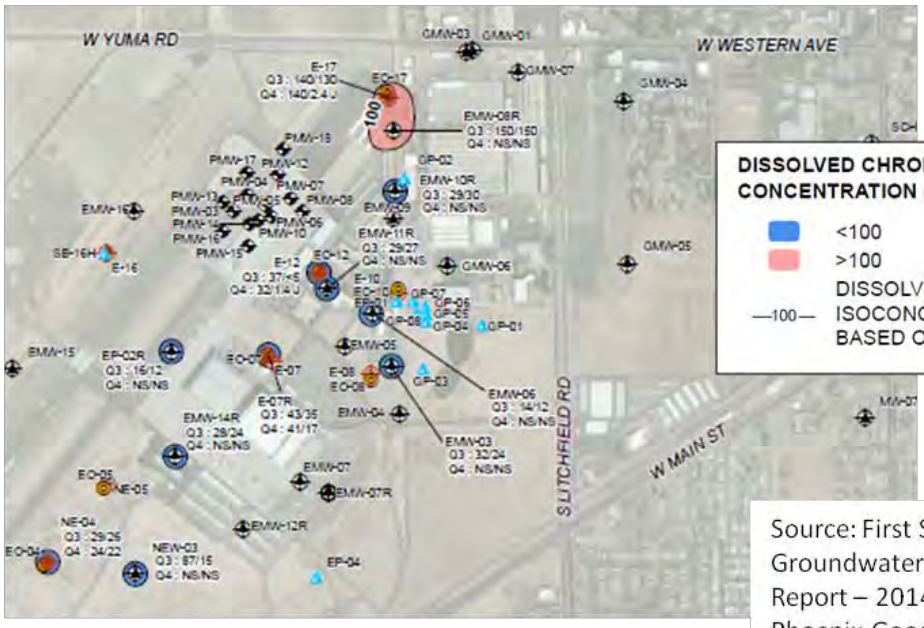
Figure 6-11 depicts the chromium plume in Subunit A at the time of the previous Five-Year Review at PGAS and depicts the 2014 chromium plume. Chromium concentration in three extraction wells (NE-02, E-07R, and E-12) at the site over the past five years has steadily and significantly decreased. Only

the chromium concentration in well E-17 has remained above the 100 µg/L level.



Source: First Semi-Annual 2010 Groundwater Monitoring Report for the Phoenix-Goodyear Airport South Site, dated August, 2010.

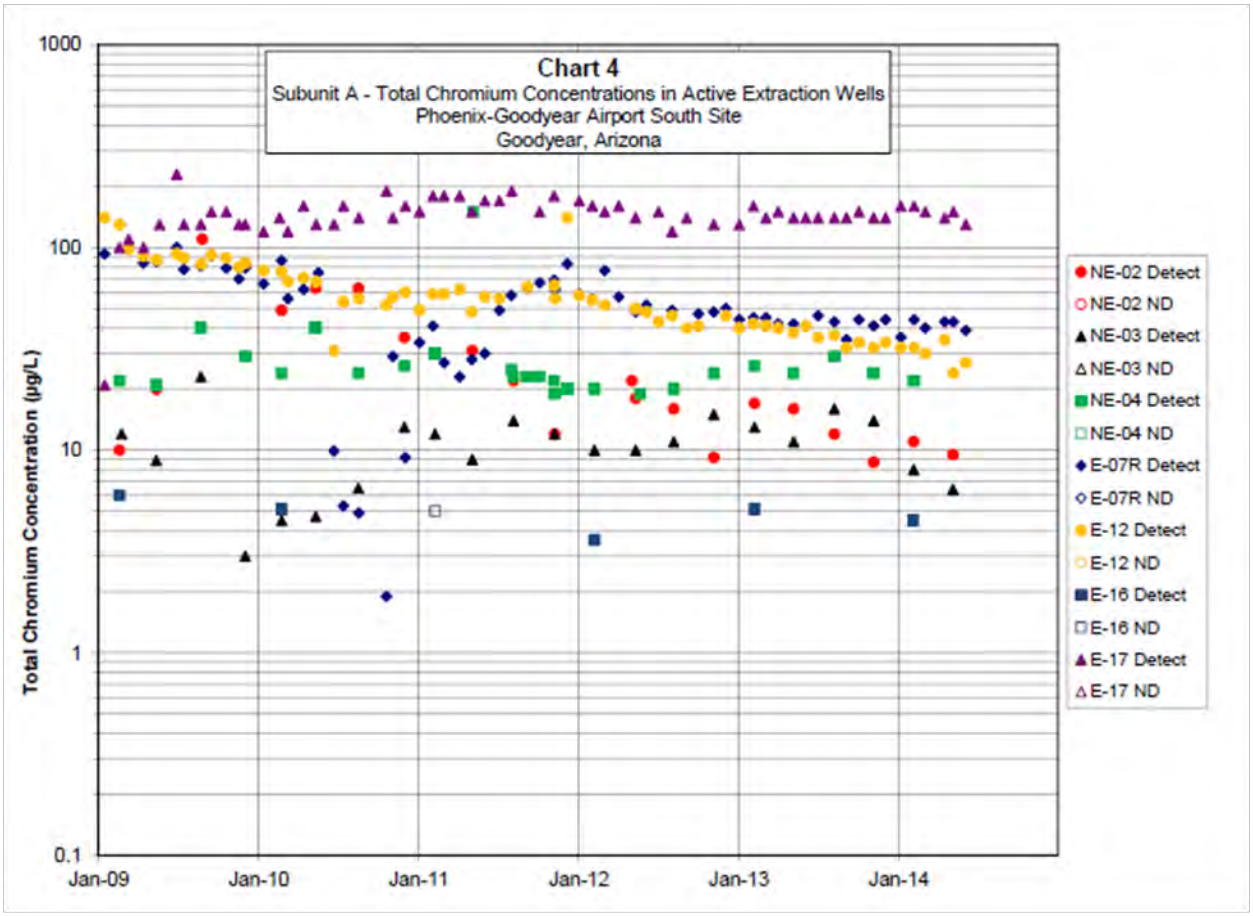
2010 Chromium plume in Subunit A



Source: First Semiannual Groundwater Monitoring Report – 2014 for the Phoenix-Goodyear Airport South Site, August 2014.

2013 Chromium plume in Subunit A

Figure 6-11. PGAS – Comparison of Chromium Concentrations in Subunit A, 2010 and 2014.



Source: First Semiannual Groundwater Monitoring Report – 2014 for the Phoenix-Goodyear Airport South Site, August 2014.

Figure 6-12. PGAS – Time history of Chromium Concentrations in select wells, Subunit A.

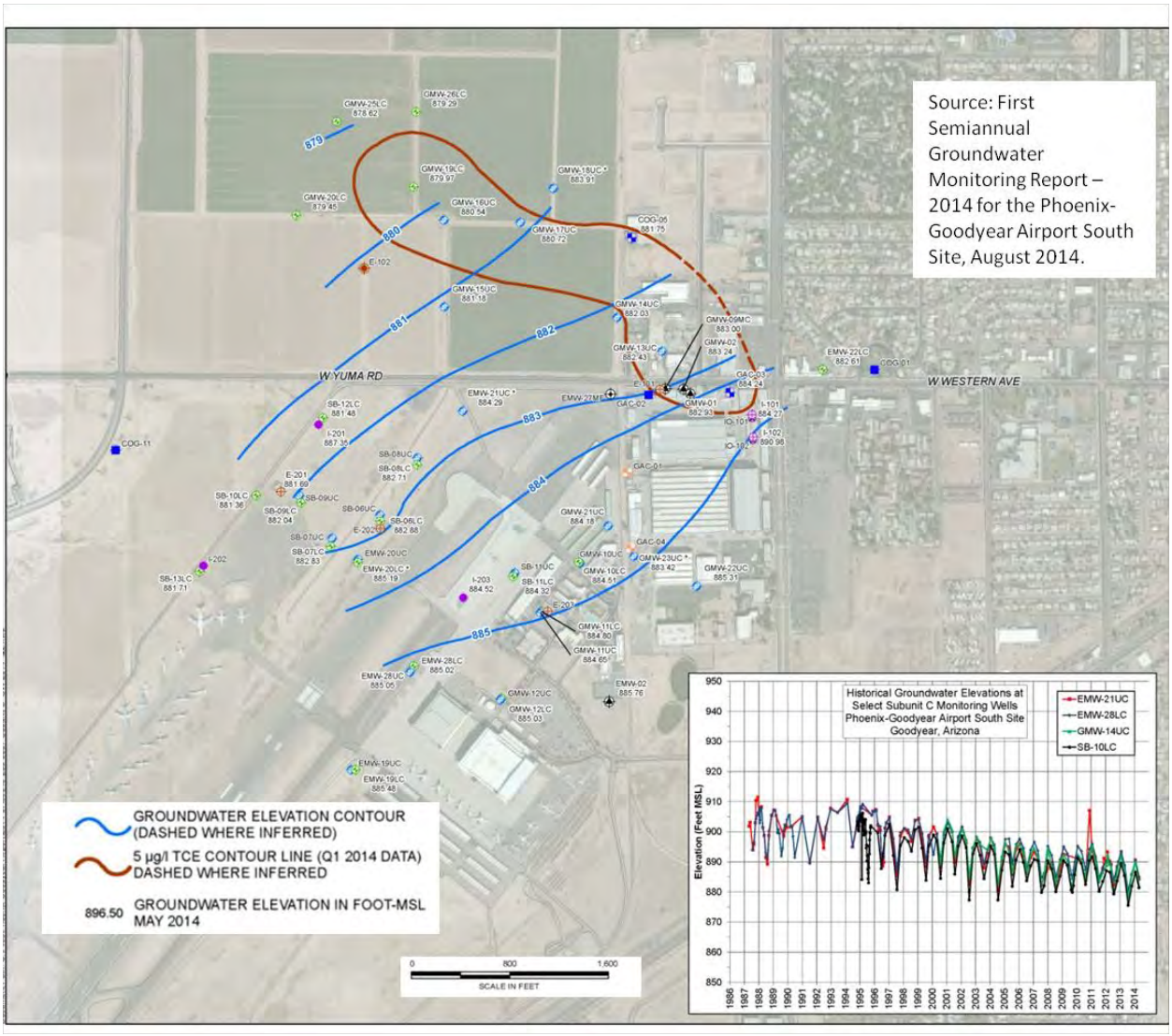
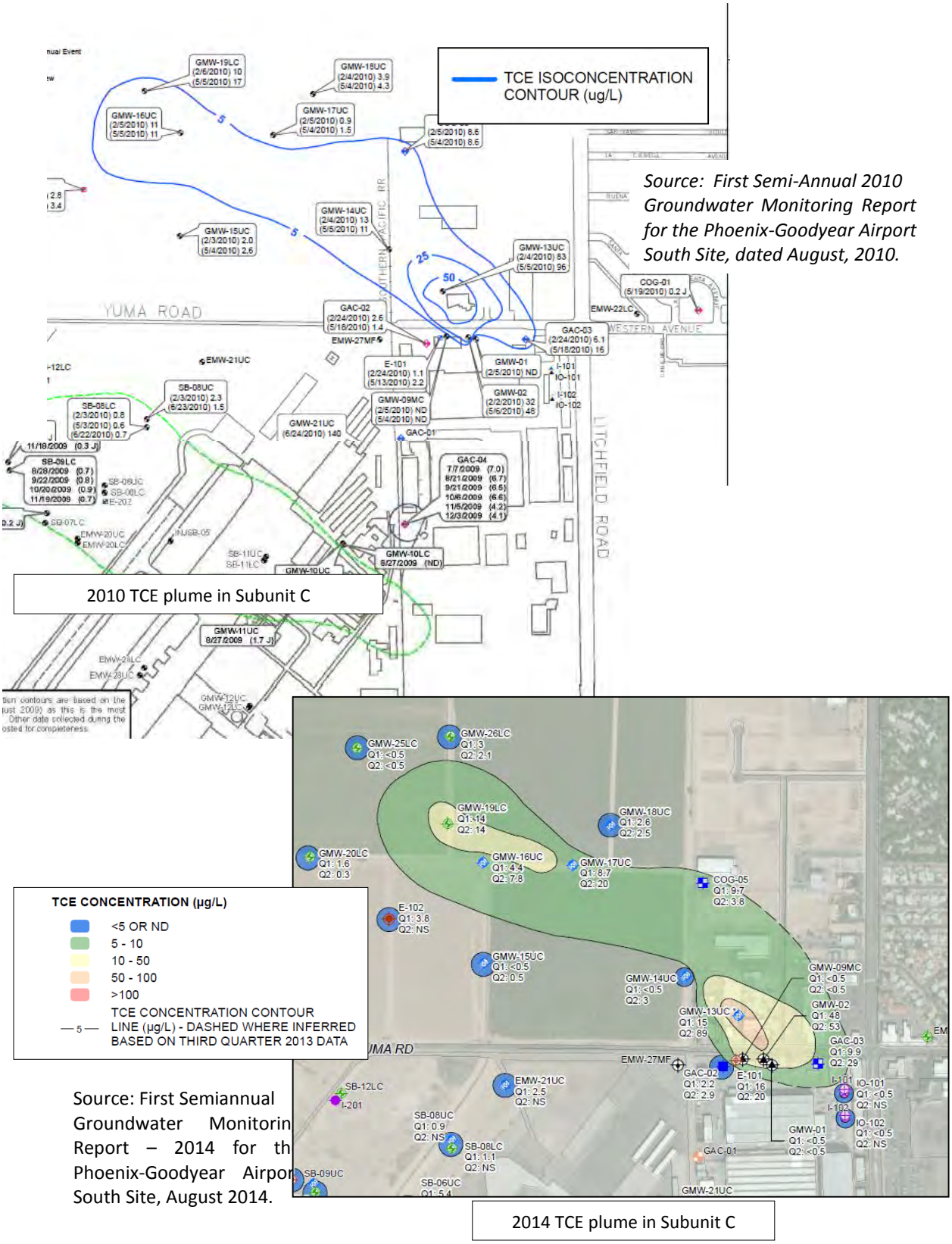


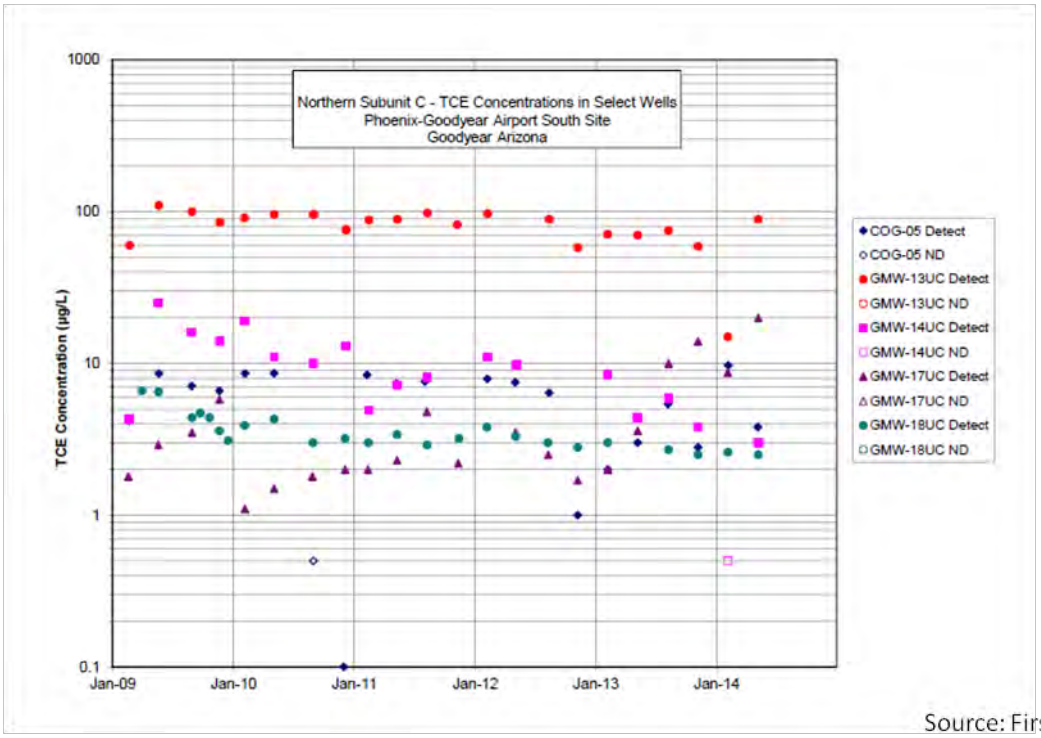
Figure 6-13. PGAS – Water Level Contour Map, First Quarter 2014, Subunit C.



Source: First Semi-Annual 2010 Groundwater Monitoring Report for the Phoenix-Goodyear Airport South Site, dated August, 2010.

Source: First Semiannual Groundwater Monitorin Report – 2014 for th Phoenix-Goodyear Airpor South Site, August 2014.

Figure 6-14. PGAS – Comparison of TCE Concentrations in Subunit C, 2010 and 2014.



Source: First Semiannual Groundwater Monitoring Report – 2014 for the Phoenix-Goodyear Airport South Site, August 2014.

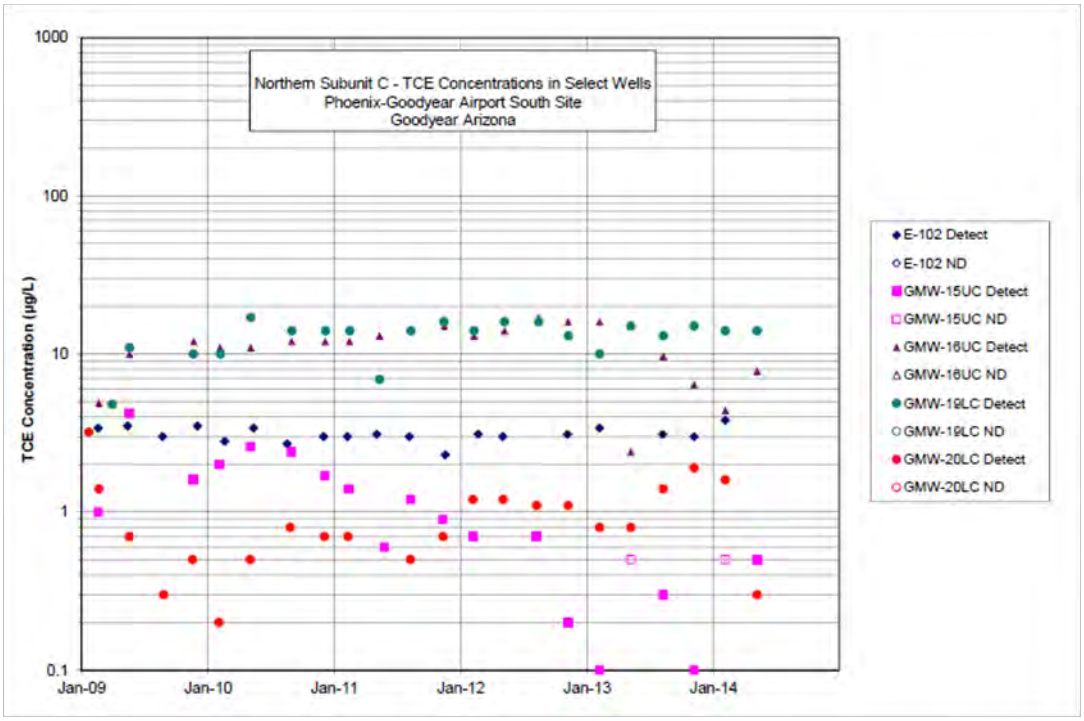
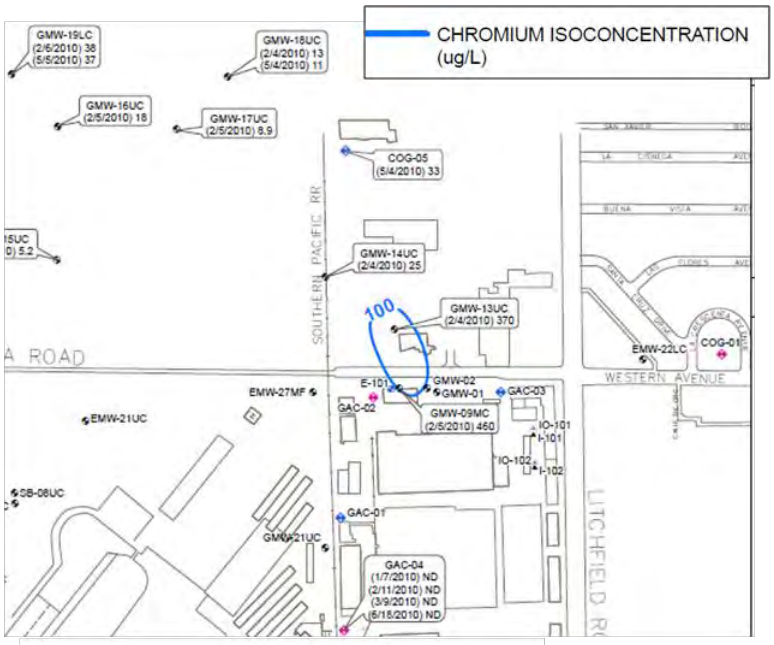
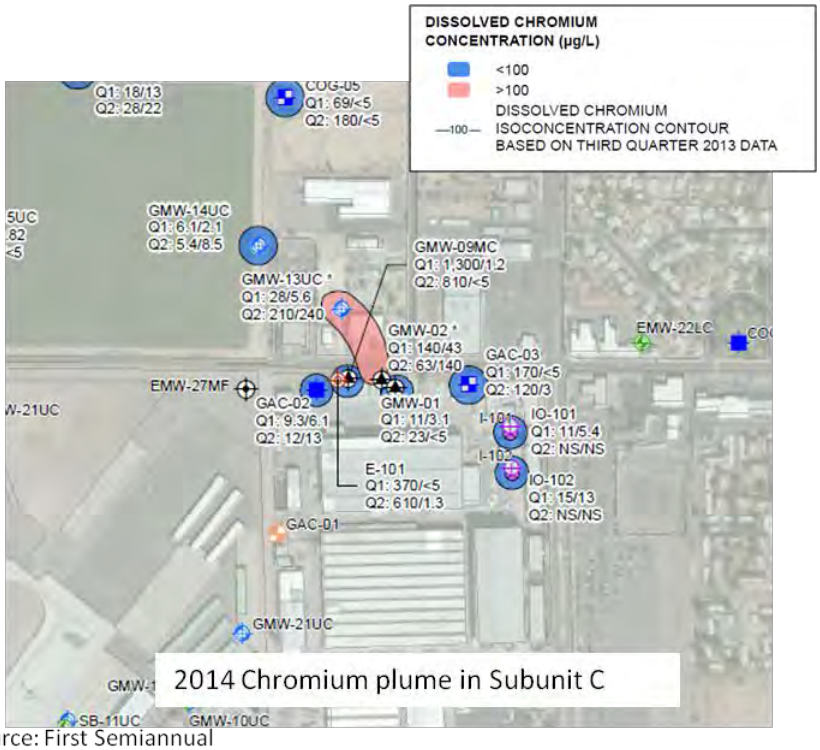


Figure 6-15. PGAS – Time history of TCE concentrations in select wells, Subunit C.



2010 Chromium plume in Subunit C

Source: First Semi-Annual 2010 Groundwater Monitoring Report for the Phoenix-Goodyear Airport South Site, dated August, 2010.



2014 Chromium plume in Subunit C

Source: First Semiannual Groundwater Monitoring Report – 2014 for the Phoenix-Goodyear Airport South Site, August 2014.

Figure 6-16. PGAS – Comparison of Chromium Concentrations in Subunit C, 2010 and 2014.

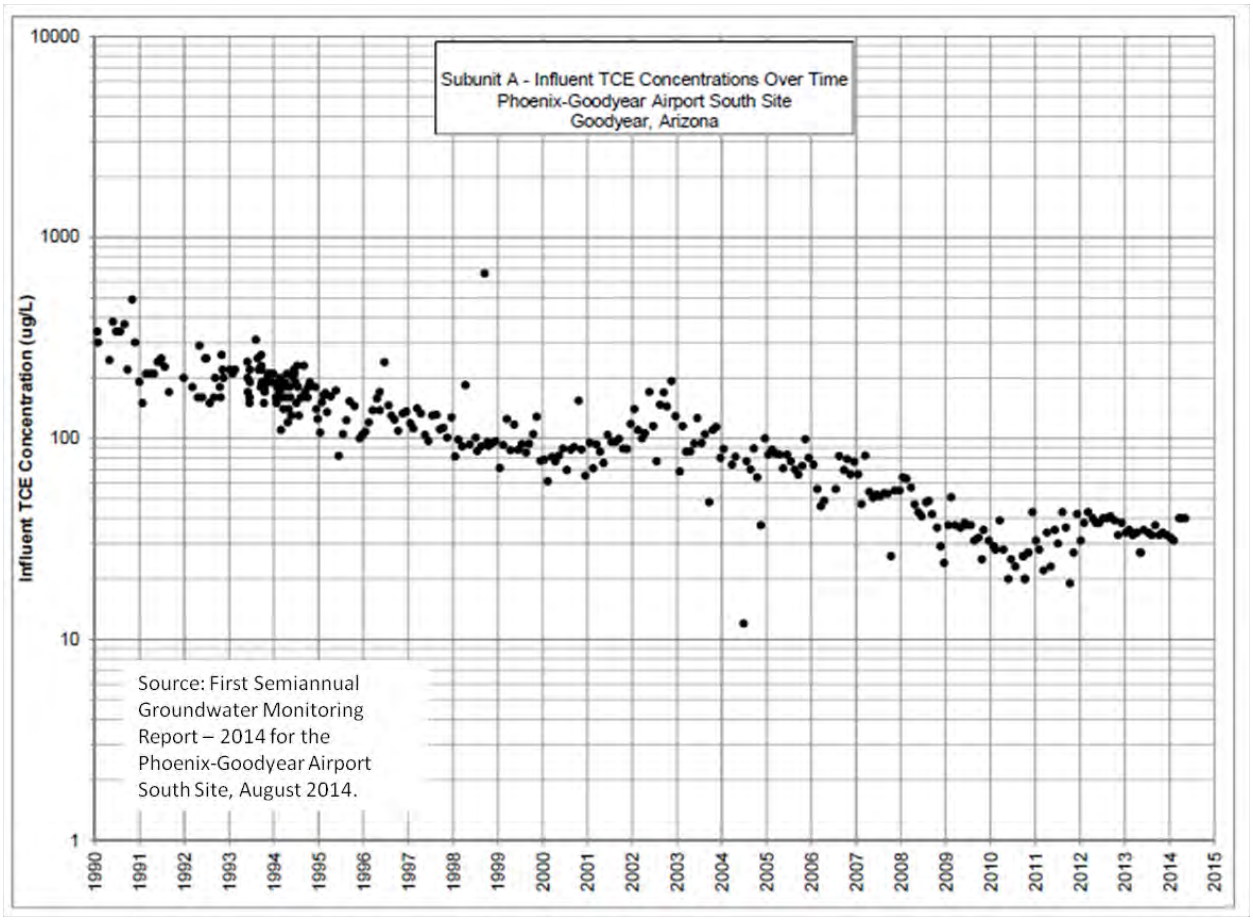


Figure 6-17. PGAS – Influent TCE Concentrations over time.

shows a time history of chromium concentrations in select wells screened in Subunit A.

In summary, TCE plume concentrations in Subunit A appear to have maintained a consistent trend since the previous Five Year Review. The chromium concentrations have also remained consistent since 2010.

6.4.2.3 Subunit C

Potentiometric contours for Subunit C at PGAS for the first quarter of 2014 are shown in Figure 6-13. These measurements include any effects from the groundwater extraction and injection operations associated with the ongoing remedy. The groundwater in Subunit C flows toward the west-northwest at PGAS (Haley & Aldrich, 2014). These contour lines are based on the PGAS wells and do not incorporate water elevations from the northern PGAN wells. Well E-102, the primary extraction well in the northern Subunit C area, went off-line in May 2014 due to pump failure. E-102 was replaced by E-103 in 2014. E-103 went online in September 2014.

Figure 6-14**Error! Reference source not found.** depicts the TCE plume at PGAS in Subunit C at the time of the previous FYR and the 2014 TCE plume. As of the First Semi-annual Groundwater Monitoring Report for 2014, the Subunit C TCE plume has generally maintained the same footprint and level of TCE concentrations since the last Five Year Review. Near the source, The TCE contaminant levels remains high (60 to 100 µg/L) with a steady trend line. It appears the extraction wells may be drawing the far (north) end of the plume back towards these wells at a very modest rate. Figure 6-15 shows a time history of TCE concentrations in select wells screened in Subunit C.

6.4.2.4 Chromium

Figure 6-16**Error! Reference source not found.** depicts the chromium plume at PGAS for concentrations greater than 100 µg/L in Subunit C at the time of the previous Five-Year Review and the 2014 chromium plume. The 100 footprint and levels of concentrations in this plume is diminishing. The MCL for chromium is 100 µg/L. Chromium has consistently been detected in well GMW-13UC with concentrations greater than 200 µg/L in 2010 and 300 µg/L in 2014. Total and dissolved chromium in the other sampled northern Subunit C wells were detected below 100 µg/L during the reporting period.

The source of TCE and chromium in Subunit C at the northern Subunit C monitoring wells at PGAS was from the conduit action of GAC-02 and GAC-03 in the past. The source of chromium in some of the northern Subunit C monitoring wells is not known. (ITSI Gilbane, 2013).

6.4.2.5 Southern Plume

Sample results for TCE in the Southern Subunit C wells were either non-detect or less than the MCL of 5 µg/L during the reporting period, except for well SB-06UC with a TCE concentration of 5.4 µg/L, slightly above the MCL. Except for this well, TCE concentrations in all of the Southern Subunit C monitoring wells in the current monitoring program have been below the MCL since May 2012.

Active extraction in southern Subunit C ceased in 2009, after the TCE cleanup goal had been met for four quarters, and following submittal and agency approval of a pulsed pumping approach. Southern Subunit C wells continue to be monitored, and extraction could re-commence, if necessary. However, a source of

TCE at or around well GAC-04 continues to affect this area. Between 1992 and 1995, the TCE concentration generally remained less than 5.0 µg/L, thus sampling at this well ceased between 1995 and 2006. In 2007, when the well was added back into the sampling protocol, TCE concentrations were reported as high as 86 µg/L. Since 2010, TCE concentrations have ranged from <1 to 100 µg/L with temporal variations. To address this issue, two monitoring wells (GMW-21UC and GMW-22UC) were installed, near GAC-04 in 2010 and GMW-23UC in 2012. Each monitoring well is screened in the upper portion of the Subunit C aquifer. Well GAC-04 is screened in the upper half of the Subunit C aquifer. The TCE concentration in well GMW-21UC during the first sampling in June 2010 was 140 µg/L, and then < 0.5 to 1.5 µg/L thereafter to 2012. Concentration of TCE in GMW-22UC and GMW-23UC were consistently < 0.5 µg/L in 2012 to 2014. The source of TCE at this well is still not clear. Results of several historical and recent rebound tests indicate that production well GAC-04 may be a possible conduit for TCE affected groundwater migration between Subunit A and Subunit C. Following discussions with the EPA and ADEQ, it was agreed that GAC-04 should be abandoned to remove the potential conduit. Abandonment of GAC-04 was completed in August 2012.

6.4.2.6 Other Work

Currently, chromium is not actively treated. Water extracted for TCE treatment that contains chromium above remedial action goals is blended with water that is not impacted by chromium.

In October 2013, as part of recent voluntary characterization work at Northern Subunit C, GTRC collected depth-discrete Hydrasleeve™ samples in monitoring wells GMW-02, GMW-13UC, and GMW-14UC to evaluate whether stratification of TCE and/or chromium concentrations exist within the screened interval of these wells. The Hydrasleeves™ were deployed in approximate 10-foot intervals, starting at 5 feet below the top of the screen. Based on the sampling results, there does not appear to be significant stratification of either TCE or chromium concentrations. Overall, the concentrations were generally consistent with those observed during routine monitoring.

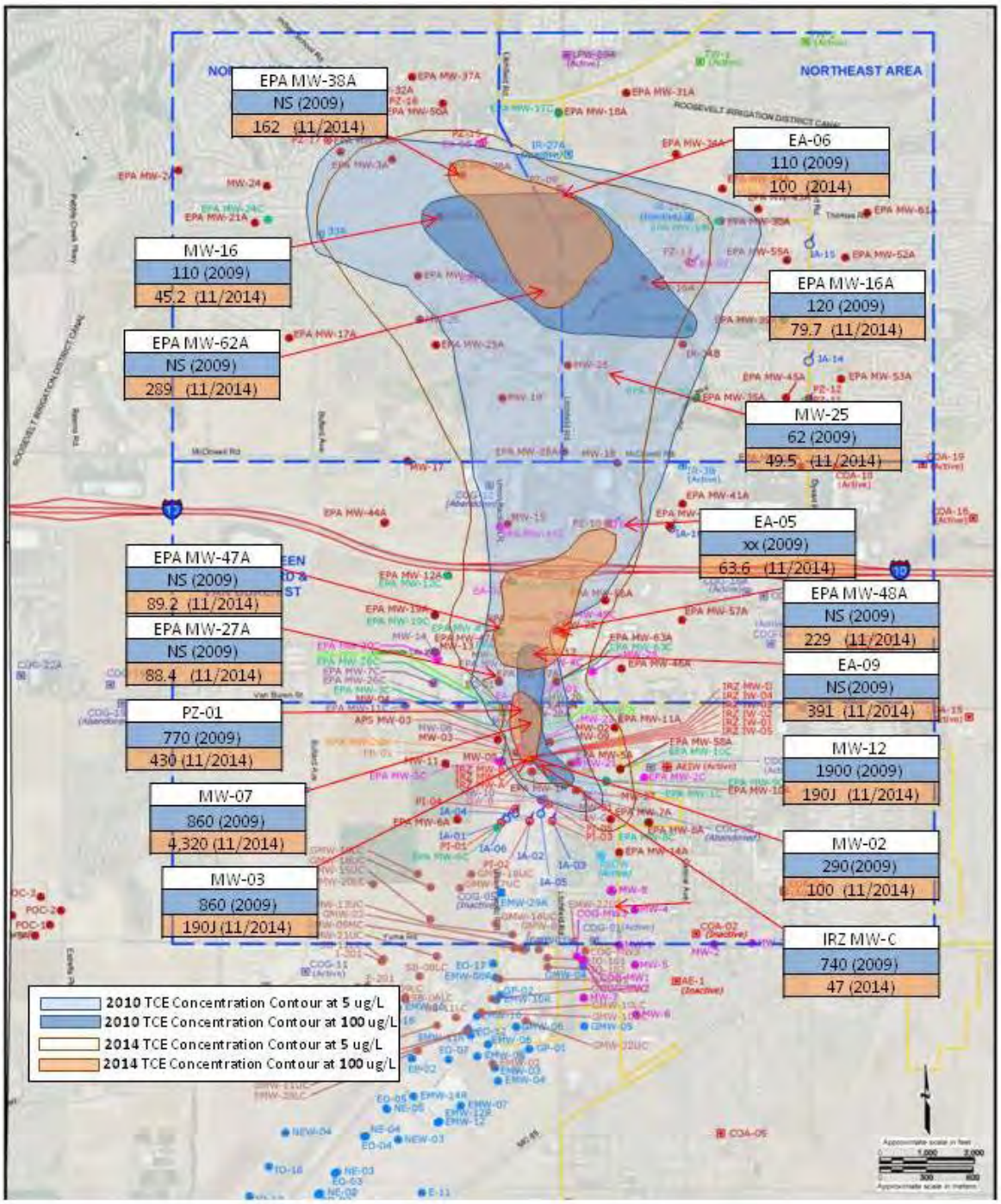


Figure 6-1. PGAN – Comparison of TCE Concentrations in Subunit A, 2010 and 2014.

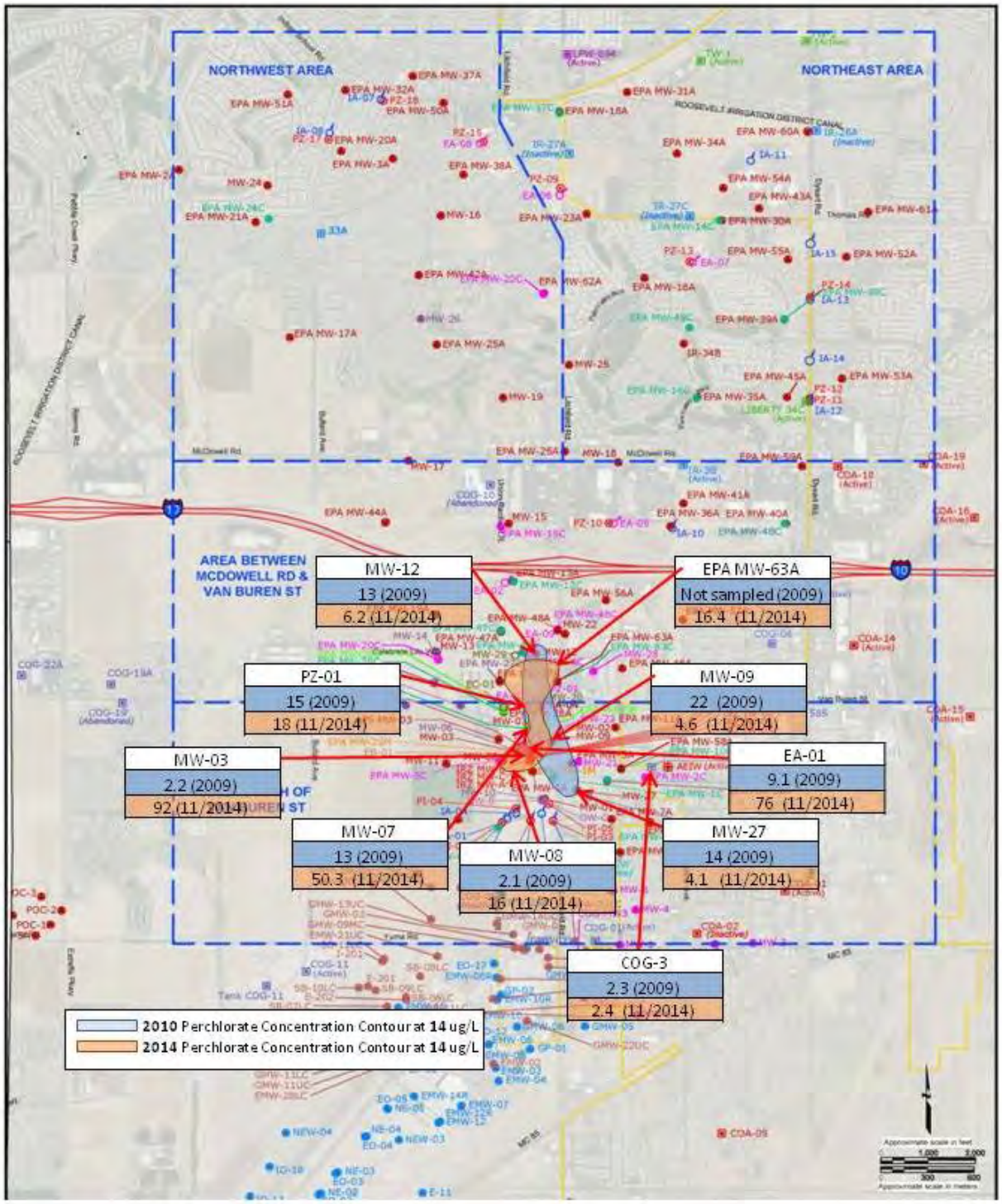


Figure 6-2. PGAN – Comparison of Perchlorate Concentrations in Subunit A, 2009 and 2014.

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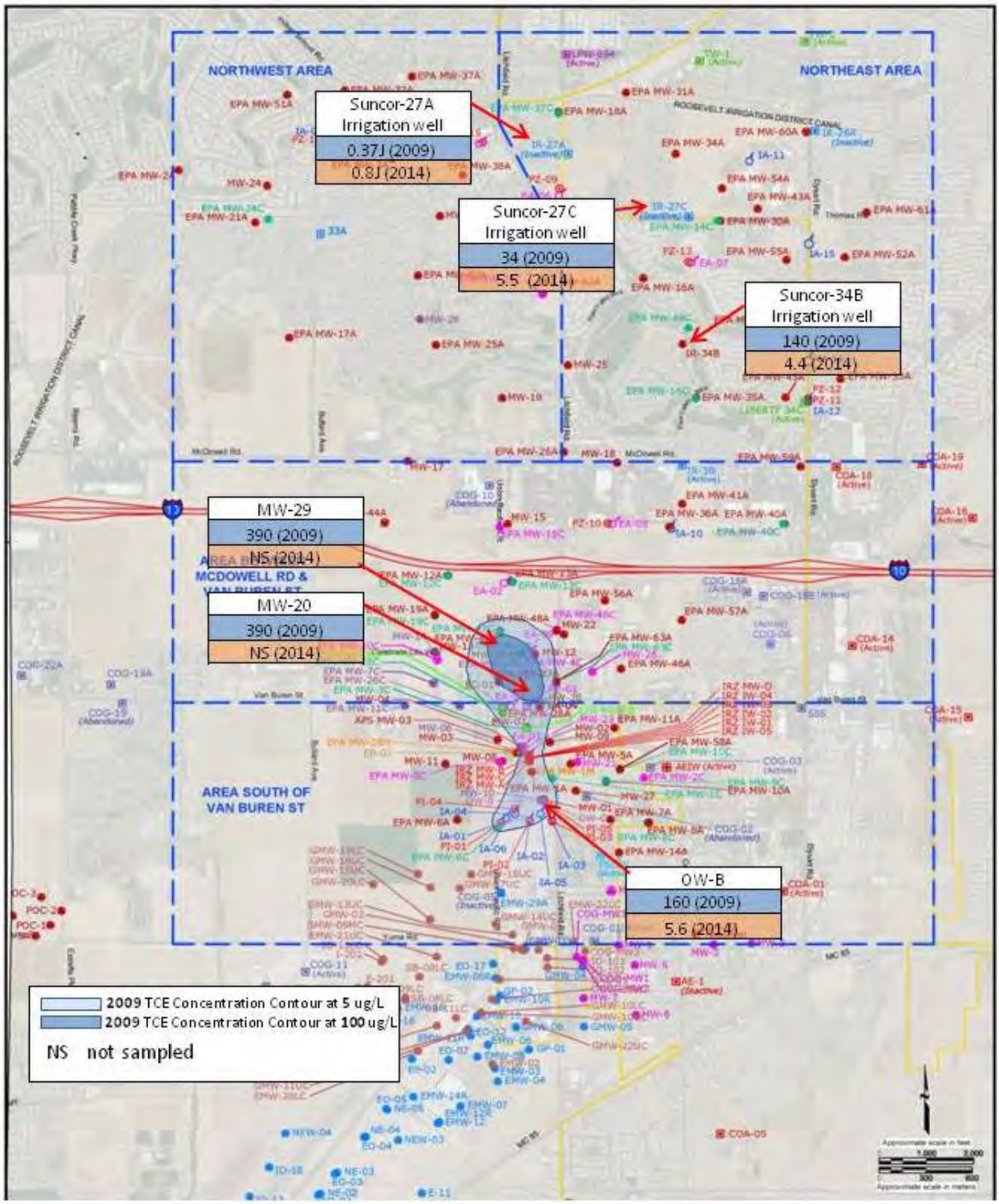


Figure 6-3 PGAN – TCE Concentrations in Subunit B, C and MAU, 2009.

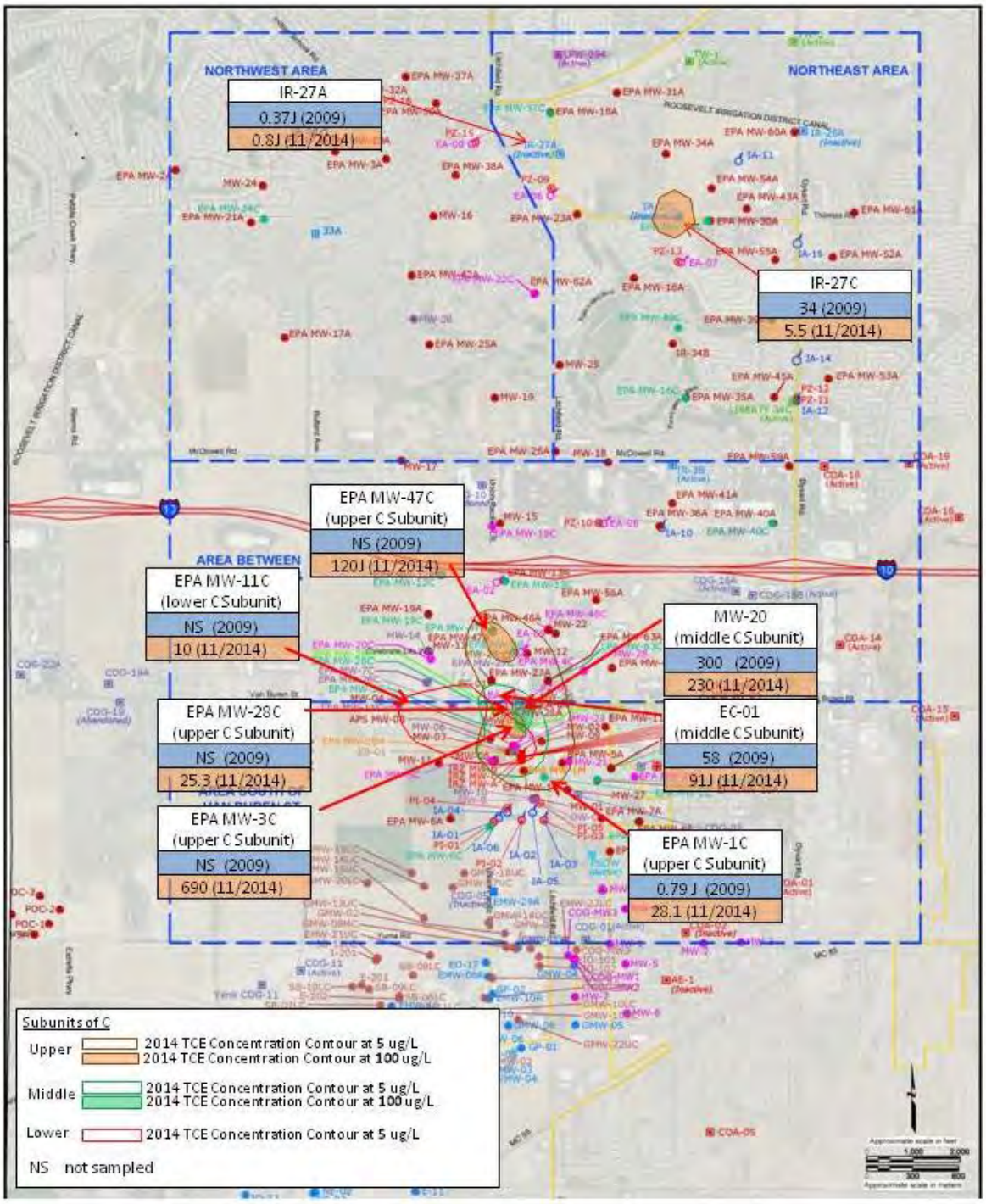


Figure 6-4. PGAN – TCE Concentrations in upper Subunit C, 2014

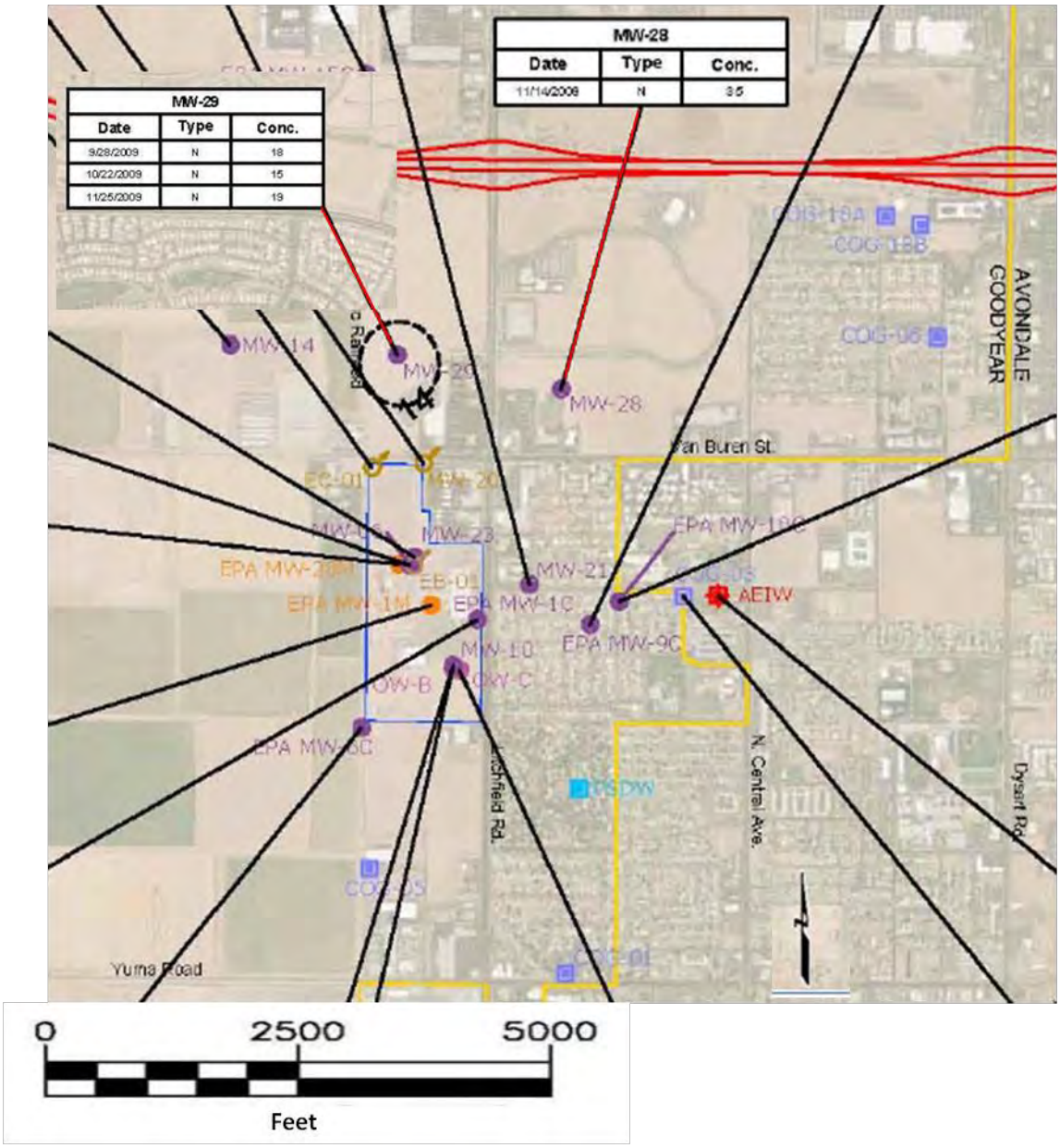


Figure 6-5. PGAN – Perchlorate Concentrations in Subunit B, C and MAU, 2009.

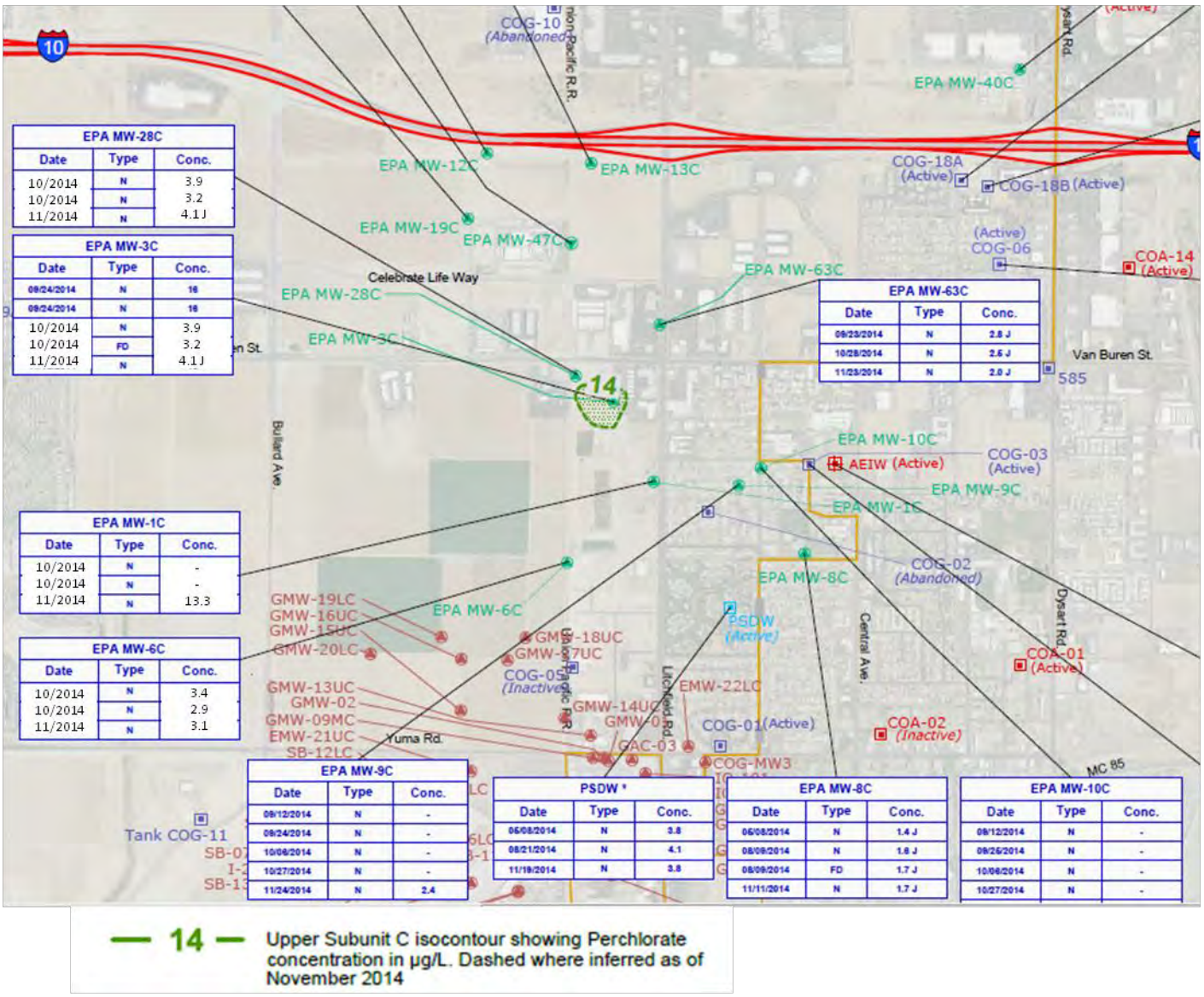


Figure 6-6. PGAN – Perchlorate Concentrations in upper Subunit C, 2014.

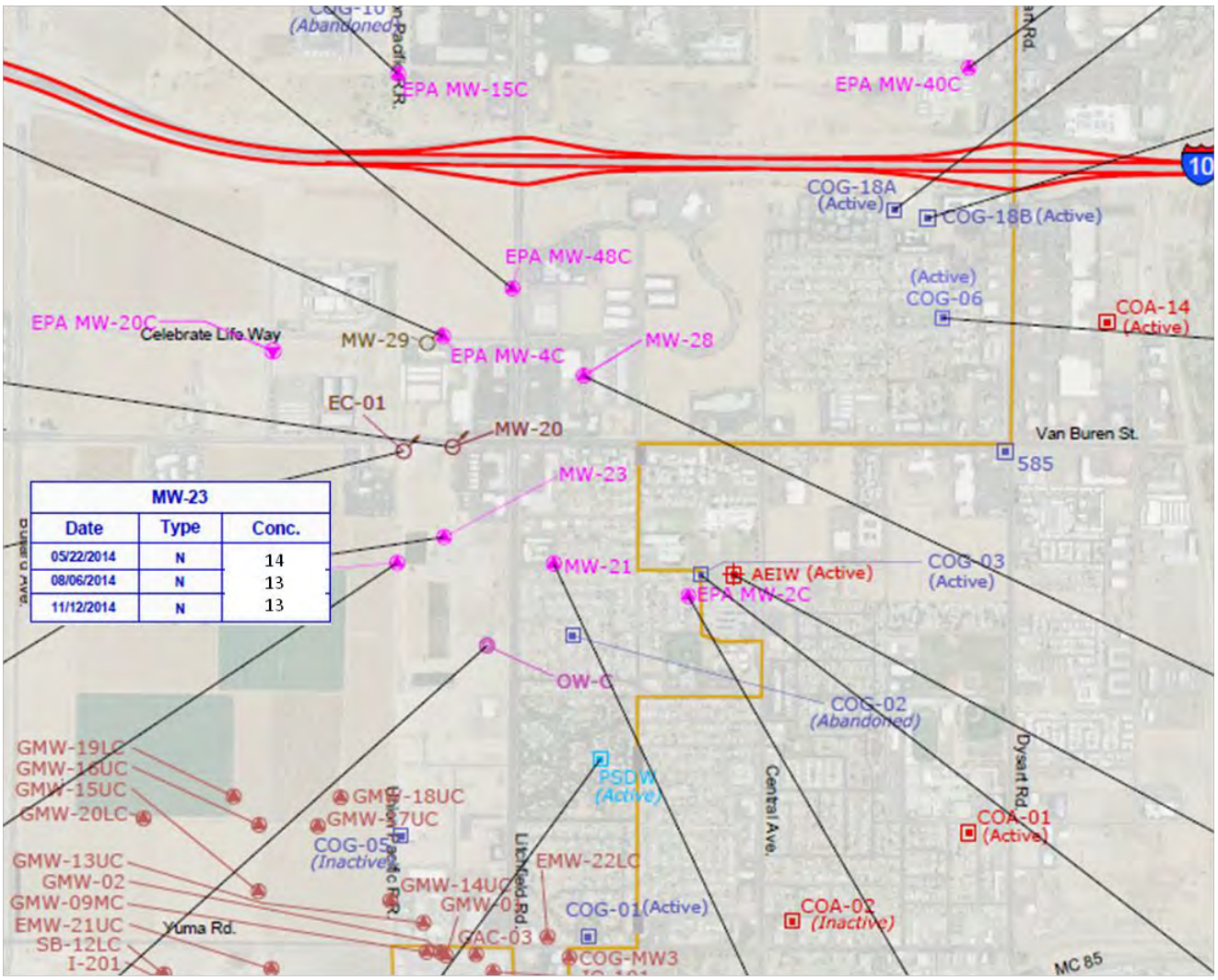
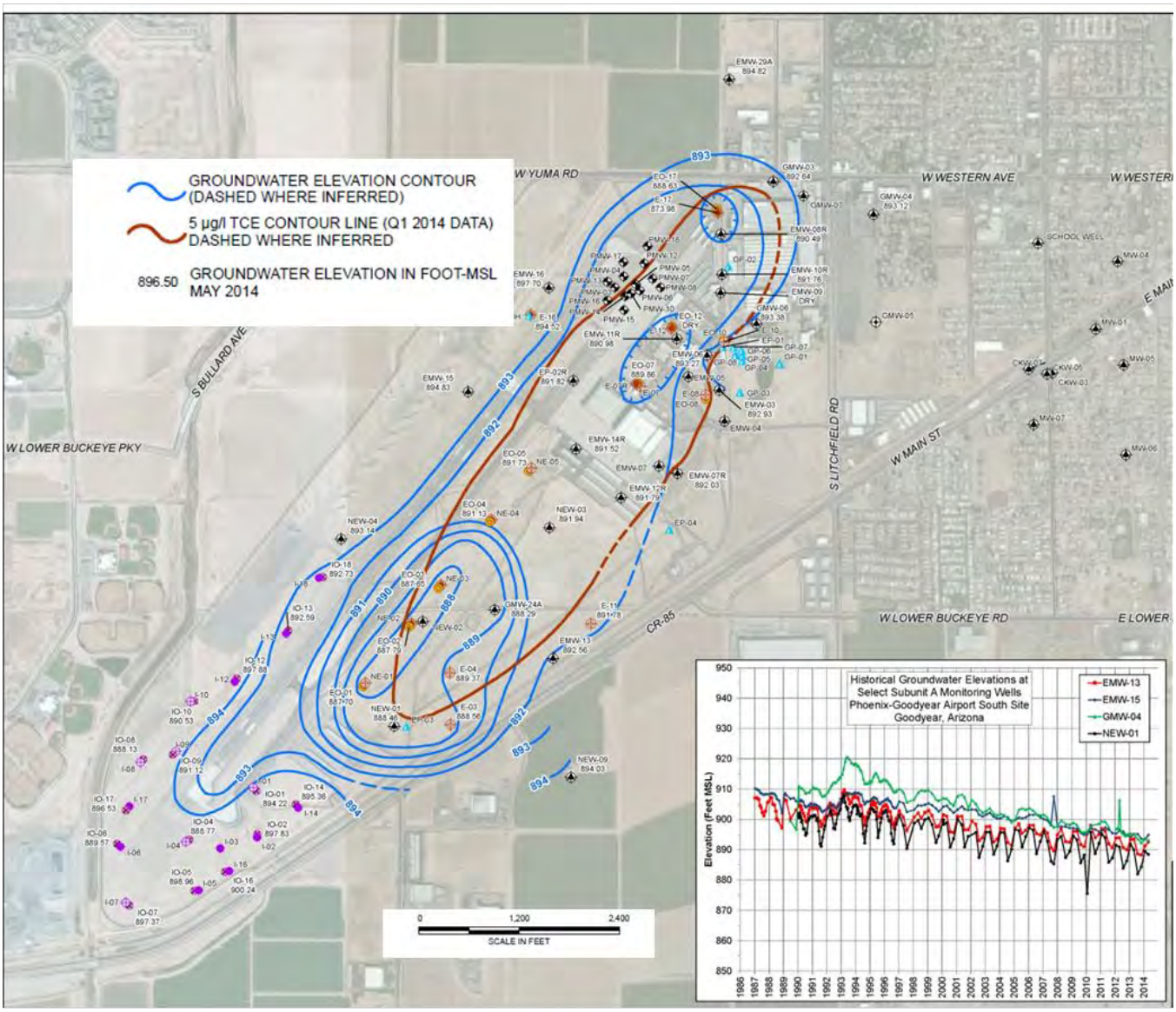
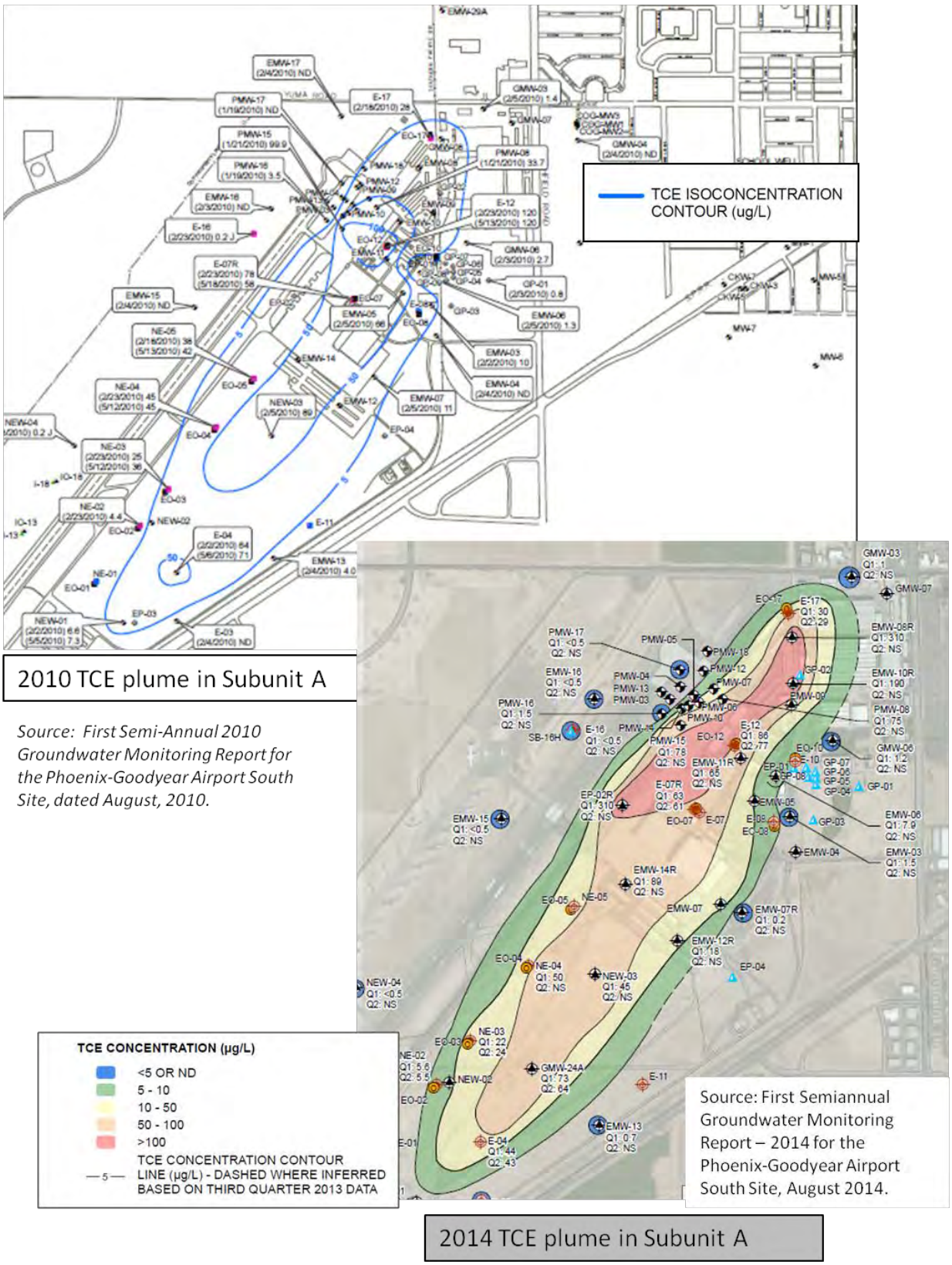


Figure 6-7. PGAN – Perchlorate Concentrations in middle and lower Subunit C, 2014.



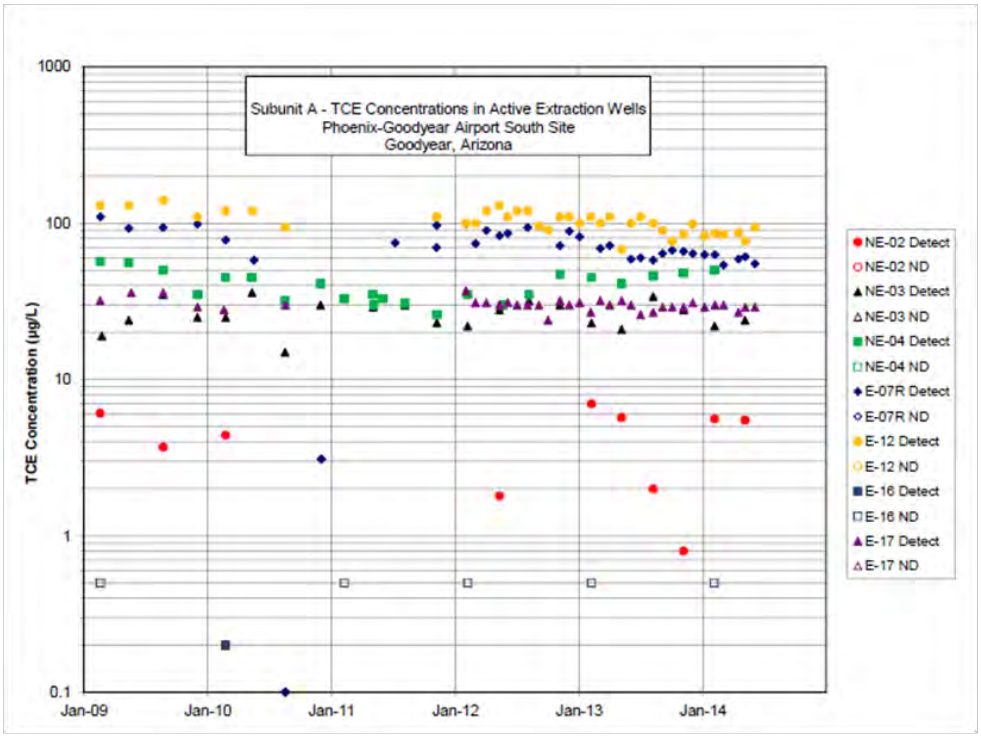
Source: First Semiannual Groundwater Monitoring Report – 2014 for the Phoenix-Goodyear Airport South Site, August 2014.

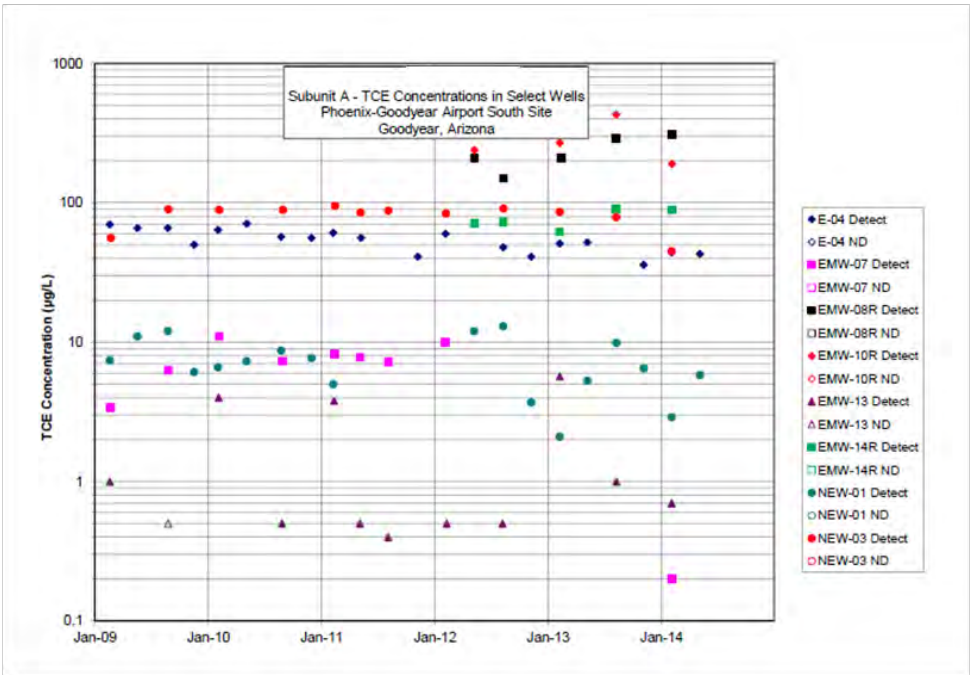
Figure 6-8. PGAS – Water Level Contour Map, First Quarter 2014, Subunit A.



Source: First Semi-Annual 2010 Groundwater Monitoring Report for the Phoenix-Goodyear Airport South Site, dated August, 2010.

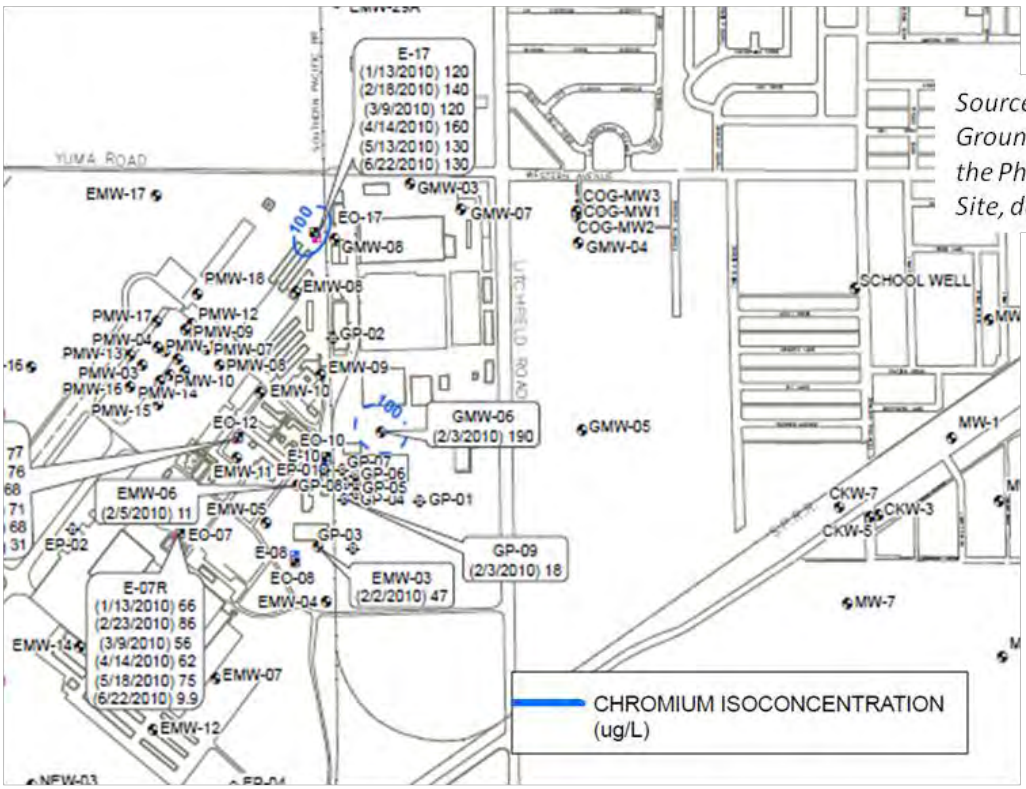
Figure 6-9. PGAS – Comparison of TCE Concentrations in Subunit A, 2010 and 2014.





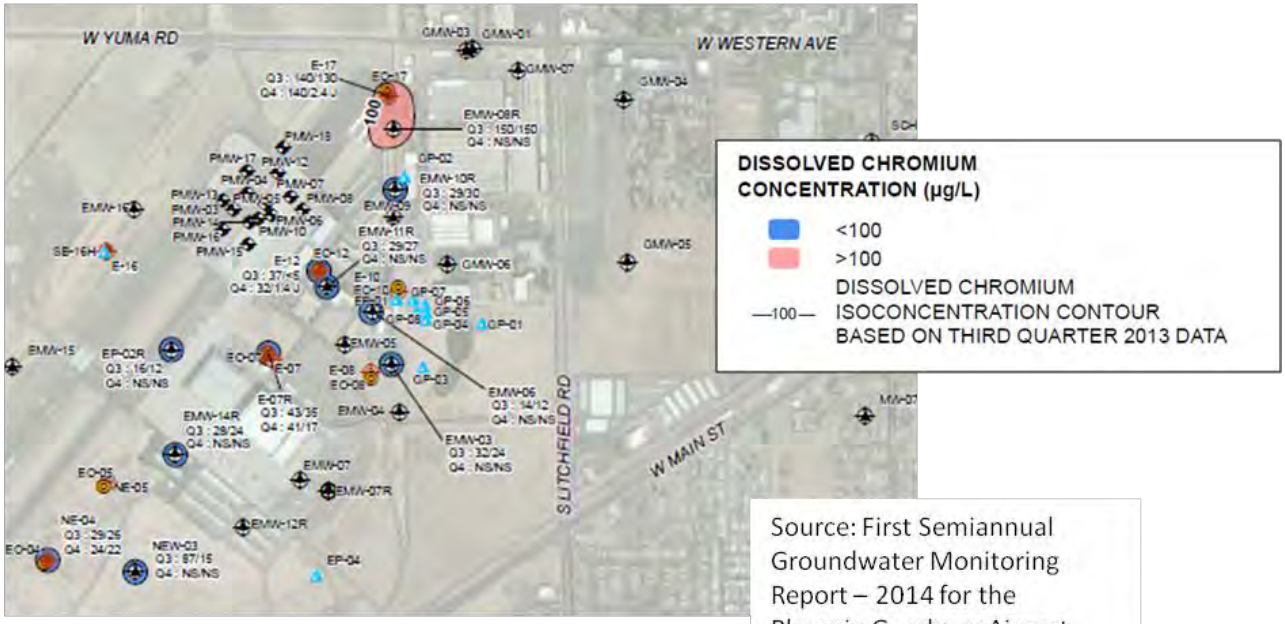
Source: First Semiannual Groundwater Monitoring Report – 2014 for the Phoenix-Goodyear Airport South Site, August 2014.

Figure 6-10. PGAS – Time history of TCE concentrations in select wells, Subunit A.



Source: First Semi-Annual 2010 Groundwater Monitoring Report for the Phoenix-Goodyear Airport South Site, dated August, 2010.

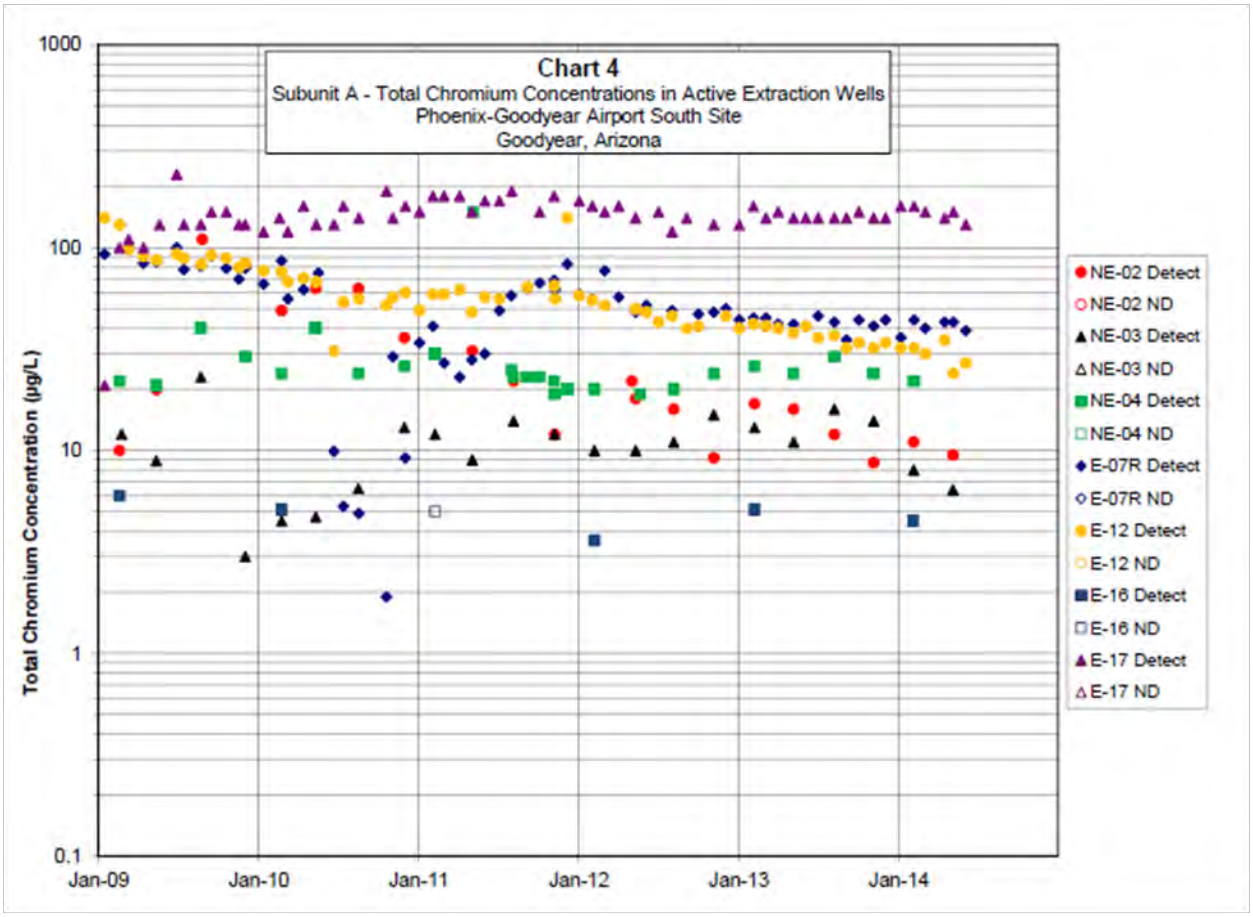
2010 Chromium plume in Subunit A



Source: First Semiannual Groundwater Monitoring Report – 2014 for the Phoenix-Goodyear Airport South Site, August 2014.

2013 Chromium plume in Subunit A

Figure 6-11. PGAS – Comparison of Chromium Concentrations in Subunit A, 2010 and 2014.



Source: First Semiannual Groundwater Monitoring Report – 2014 for the Phoenix-Goodyear Airport South Site, August 2014.

Figure 6-12. PGAS – Time history of Chromium Concentrations in select wells, Subunit A.

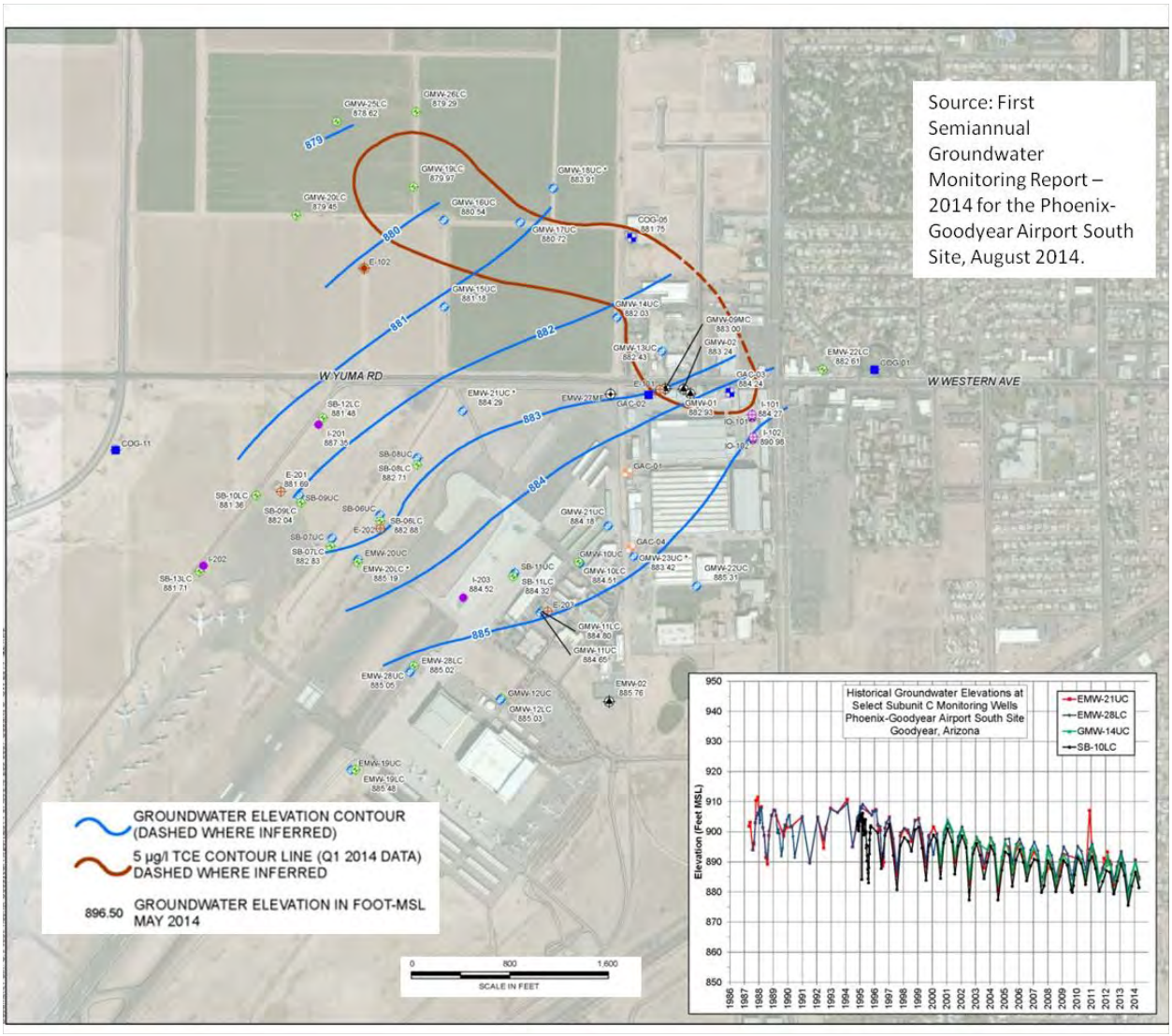


Figure 6-13. PGAS – Water Level Contour Map, First Quarter 2014, Subunit C.

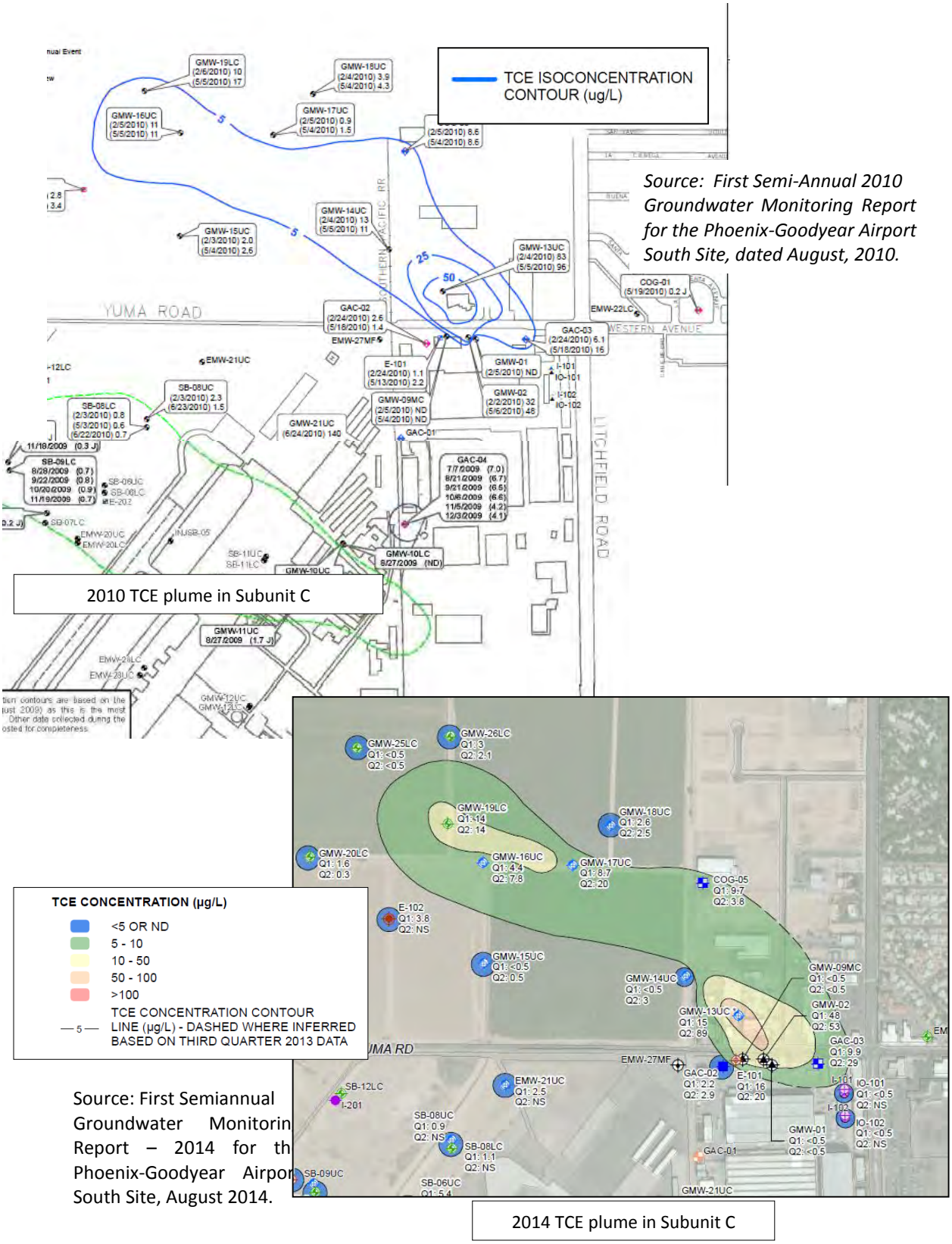
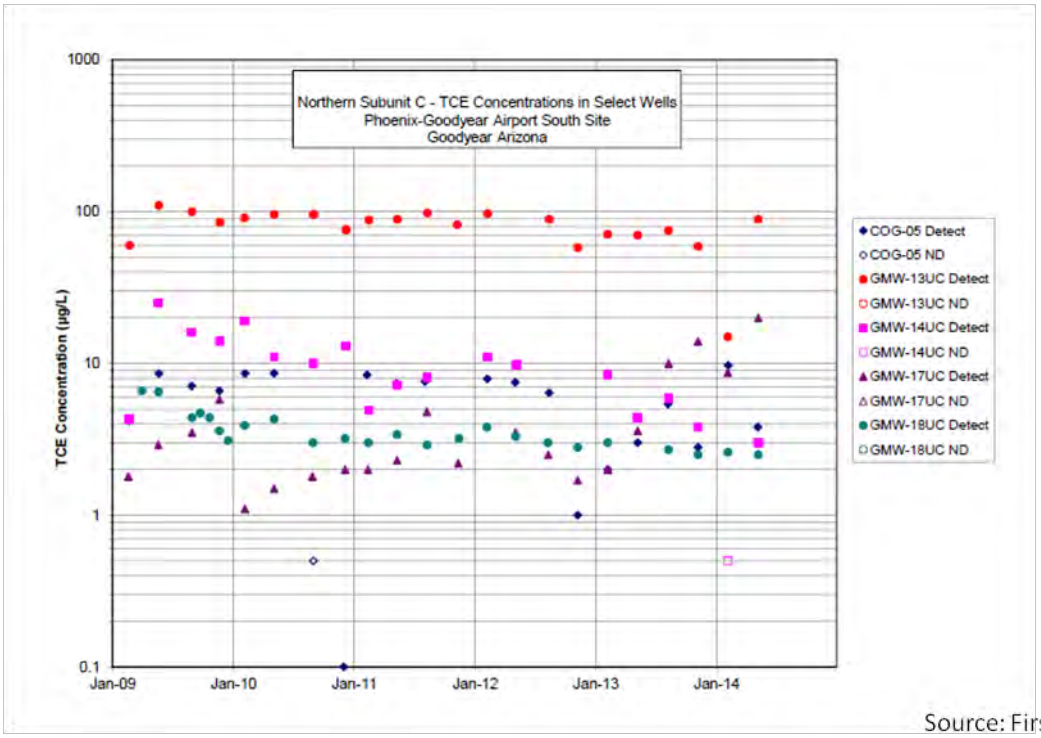


Figure 6-14. PGAS – Comparison of TCE Concentrations in Subunit C, 2010 and 2014.



Source: First Semiannual Groundwater Monitoring Report – 2014 for the Phoenix-Goodyear Airport South Site, August 2014.

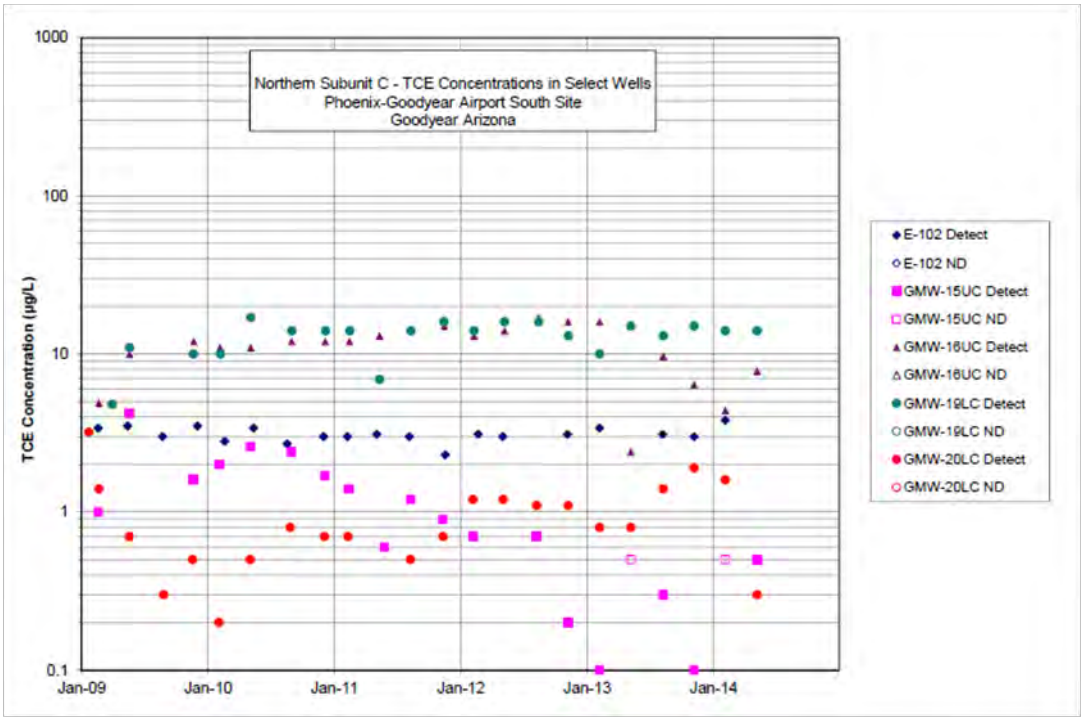
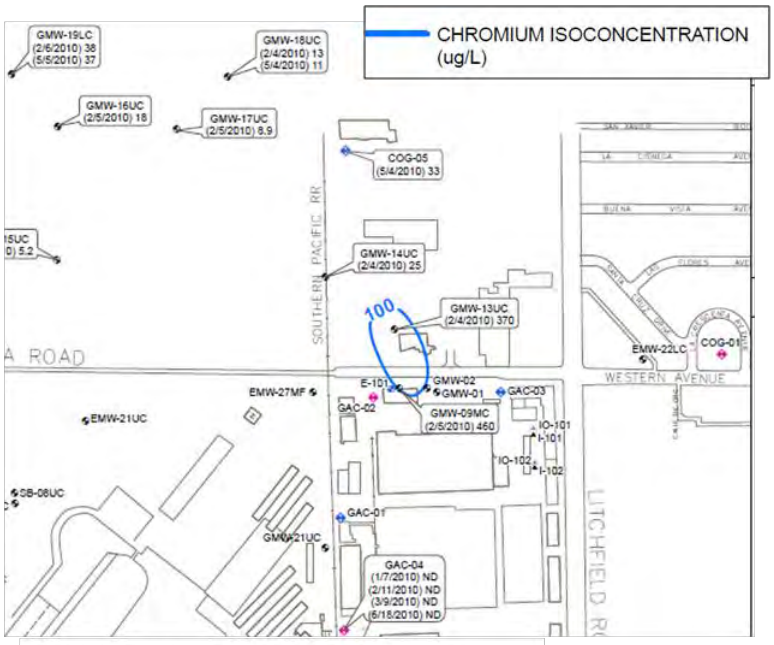
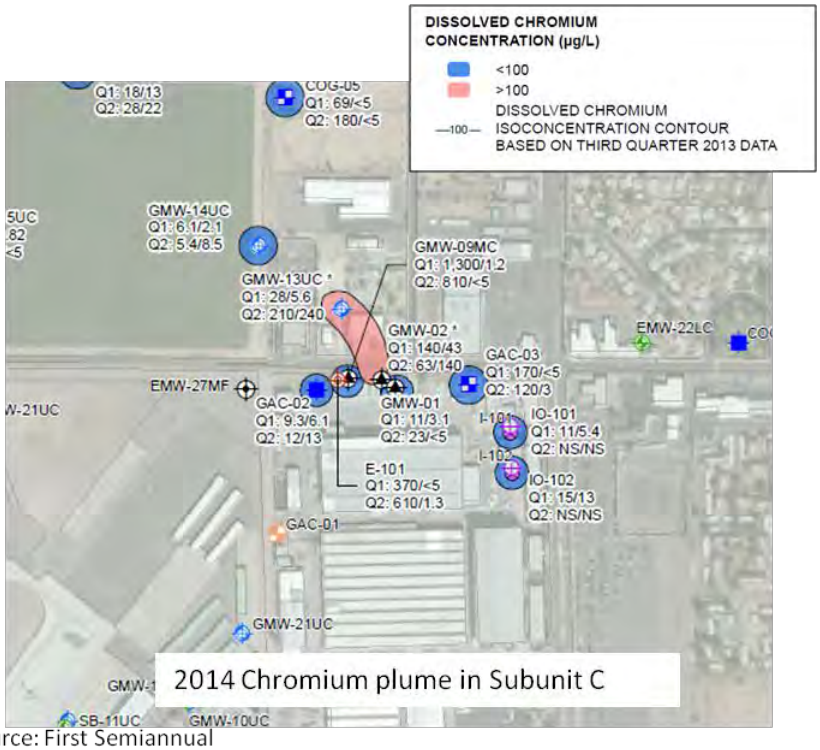


Figure 6-15. PGAS – Time history of TCE concentrations in select wells, Subunit C.



2010 Chromium plume in Subunit C

Source: First Semi-Annual 2010 Groundwater Monitoring Report for the Phoenix-Goodyear Airport South Site, dated August, 2010.



2014 Chromium plume in Subunit C

Source: First Semiannual Groundwater Monitoring Report – 2014 for the Phoenix-Goodyear Airport South Site, August 2014.

Figure 6-16. PGAS – Comparison of Chromium Concentrations in Subunit C, 2010 and 2014.

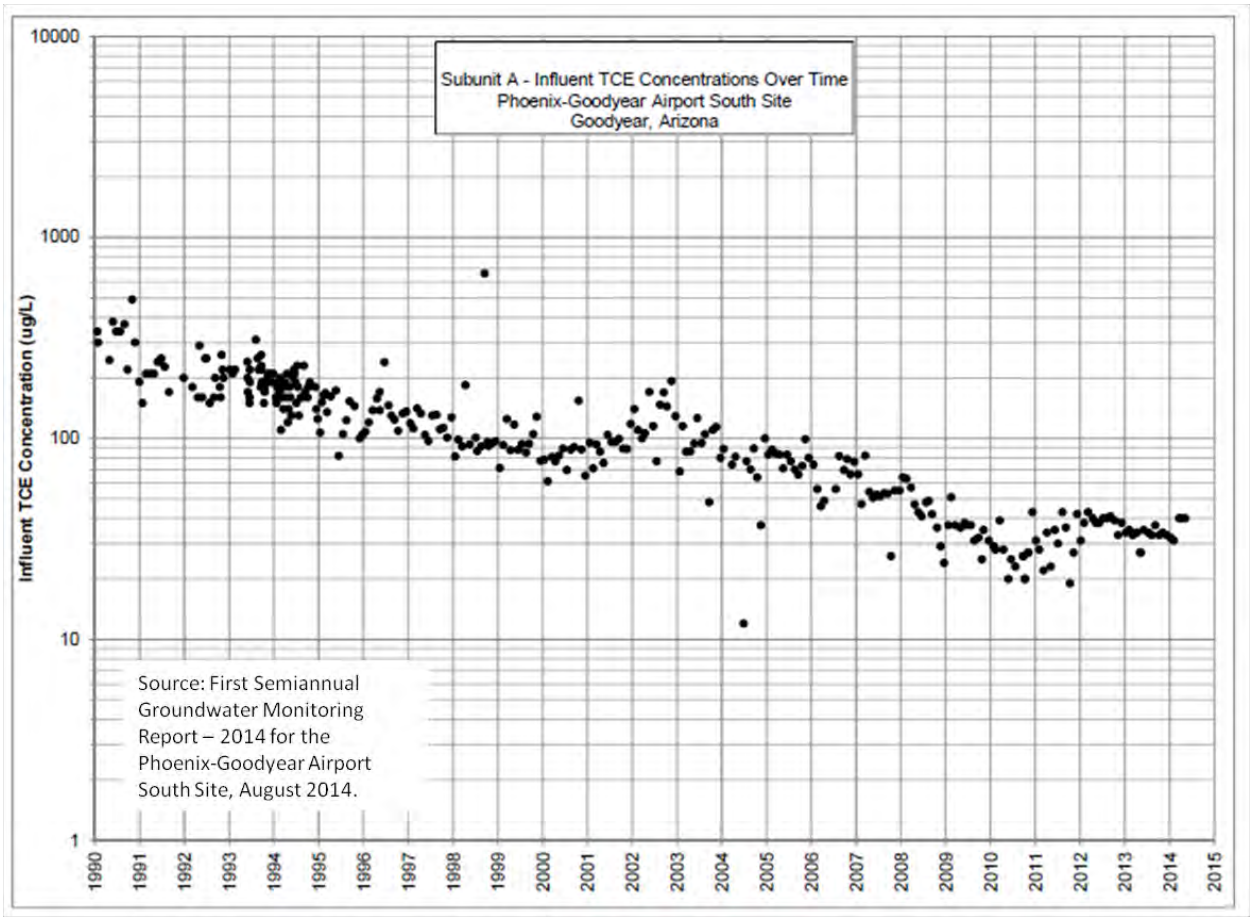


Figure 6-17. PGAS – Influent TCE Concentrations over time.

6.5. Site Inspection

A site visit to the PGAN and PGAS Site was conducted on 25 February 2015. The Superfund Site is split into two areas; PGA South was inspected in the morning, PGA North in the afternoon. The distinct sites have separate plumes, team members, stakeholders, and treatment systems. At each site, the participants toured the groundwater treatment plants after an overview of the site and the remedial history. The groundwater treatment plants are manned daily by the respective site managers.

During the site inspection all remedy components were observed to be operational. There was proper signage and security to maintain protection of the multiple treatment systems.

Site inspection checklists are presented in Appendix D and a trip report and photographs from the site inspection are presented in Appendix E.

6.6. Interviews

During the FYR process, interviews were conducted with parties impacted by the Site, including the current landowners, and regulatory agencies involved in Site activities or aware of the Site. The purpose of the interviews was to document the perceived status of the Site and any perceived problems or successes with the phases of the remedy that have been implemented to date. Interviews are summarized below and complete interviews are included in Appendix C.

At PGAN the remedy is functioning as expected. There has been regular maintenance to all treatment systems which has led to increased uptime. Total quality management improvements include employing Kaizen events to review and evaluate treatment systems. The ROD Amendment to PGAN is robust enough to capture the unknowns that remain with plume capture in Subunits A and C. Reinjection of treated groundwater is assisting with hydraulic containment.

At PGAS the remedy is functioning as intended. There is now beneficial reuse of the treated water from the Northern Subunit C treatment system and they have made progress with installation of 3 extraction wells in Subunit A. There has been improvements made to the operation and maintenance procedures that include emergency action plans for uncontrolled releases.

Community involvement for both PGAN and PGAS is adequate. There are regular meetings to involve the community. The responsible parties are involved in the meetings and responsive to questions and concerns. All interviewees agree this is an interesting and complex project.

The following interviews were conducted as part of this FYR process:

Person Interviewed	Organization	Title	Date and Location of Interview
Alan Bilzi	Environmental Venture Group, Inc., contractor to Crane Co.	President	February 19, 2015 / Via Phone
Brian Stonebrink	ADEQ	Project Manager for PGAS	February 19, 2015 / Via Phone
Patrick Shinabery	ADEQ	Former Project Manager for PGAN	February 19, 2015 / Via Phone
Wendy Flood	ADEQ	Community Involvement Coordinator	February 19, 2015 / Via Phone
Paula Panzino	Haley and Aldrich, Inc., contractor to GTRC	Remediation Program Manager, PGAS	February 20, 2015 / Via Phone and Site inspection
Ron Clark	The Goodyear Tire and Rubber Company	Project Manager, PGAS	February 20, 2015 / Via Phone and Site inspection
Tom Suriano	Clear Creek,contractor for Litchfield Park City and Avondale City	Principle Hydrologist, PGAN	February 21, 2015 / Via Phone
Stephanie Koehne	AMEC, contractor to Crane Co.	Project Manager, PGAN	February 25, 2015 / Site Inspection
Harry Brenton	Matrix New World, contractor to Crane Co.	Dir. Of Hydrogeology Services, PGAN	February 25, 2015 / Site Inspection
Tom Vanaskey	Blue World Remediation, contractor to Crane Co.	Lead Operator, PGAN	February 25, 2015 / Site Inspection

6.7. Institutional Controls

6.7.1. PGAN

Institutional Controls (ICs) were identified in the 2006 Partial Consent Decree (CD) (Crane Co. et al. v. USA, 2006) for the PGAN site. The 2006 CD requires that Crane Co. refrain from using the property "in any manner that would interfere with or adversely affect the implementation, integrity, monitoring or protectiveness of the remedial measures to be performed pursuant to the ROD and the ESDs or any future response required by EPA" (2006 CD) For the source area portion of the property, EPA requires disclosure of all land and water use restrictions to occupants as well as requirements to prevent access to

and interference with investigation and remedial measures, including with the use of fencing and signage, both of which were confirmed during the Site visit. The CD also prohibits use of the property for sensitive receptors, including schools and daycares. The 2006 CD also requires that Crane Co. inform EPA of all occupants and prohibits subsurface work without EPA's written consent. For Parcels B and C, which are owned by Crane Co. but were not part of the active operations off the facility, there are similar though less restrictive requirements. The CD requires Crane Co. to record these restrictions on EPA's request. To date, Crane Co. has placed a deed notice on Parcel A. For Parcels B and C, Crane Co. has requested to make a showing the restrictions are not required. EPA has informed Crane Co. that they may have that opportunity so long as the property is not transferred to another owner prior to EPA concurrence with such a showing.

The Site also relies in part on Arizona's Well Spacing and Well Impact Rules (A.A.C §R12-15-1302 et seq.) to prevent wells from being placed within the contaminant plume area that could impact groundwater remediation systems or hydraulic capture of groundwater contaminant plumes. Permits may be denied for any well the operation of which could result in drawdown that would cause a contaminant plume to migrate into an existing, uncontaminated well.

6.7.2 PGAS

Because the PGAS source area is primarily within Airport property, many of the restrictions provided for airport security, such as fencing, are providing de facto ICs for the PGAS remedy. EPA's 1991 CD with GTRC and Loral Defense Systems, includes a provision preventing the installation or use of groundwater wells at the site for human consumption unless the extracted water is treated to meet drinking water standards. An IC may be required for the chromium drying beds, including a deed restriction; however, GTRC has provided a technical report that is under Agency review that evaluates whether contamination contained within the cover of the sludge drying beds require property restrictions. The agencies will make a determination based on the technical report prior to requiring anything be placed on the deed to the property. As with PGAN, PGAS also relies in part on Arizona's Well Spacing and Well Impact Rules (A.A.C §R12-15-1302 et seq.) to prevent wells from being placed within the contaminant plume area that could impact groundwater remediation systems or hydraulic capture of groundwater contaminant plumes. Permits may be denied for any well the operation of which could result in drawdown that would cause a contaminant plume to migrate into an existing, uncontaminated well.

7. Technical Assessment

7.1. Question A: Is the remedy functioning as intended by the decision documents?

7.1.1. PGAN

Yes, the remedy at PGAN is functioning as intended by the ROD. Extraction wells are effectively treating contaminated groundwater and re-injection wells are largely controlling plume migration.

In one area of the Subunit A plume, IA-07 & IA-08 have been installed to ensure the TCE plume is captured in the northwest extent. Additional Subunit C wells are planned to establish the western extent of TCE in Subunit C. Optimization of the SVE system is in Phase II, which includes pneumatic well logging was conducted to test for soil permeability and contamination distribution within six SVE wells.

Monitoring active production wells near the boundary of the plume is continuing to protect people supplied by COG wells. New extraction well EA-10 and associated injection well IA-09 will address the eastern edge of the TCE plume south of I-10 and help ensure protection of COG-03.

7.1.2. PGAS

Yes, the remedy at PGAS is functioning as intended by the ROD. TCE plume concentrations in Subunit A appear to have maintained a consistent downward trend since the previous Five Year Review in 2010. The chromium concentrations have also remained consistent since 2010. The Subunit C capture issue at PGAS has been addressed with E-103.

7.2. Question B: Are the exposure assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives (RAOs) Used at the Time of Remedy Selection Still Valid?

7.2.1. PGAN

Yes, the exposure assumptions, toxicity data, cleanup levels and RAOs are still valid. There have been changes to certain toxicity values but these do not affect protectiveness of the remedy.

The MCL for arsenic has been lowered and therefore, the cleanup level is now higher than the federal MCL. Arsenic concentrations from the most recent sampling of metals in groundwater ranged from 6.5-12 µg/L. Other than this chemical-specific ARAR change, there have been no other changes to the ARARs that affect protectiveness.

The 2014 ROD Amendment summarizes the findings of the BHHRA, HHRA, and the September 2005 Air Sampling Report. It concludes that the exposure pathways remain incomplete, and that no significant risk was identified for subsurface to indoor air exposure. It also indicates that, in general, the conclusions associated with the 2012 HHRA were consistent with the finding of the BHHRA from the 1989 ROD and the 2005 indoor sampling results.

Toxicity factors for several COCs have changed since the ROD was issued. For cancer RSLs, EPA uses an excess cancer risk range between 10^{-4} and 10^{-6} for managing risk; if the excess cancer risk is below or within this range, the standard may still be considered protective. The cleanup level for chloroform is not within the excess cancer risk range and it is above the non-carcinogenic RSL; however, concentrations of chloroform in groundwater have been below the excess cancer risk range. The cleanup level for ethylbenzene is not within the excess cancer risk range; however, recent groundwater monitoring results indicate that ethylbenzene is non-detect.

7.2.2. PGAS

Yes, the exposure assumptions, toxicity data, cleanup levels and RAOs are still valid. There have been changes to certain toxicity values but these do not affect protectiveness of the remedy.

The MCL for arsenic has been lowered and therefore, the cleanup level is now higher than the federal MCL. Arsenic concentration in effluent from the Subunit C treatment system from the most recent sampling in 2012 was 17 µg/L. Other than this chemical-specific ARAR change, there have been no other changes to the ARARs that affect protectiveness.

Vapor intrusion modeling at PGAS led to a site investigation in 2007 and an indoor air investigation in 2009. Indoor air sampling and subsequent calculations determined there is not a complete pathway for vapor intrusion at PGAS.

Toxicity factors for several COCs have changed since the ROD was issued. For cancer RSLs, EPA uses an excess cancer risk range between 10^{-4} and 10^{-6} for managing risk; if the excess cancer risk is below or within this range, the standard may still be considered protective. Chloroform and ethlybenzene toxicity information has changed and the cleanup levels for these COCs are above EPA's protective range. However, these COCs have not been detected in levels above the levels EPA has deemed protective.

7.3. Question C: Has Any Other Information Come to Light That Could Call Into Question the Protectiveness of the Remedy?

7.3.1. PGAN

There is no other information that has come to light that would call into question the protectiveness of the remedy.

7.3.2. PGAS

There is no other information that has come to light that would call into question the protectiveness of the remedy.

7.4. Technical Assessment Summary

The remedy at PGA is functioning as intended; and the recent installation of extraction wells and monitoring wells at PGAN have improved capture and plume definition. The 2014 ROD amendment provides for enhanced treatment at the PGAN source area for TCE along with perchlorate, a PGAN contaminant that was not addressed in the 1989 ROD. The remedy at PGAS is functioning as intended by the ROD. TCE plume concentrations in Subunit A at PGAS appear to have maintained a consistent downward trend since the previous Five Year Review in 2010.

Results from the monitoring program for the active production wells near the boundary of the plume has shown that the remedy is protective.

The MCL for arsenic has been lowered and therefore, the cleanup level is now higher than the federal MCL. There is a lack of recent data on trace metals other than chromium in groundwater. Metals such as cadmium, lead, arsenic, and nickel were identified in the 1989 ROD as contaminants exceeding ARARs. Toxicity factors for several COCs have changed since the ROD was issued; however, actual concentrations detect for these chemicals, chloroform and ethlybenzene, are within the protective risk range.

At PGAN, a restrictive covenant required on portions of the UPI property have not been implemented. The previous FYR also identified that a deed restriction was required for the chromium drying beds at PGAS. EPA is currently review that evaluates whether contamination contained within the cover of the sludge drying beds require property restrictions. The land use has not changed since the last five year review.

8. Issues

Table 8-1 summarizes the issues for the PGA Site.

Table 8-1. Issues for the Phoenix-Goodyear Airport (North and South Areas) Site

Issue	Affects Current Protectiveness (Yes or No)	Affects Future Protectiveness (Yes or No)
At PGAN and PGAS, there is a lack of recent data on trace metals other than chromium in groundwater.	No	Yes
The MCL for arsenic has changed since the ROD; remedy at PGAN and PGAS may not be protective of human health if there is any completed exposure pathway to groundwater.	No	Yes
At PGAN, Institutional controls (ICs) were required in the 2006 Partial Consent Decree; restrictive covenants required on portions of the UPI property have not been implemented.	No	Yes
At PGAS, ICs were recommended in the previous Five-Year Review for the residual chromium contamination; however, no chromium related ICs have been implemented at PGAS to date.	No	Yes

9. Recommendations and Follow-up Actions

Table 9-1 provides recommendations to address the issues at the PGA Site

Table 9-1. Recommendations to Address Issues at the Phoenix-Goodyear Airport (North and South Areas) Site

Issue	Recommendations/ Follow-Up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness? (Yes or No)	
					Current	Future
There is a lack of recent data on trace metals other than chromium in groundwater.	Modify the existing sampling plans to test for all COCs at Site and COG wells as needed.	PRP	EPA	01/2017	No	Yes
The MCL for arsenic has changed since the ROD at PGAN and PGAS may not be protective of human health if there is any completed exposure pathway to groundwater.	Assess the need for new cleanup level for arsenic and document in a decision document				No	Yes
At PGAN, Institutional controls (ICs) were required in the 2006 Partial Consent Decree; restrictive covenants required on portions of the UPI property have not been implemented.	Determine the necessity of institutional controls (IC) as required in the 2006 Partial Consent Decree.	PRP	EPA	01/2017	No	Yes
At PGAS, ICs were recommended in the previous Five-Year Review for the residual chromium contamination; however, no chromium related ICs have been implemented at PGAS to date.	Implement ICs, if after reviewing the recent sampling data, EPA determines that an IC is still needed. .	PRP		01/2017	No	Yes

10. Protectiveness Statement(s)

10.1. PGAN

The remedy at PGAN is currently protective of human health and the environment because there is no complete exposure pathway to Site contamination. Soil contamination has been addressed and the vapor intrusion pathway is not complete. Monitoring of City of Goodyear (COG) production wells and Site sentinel wells continues to ensure that the public is not being exposed to groundwater contamination that exceeds the ARARs. In order for the remedy to be protective in the long-term, the following actions need to be taken: modify the sampling plans to include all COCs, assess the need for new cleanup level for arsenic and determine the necessity of institutional controls.

10.2. PGAS

The remedy at PGAS is currently protective of human health and the environment because there is no complete exposure pathway to contaminated groundwater or soil. Soil contamination has been addressed and the vapor intrusion pathway is not complete. Monitoring of COG production wells continues to ensure that the public is not being exposed to contaminated groundwater that exceeds the MCLs. However, in order for the remedy to be protective in the long-term, the following action needs to be taken: modify the sampling plans to include all COCs, assess the need for new cleanup level for arsenic and determine the necessity of institutional controls.

11. Next Review

This is a statutory Site that requires ongoing FYRs as long as waste is left on site that does not allow for unlimited use and unrestricted exposure. The next FYR will be due within five years of the signature date of this FYR.

Appendix A: List of Documents Reviewed

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List of Documents Reviewed

AMEC. (2013a). *Final Source Areas, Soil, and Facility Structures Screening Level Ecological Risk Assessment*. Phoenix-Goodyear Airport - North Superfund Site, Goodyear, Arizona. 11 February 2013.

AMEC. (2013b). *Final Subunit A Capture Zone Report, Phoenix-Goodyear Airport-North Superfund Site.* Prepared on behalf of Crane Co. 11 April 2013.

AMEC Geomatrix, Inc. (2011). *Phase I Soil Gas Investigation Report.* Prepared on behalf of Crane Co. 21 January 2011.

AMEC. (2012) Final Source Areas, Soil, and Facility Structures Human Health Risk Assessment. Phoenix Goodyear Airport-North Superfund Site. November 2012.

ARCADIS (2005) Air Sampling Report, Phoenix-Goodyear Airport North Superfund Site. 9 September 2005.

ARCADIS. (2005). *Soil Vapor Extraction System Operations and Maintenance Plan.* 2 December 2005.

ARCADIS. (2007). *Revised Final Site Evaluation Report, Former UPI Site, Phoenix-Goodyear Airport North Superfund Site, Goodyear, Arizona.* 27 March 2007.

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ARCADIS. (2008b). *Final EA-05 and EA-06 Groundwater Treatment Systems Operation and Maintenance Plan.*

Coffmann Associates, Inc. (2007). *Final Phoenidx Goodyear Airport Master Plan 2005-2025.* November 2007.

Crane Co. et al. v. USA, Partial Consent Decree, Civil Action Nos. CIV-03-2226-PHX-ROS and CIV-04-1400-PHX-ROS (Consolidated) (D. Ariz. April 11, 2006).

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Gilbane. (2014). *Evaluation of Groundwater Chromium Issues at the Phoenix-Goodyear Airport South Superfund Site.* 25 November 2014.

Haley & Aldrich, Inc. (2014). *First Semiannual Groundwater Monitoring Report - 2014, Phoenix-Goodyear Airport South Superfund Site.* Prepared for The Goodyear Tire & Rubber Company. 11 August 2014.

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ITSI Gilbane. (2012). *Statistical Analysis Summary Report of TCE and Total Chromium Concentrations in Selected Monitoring Wells Using Both Low-Flow and HydraSleeve Sampling Technologies at the Phoenix-Goodyear Airport South Superfund Site.* 9 October 2012.

ITSI Gilbane. (2013). *Final Groundwater Investigation for the Area Between Phoenix-Goodyear Airport North Superfund Site, Phoenix-Goodyear Airport South Superfund Site, and Western Avenue Plume Water Quality Assurance Revolving Fund Site.* 5 March 2013.

LATA (Los Alamos Technical Associates.) (2010). *First Semi-Annual 2010 Groundwater Monitoring Report.* Prepared for Goodyear Tire and Rubber Company. August 2010.

Matrix (Matrix New World Engineering, Inc.) (2009). *Draft - Revised Main Treatment System Operations and Maintenance Plan.* October 2009.

Matrix (2010). *Annual Groundwater Operation and Remediation Report, Phoenix-Goodyear Airport - North Superfund Site, Goodyear, Maricopa County, Arizona.* 30 March 2010.

Matrix (2013). *Final SVE Phase I Optimization Completion Report and Phase II Optimizaiton Work Plan, Phoenix-Goodyear Airport-North Superfund Site, Goodyear, maricopa County, Arizona.* Prepared for Crane Co. 30 October 2013.

Phillips, L. (2014). *Evaluation of Groundwater Chromium Issues at the Phoenix-Goodyear Airport South Superfund Site, Goodyear, Arizona.* Technical Memorandum to Catherine Brown. 25 November 2014.

Sharp (Sharp and Associates, Inc.) (1994). *Final Operations and Maintenance Manual, Northern Subunit B/C Groundwater Remediation System, Phoenix-Goodyear Airport Superfund Site, Goodyear, Arizona.* 22 April 1994.

Sharp (Sharp and Associates, Inc.) (2005). *Satatus of Subunit A Groundwater Cleanup and Groundwater Model Predictions of the Phoenix-Goodyear Airport South Site, Goodyear, Arizona.* February 2005.

TRC. (2008). *Phoenix-Goodyear Airport South Site Screening-Level Ecological Risk Assessment.* Prepared for Goodyear Tire and Rubber Company. June 2008.

TRC. (2012a). *Technical Memorandum - Subunit C Chromium Sampling and Analysis Evaluation, Phoenix Goodyear Airport South (PGAS) Superfund Site.* Prepared on behalf of Goodyear Tire & Rubber Company. 17 January 2012.

TRC. (2012b). First Semi-Annual 2012 Groundwater Monitoring Report. Prepared for Goodyear Tire and Rubber Company. August 2012.

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Appendix B: Press Notices and Fact Sheet

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Press Notices and Fact Sheet

PUBLIC NOTICE
EPA-LED COMMUNITY ADVISORY
GROUP (CAG) MEETING
AND
THIRD FIVE-YEAR REVIEW OF CLEANUP AT THE
PHOENIX-GOODYEAR AIRPORT SUPERFUND SITE
NORTH AND SOUTH AREAS

The U.S. Environmental Protection Agency (EPA) and the Arizona Department of Environmental Quality (ADEQ) invites the public to attend an upcoming community meeting:

Tuesday, March 17, 2015
6:00 p.m. to 8:30 p.m.
City of Goodyear Justice Facility
14455 W. Van Buren Street Suite B-101
Goodyear, AZ 85338

The purpose of the meeting is to discuss site activities, promote meaningful community involvement, and announce that EPA and ADEQ have begun the third Five-Year Review at the Phoenix-Goodyear Airport Superfund Site in Goodyear, AZ.

Five-Year Reviews of cleanup actions at Superfund sites are conducted to evaluate the implementation and the effectiveness of the cleanup remedy to determine if it remains protective of human health and the environment.

Upon completion of the review, a copy of the final report will be placed in the local information repositories listed below and a notice will appear in this newspaper announcing the completion of the Five-Year Review.

Please visit the site's web sites at:
www.epa.gov/region09/phoenix-goodyearairport or
www.azdeq.gov/Phoenix-Goodyear_Airport_North.html

SITE REPOSITORIES:

City of Goodyear Library
14455 West Van Buren St.
Suite C-101
Goodyear, AZ 85338
(602) 652-3000

EPA Superfund
Records Center MC SFD7-C
95 Hawthorne St Suite 403S
San Francisco, CA 94105
(415) 820-4700

CONTACT INFORMATION:

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Superfund Project Manager
USEPA Region 9
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brown.catherine@epa.gov

Carlin Hafiz
Community Involvement
Coordinator
USEPA Region 9
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Los Angeles, CA 90017
hafiz.carlin@epa.gov

CNS#2725048

Site Contacts

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Ext: 6027714410
flood.wendy@azdeq.gov

Site Repositories

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14455 West VanBuren St.
Suite C-101
Goodyear, AZ 85338
(602) 652-3000

EPA Superfund
Records Center MC SFD7 - C
95 Hawthorne St Suite 403S
San Francisco, CA 94105
(415) 820-4700

www.epa.gov/region09/phoenix-goodyearairport
www.azdeq.gov/Phoenix-Goodyear_Airport_North.html
www.azdeq.gov/environ/waste/sps/Phoenix_Goodyear_Airport_South.html

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United States Environmental Protection Agency, Region 9
75 Hawthorne Street (SFD-6-3)
San Francisco, CA 94105
Attn: Catherine Brown (PGA 2/15)

Official Business
Penalty for Private Use, $300

Address Service Requested

Phoenix-Goodyear Airport Superfund Site
North and South Areas

February 2015

Cleanup activities at Phoenix-Goodyear Airport Superfund Site, North and South Areas continue (Figure 1). The U.S. Environmental Protection Agency (EPA), in conjunction with the Arizona Department of Environmental Quality (ADEQ), has an enhanced cleanup strategy at the Phoenix-Goodyear Airport – North (PGA-North) Superfund Site. This fact sheet provides important information regarding: 1) actions taking place intended to speed up groundwater cleanup for both areas; 2) announces the next Five-Year Review and; 3) the reorganization of the Community Advisory Group for the entire site.

About the Site

The PGA Superfund Site was originally listed on the National Priorities List in September 1983 as the Phoenix-Litchfield Airport Area Superfund Site. After the airport was transferred to the ownership of the City of Phoenix, the Site was renamed the Phoenix-Goodyear Airport (PGA) Area Superfund Site. Based on groundwater investigations which later identified two different sources of contamination, the Site was divided into two areas, PGA-North and PGA-South with different parties responsible for the cleanups.

PGA North: US EPA Starts New Phase of Work

In September 2014, EPA added an enhancement to the current remedy to address both contaminants of concern – trichloroethylene (TCE) and perchlorate (ClO_4) – in the shallow groundwater aquifer at the Main Drywells Source Area (Source Area). EPA's goal in proposing this enhancement is to augment the cleanup remedy for TCE and ClO_4 to shorten the time it will take to restore the aquifer.

U.S. ENVIRONMENTAL PROTECTION AGENCY

The proposed additional remedial action focuses on the Source Area, where contamination levels in groundwater are the highest. EPA's proposal will employ the injection of in-situ chemical reducing agents which will be phased in over a multi-year period (Figure 2). Each phase will be completed in a two-step process.

1. The first step will involve the injection of solutions containing iron and carbon into the Source Area that will chemically break down the contaminants into non-toxic, more stable and/or less mobile forms and to create the right conditions for further breakdown of these chemicals.
2. The second step will use microbes to break down more TCE and perchlorate into non-toxic products, once conditions are appropriate.

Figure 1: PGA Superfund Site

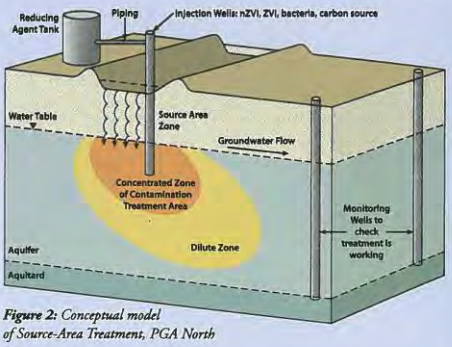

Figure 2: Conceptual model of Source-Area Treatment, PGA North

These methods have been used at other sites in Region 9 and have proven effective. In addition, the PGA North Site has successfully pilot tested in-situ chemical reduction of chlorinated solvents.

During and after the implementation of the remedial action in the Source Area, groundwater monitoring for treatment effectiveness will be conducted. The hydraulic barrier along and near West Van Buren Street provided by the existing groundwater extraction wells will remain in place to ensure that contaminants will not migrate down gradient. Also, an additional extraction and injection well, EA10 and IA09, will be added.

All of the activities proposed here will occur within the footprint of the existing Site. The enhancements proposed in the ROD Amendment are primarily intended to shorten the time necessary to complete the remedial action.

PGA-South: Enhancements to the Clean Up

The cleanup at PGA-South has been operating for 30 years with an overall system uptime of 94%. To date:

- more than 5900 pounds of TCE have been removed through three groundwater pump and treat systems.
- more than 16 pounds of chromium have been removed through a groundwater pump and treat system on Well E-17.
- more than 2500 pounds of TCE have been removed from the subsurface by the Soil Vapor Extraction system.

While there are no remaining source areas at PGA-South and the contaminant plume has long been contained through treatment (since 1994), ground water monitoring continues for wells at the site. In 2014, three key Subunit A Extraction wells were replaced with the intention of optimizing mass removal.

EPA and ADEQ are in discussions with the responsible party to examine other ways to accelerate the cleanup of the aquifer.

What Are the Next Steps in 2015?

PGA-North: A Remedial Design/ Remedial Action Work Plan was sent to EPA on December 1, 2014. The design and action plan describes how the enhancement to the remedy in the Source Area will be accomplished. After approval by EPA and ADEQ, the work plan will be posted on EPA's and ADEQ's website (links below).

PGA-South: Extraction and treatment of groundwater continues with efforts to optimize the system for contaminant mass removal.

Sitewide: The third Five Year Review will be conducted in 2015. The purpose of the Five Year Review is to evaluate the implementation and the effectiveness of the cleanup remedy to determine if it remains protective of human health and the environment.

How Can I Contact EPA and Get Involved?

EPA and ADEQ work hard to promote meaningful community involvement and our shared goal is to keep the community informed of current and planned site activities. In 2015, EPA will take steps to transition to a new EPA-led Community Advisory Group (CAG) with the goal of communicating Site activities. Residents of Goodyear, Avondale or Litchfield Park who are interested in participating in this group should submit their names and addresses to Catherine Brown or Carlin Hafiz at the addresses listed on the opposite page.

Appendix C: Interview Forms

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Interview Forms

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Five-Year Review Interview Record			
Site:	Phoenix Goodyear Airport Superfund Site	**EPA ID No:**	AZD980695902

Interview Type: Teleconference
Location of Visit: N/A
Date: February 19, 2015
Time: 0930

Interviewers

Name	Title	Organization
Catherine Brown	EPA RPM	EPA
Karah Haskins	Physical Scientist	USACE

Interviewees

Name	Organization	Title	Telephone	Email
Alan Bilzi	Environmental Venture Group, Inc.	President		abilzi@aol.com

Summary of Conversation

Consultant to Crane Co. for Technical Activities at PGA North. Al has been on project for 21 years.

1) **What is your overall impression of the project?**

It's a very dynamic technically challenging, long term remediation project with a lot of involvement from all levels including city, county, federal. There is good community acceptance from city representatives. Public participation can be few in number, but that is good because it shows that the community is accepting the remedy. Over the last FYR relationships have improved because they have started routine meetings and the relationship between EPA and the state has improved. Catherine agrees with that.

2) **Is the remedy functioning as expected? How well is the remedy performing?**

GW pump and treat systems for Subunits A and C are functioning as expected. All public water supply wells are protected. City monitoring of water supplies and risk assessment work shows that the remedy is protective and that no pathways are complete.

SVE system is working as expected. There has been recent optimization testing that will show results in the next year or so.

City of Goodyear water supply wells are sampled once a month. COG-3 is monitored twice monthly at PGA north during high pumping season between May and October as agreed.

3) **What does the monitoring data show? Are there any trends that show contaminant levels are decreasing?**

Subunit A groundwater is about 100-250 feet below ground surface and the plume is fully contained. Measures implemented that involve reinjection of treated water is shrinking the contamination plume in size. Concentrations are decreasing in many monitoring wells from the influence of perimeter reinjection. There has been a decline in concentrations from the extraction wells.

Subunit C is largely defined and we are continuing to add to monitoring wells. Local groundwater wells tap into subunit C and deeper aquifers. There are extraction wells in subunit C, but the long-term pump and treat systems are not complete. The plume is not moving towards production wells. Over next five years they will work to get additional containment of subunit C.

4) **Is there a continuous O&M presence? If so, please describe staff and activities. If there is not a continuous on-site presence, describe staff and frequency of site inspections and activities.**

We do have continuous O&M personnel--2 full time operators on-site 5 days a week. On call 24/7 if systems were to malfunction. In addition, there is 1 full time construction/maintenance supervisor and 3 full time maintenance workers that can repair pipelines/ treatment systems. We can add to labor pool on an as needed basis. 1 full time environmental engineer in City of Goodyear. 2 full time GW sampling technicians. Technical staff remotely monitor treatment systems.

5) **Have there been any significant changes in the O&M requirements, maintenance schedules, or sampling routines in the last five years? If so, do they affect protectiveness of the remedy? Please describe changes and impacts.**

O&M upgrades have been performed at all five treatment systems and SVE system. Examples:
-33A treatment facility: new manifold and treatment vessel refurbishing

-Main Treatment System New manifold and piping. Brought on new air stripper. Plumbed for separation of A and C extraction wells
-EA-08: new concrete block wall around facility, concrete containment and retrofit on controls
-EA-06: automated irrigation system which provides irrigation water to City of Goodyear park
-EA-05: new bag filter vessels, influent and discharge
-SVE system: major refurbishing including new carbon vessels, piping, manifold and complete control system

Treatment volumes and system up time has increased for all GW treatment systems. SVE system is currently down for rebound testing.
Put in 2 new Subunit A extraction wells. Reinjection system in the NE has been completed and installed two new injection wells in the NW for plume containment including all piping.

6) What are the annual operating costs for your organization's involvement with the site?

Not at liberty to disclose cost figures. Would need to get written permission from Crane Co.

7) Have there been unexpected O&M difficulties or costs at the site in the last five years? If so, please give details.

Two that he can note: when they were separating a pipeline from two extraction wells, the connection to an unused pipeline leaked. There was water discharged to surface soil. Water and air sampling was conducted and no health risks were found to be associated with leak. Both wells got new pipelines to the treatment system.

MW-29 pump malfunction. Pump became lodged in the well and the well is not functional.
Work plan has been submitted to EPA to abandon MW-29 and replace with larger and more functional well.

8) Have there been opportunities to optimize O&M or sampling efforts? Please describe changes and resultant or desired cost savings or improved efficiency.

Uptime at Crane Co. treatment systems has improved. Total quality management improvements include employing Kaizen events to review and evaluate treatment systems. There have been Kaizen events at all 5 GW treatment systems and the SVE system. Improved labeling of system components and maintenance schedules. Resulting in minimized unplanned maintenance costs and increased system uptime. Color coding for influent and effluent water, signage and maintenance schedules for each system. Regarding GW sampling, increased efficiency by using low flow sampling techniques which also reduce cost.

9) 9) Are you aware of any changes in Federal/State/County/Local laws and regulations that may impact the protectiveness of the remedy?

No, not aware of any changes to any laws. Formal establishment of Perchlorate cleanup level by EPA. Former county permit for air stripping emissions no longer needed, but the emissions never reached levels that exceeded the former permit.

10) Do you have any comments, suggestions, or recommendations regarding the project?

Al thinks this is a most interesting project mainly because he has been on it for so long. Fortunate there is a great technical staff on agency, Crane Co. city and state teams. Great support and leadership.

Suggestion for City of Goodyear landscape research and demonstration project along Litchfield road: The project was tabled by city management and was going to be an area along Litchfield road where universities could do research for desert landscapes. There was an agreement to utilize land which had been signed by Crane Co. Would be great if EPA could find out from the city what happened and move forward with the use the land as a research facility.

Five-Year Review Interview Record			
Site:	Phoenix Goodyear Airport Superfund Site	**EPA ID No:**	AZD980695902

Interview Type: Teleconference
Location of Visit: N./A
Date: February 19, 2015
Time: 1000

Interviewers

Name	Title	Organization
Catherine Brown	EPA RPM	EPA
Karah Haskins	Physical Scientist	USACE

Interviewees

Name	Organization	Title	Telephone	Email
Brian Stonebrink	ADEQ	PM for PGAS		Stonebrink.Brian@azdeq.gov

Summary of Conversation

Involved with PGA south project in 2006 & 2007 and started back in November 2013 to present.

1) **What is your overall impression of the project?**

His overall impression is that progress is being made. There is now beneficial reuse of treated water from the Northern Subunit C treatment system and they have made progress with installation of extraction wells and installation of 3 new extraction wells in subunit A. PRP has been continuing to investigate GW data gaps and assessing vertical contamination.

2) **Is the remedy functioning as expected? How well is the remedy performing?**

Extraction optimization system should increase capture. At this stage in the process it takes a lot of effort to get lower levels of contamination so it is expected that it will take some time to see further decreases in plume contamination.

3) **What does the monitoring data show? Are there any trends that show contaminant levels are decreasing?**

Monitoring data shows that Subunit A has slight decreases in contamination. Now that extraction well in Subunit C is operating it will take some time to extract high concentrations and move groundwater flow, but at least there is capture. Southern subunit C is below or near the MCLs, indicating that treatment was effective there. Monitoring continues to show that COG wells are being protected.

4) **Is there a continuous O&M presence? If so, please describe staff and activities. If there is not a continuous on-site presence, describe staff and frequency of site inspections and activities.**

There have been some changes in engineering system review that will update O&M Plan as part of recent extraction well installations. Emergency action plan is in place for uncontrolled releases. Consulting firm has a local presence. Haley and Aldrich has been keeping up with system requirements.

5) **What are the annual operating costs for your organization's involvement with the site?**

Oversight is consistent with previous years for document reviews, project meetings, community involvement, etc.. 30-40 thousand for ADEQ oversight.

6) **Have there been unexpected O&M difficulties or costs at the site in the last five years? If so, please give details.**

We are now managing the treated water that is going to COG to meet the substantive permit requirements. This was not forseen years ago but overall has a great benefit to reuse that water. There have been leaks in the system, but the emergency action plan that has been implemented to prevent future leaks. Property owner City of Phoenix was happy to have emergency action plan, shutdown procedures and contacts updated.

7) **Are you aware of any changes in Federal/State/County/Local laws and regulations that may impact the protectiveness of the remedy?**

Not that he can think of. Still need to meet the Arizona Aquifer Water Quality Standards and MCLs which haven't changed.

8) **Do you have any comments, suggestions, or recommendations regarding the project?**

Encourage continued maintenance as the system ages. Replace piping as needed. Satisfied with the amount of effort that the RP have put in the last few years to keep the system running and optimization of extraction wells.

Five-Year Review Interview Record			
Site:	Phoenix Goodyear Airport Superfund Site	**EPA ID No:**	AZD980695902

Interview Type: Teleconference
Location of Visit: N/A
Date: February 19, 2015
Time: 1030

Interviewers

Name	Title	Organization
Catherine Brown	EPA RPM	EPA
Karah Haskins	Physical Scientist	USACE

Interviewees

Name	Organization	Title	Telephone	Email
Patrick Shinabery	ADEQ	PM for PGA North site		Shinabery.Patrick@azdeq.gov

Summary of Conversation

Patrick has been with the site for about 1 year.

1) **What is your overall impression of the project?**

I believe the project is being managed very well at this point. The team involves educated professionals that are competent in their field.

2) **Is the remedy functioning as expected? How well is the remedy performing?**

The remedy is not functioning as expected with respect to the old ROD, so that is why there was a ROD amendment. Only concern about selected remedy is that we don't want to lose capture of anything that is injected and will need to determine how best to maintain capture. There are some unknowns about the status of containment of subunit A plume. Looks good but there are a lot of unknowns. There is an amount of movement into Subunit C through Subunit B. They are still gathering data, but he feels the new selected remedy is robust enough to take care of the unknowns.

3) **What does the monitoring data show? Are there any trends that show contaminant levels are decreasing?**

Has not looked at trend analysis. The plume is being pushed around from extraction and injection wells. Not overall decreasing, but maybe in some small areas. More mass needs to be removed from the source.

4) **Is there a continuous O&M presence? If so, please describe staff and activities. If there is not a continuous on-site presence, describe staff and frequency of site inspections and activities.**

There are monthly calls. He is impressed with the presence that they have and the level of detail that they keep them up to date.

5) **Have there been any significant changes in the O&M requirements, maintenance schedules, or sampling routines in the last five years? If so, do they affect protectiveness of the remedy? Please describe changes and impacts.**

Not much, some personnel change.

6) **Have there been unexpected O&M difficulties or costs at the site in the last five years? If so, please give details.**

No

7) **Have there been opportunities to optimize O&M or sampling efforts? Please describe changes and resultant or desired cost savings or improved efficiency.**

Ongoing process always being reviewed. In monthly meetings they are fairly active and make improvements as they come up.

8) **Are you aware of any changes in Federal/State/County/Local laws and regulations that may impact the protectiveness of the remedy?**

No, there have not been that he is aware of.

9) **Do you have any comments, suggestions, or recommendations regarding the project?**

The project is being managed really well.

Five-Year Review Interview Record			
Site:	Phoenix Goodyear Airport Superfund Site	**EPA ID No:**	AZD980695902

Interview Type: Teleconference
Location of Visit: N/A
Date: February 19, 2015
Time: 1100

Interviewers

Name	Title	Organization
Catherine Brown	EPA RPM	EPA
Karah Haskins	Physical Scientist	USACE-Seattle

Interviewees

Name	Organization	Title	Telephone	Email
Wendy Flood	ADEQ	Community involvement coordinator		Flood.Wendy@azdeq.gov

Summary of Conversation

Wendy has been on PGA project for about 3 years. She was not involved at the time of the previous FYR.

1) **What is your overall impression of the project?**

PGA north and south are progressing as expected. There is active treatment, plume capture, and involved parties.

2) **Is the remedy functioning as expected? How well is the remedy performing?**

Remedy is functioning as expected. At the moment issues involve trying to deal with plume containment and functionality. The recent ROD amendment is a positive move forward for accelerated cleanup and enhancing the remedy.

3) **What does the monitoring data show? Are there any trends that show contaminant levels are decreasing?**

Not familiar with monitoring data. There haven't been any major surprises from concentrations.

4) **What is your overall impression of community involvement ?**

There were quarterly meetings that the state put on. Both north and south have supplied info to the public about well drillings and plume containment and other site related activities. There have been at least two or three fact sheets so that has been a positive way to keep the community involved. For the proposed plan there was a lot of work to involve the community. Participants for north and south have showed significant effort when asked to provide information or participate. t.

5) **In terms of community involvement do you have any recommendations?**

Level of community involvement has been stable. Recommend that the current CAG remain since they are a dedicated, informed group of community members to help ensure the level of involvement continues because it has been well received.

6) **Have there been any complaints from the community?**

Any complaints that have been received are minor and have been addressed.

Additional Site-Specific Questions

Five-Year Review Interview Record			
Site:	Phoenix Goodyear Airport North, Goodyear, Arizona	**EPA ID No:**	AZD980695902

Interview Type: Site Visit
Location of Visit: Phoenix Goodyear Airport
Date: 25 February, 2015
Time: 1130 hrs

Interviewers

Name	Title	Organization
Matthew Masten	Environmental Engineer	USACE

Interviewees

Name	Organization	Title	Telephone	Email
Stephanie Koehne	AMEC	Project Manager	480-734-6279	
Harry Brenton	Matrix New World	Dir. of Hydrogeologic Svcs	623-322-7003	
Tom Vanaskey	Blue World Remediation	Lead Operator	855-244-8125	

Summary of Conversation

1) What is your overall impression of the project?

Ms. Koehne: This is a large plume; it's a complex and dynamic project, which is exciting. We have to interface on a regular basis with many different stakeholders. In the last 5 years, the progress has been phenomenal. We have upgraded treatment systems, added extraction and injection wells, how the systems are maintained- the Kaizen system has brought up our overall quality, making sure any problems are handled on a regular basis. With the source area remediation and the ROD getting amended and approved, it's a very dynamic, technical project. Many disciplines are involved, working with many stakeholders – it makes it an exciting project to work on.

2) Is the remedy functioning as expected? How well is the remedy performing?

Mr. Brenton: I think its performing very well, over the last 5 years, we've installed multiple extraction wells in Subunit A, multiple injection wells in Subunit A. We've really been able to contain the plume in Subunit A and even start to shrink the plume. We have removed a lot more TCE and perchlorate mass. With our local full time operators, if we do get an alarm, and a system goes down, we have very fast response. So our up-times are upwards of 95% if not higher. In the past 4 or 5 years, we have increased treatment capacity and improved system up-time. We've done a very good job of containing the Subunit A TCE and perchlorate plumes.

Ms. Koehne: In the last 5 years, we have installed 56 monitoring wells, within Subunit A, B and C. This has enabled us to refine where we are putting extraction and injection wells.

Mr. Brenton: This has helped us understand the hydrostratigraphy of the site.

3) What does the monitoring data show? Are there any trends that show contaminant levels are decreasing?

Mr. Brenton: Levels have gone down overall, certainly on the periphery, for example well EPA MW35A in the northeast, before we started to inject water in this area we had concentrations in 35A that were above 5 (ppb) (TCE). We still have concentrations in the interior of the plume that move up and down, but on the periphery we have concentrations that are now non-detect or have shrunk. Due to seasonal fluctuation, we have ebb and flow of the plume, but overall it is starting to shrink.

4) Is there a continuous O&M presence? If so, please describe staff and activities. If there is not a continuous on-site presence, describe staff and frequency of site inspections and activities.

Mr. Vanaskey: Jeff and I are here full time, Monday-Friday, actually 24/7 coverage. If anything goes down, we are minutes away, responding to emails and phone calls.

Mr. Brenton: There are group emails that go out and will responded to.

Ms. Koehne: There is a SCADA system, so anyone with access can go on and check the status of the systems at anytime from anywhere.

Mr. Vanaskey: We have a really good "phone tree" set up to make sure someone gets the message.

Ms. Koehne: We also have a full-time construction supervisor on site and people under him, and two full time groundwater monitoring technicians, so someone is always on site.

Mr. Vanaskey: There isn't a day that goes by that someone isn't putting a visual on each system.

5) Have there been any significant changes in the O&M requirements, maintenance schedules, or sampling routines in the last five years? If so, do they affect protectiveness of the remedy? Please describe changes and impacts.

Ms. Koehne: No changes in requirement, we now have a larger support group on site on a regular basis.

Mr. Vanaskey: This helps because now we don't have to wait for a subcontractor or someone to come out and fix something. It's in-house now.

Mr. Brenton: We've made some marked improvements in the way the systems communicate through the SCADA system, so everything is almost state of the art now.

6) What are the annual operating costs for your organization's involvement with the site?

Ms. Koehne: In general, that is something that would have to be requested in writing from the Crane Co. representative.

7) Have there been unexpected O&M difficulties or costs at the site in the last five years? If so, please give details.

Mr. Vanaskey: We had a spill at EA02, in 2011 or 2012. We were separating two extraction wells and tying into a preexisting line, that line had a leak, which we were unaware of. The spill was cleaned up and soil and air sampling was performed, all non-detect. New line was installed back to the MTS and pressure tested.

Mr. Brenton: MW29 extraction well: the pump was being pulled for repairs, and became lodged, now that well is inoperable. A work plan has been submitted for replacement. Well MW29 was originally a monitoring well, and was not purpose built for extraction.

Ms. Koehne: Crane Co corporate has "Kaizened" a system each year for the last few years. This has led to color coding systems, paths for operators to follow, and a "Red Tag" system to identify and fix issues with the systems. This allows us to track and maintain and more quickly identify and repairs problems, this helps safety and up-time.

Mr. Vanaskey: Anybody can submit a red tag, they get submitted to a computer system, everyone is aware and they can get fixed quickly, depending on the priority. We also have a 3rd party QC person coming in and inspecting the systems.

8) Have there been opportunities to optimize O&M or sampling efforts? Please describe changes and resultant or desired cost savings or improved efficiency.

Ms. Koehne: The Kaizen system has been a big one.

Mr. Brenton: In addition to Kaizen, we do an internal audit of our sampling persons. We have an internal person from New Jersey come out once a year and follow the samplers. They make sure they are following the QAPP and we are getting good data.

Ms. Koehne: Harry will do a review on a monthly basis and try to optimize the sampling program; it's an on-going analysis.

Mr.Brenton: We are looking at applying some Kaizen principles to the groundwater sampling program as well.

9) Are you aware of any changes in Federal/State/County/Local laws and regulations that may impact the protectiveness of the remedy?

Ms. Koehne: We did have Air Permits that are no longer required. Our discharge rates were less than the county requirements anyhow. We still follow the requirements of the permit; we just don't necessarily need one.

10) Do you have any comments, suggestions, or recommendations regarding the project?

Mr. Brenton: I think the project is running very smoothly, some positive things have happened in the past few years. We send monthly summaries to the City of Goodyear, there is some good stewardship taking place.

Additional Site-Specific Questions

Five-Year Review Interview Record			
Site:	Phoenix Goodyear Airport South, Goodyear, Arizona	**EPA ID No:**	AZD980695902

Interview Type: Teleconference
Location of Visit: NA
Date: 2/20/2015
Time: 10 AM PST

Interviewers

Name	Title	Organization
Catherine Brown	Remediation Project Manager	EPA Region 9

Interviewees

Name	Organization	Title	Telephone	Email
Ron R. Clark	The Goodyear Tire & Rubber Company	Project Manager	(330) 668.4600 x113	ron_clark@goodyear.com
Paula C. Panzino	Haley & Aldrich, Inc.	Remediation Program Manager	(480) 760.2418	ppanzino@haleyaldrich.com

Summary of Conversation

1) What is your overall impression of the project?

GTRC's overall impression of the project is that the treatment system has been successfully operating in compliance with the ROD for over 20 years. Based on the mass estimates provided in the FS, over 90% of the mass has been removed. GTRC has remediated the southern Subunit C TCE plume and has recently optimized capture of the northern Subunit C plume. The ground water containment systems installed at PGA South are protective of human health and the environment.

2) Is the remedy functioning as expected? How well is the remedy performing?

The groundwater remedy has functioned as expected. The Subunit A footprint has decreased significantly, and TCE in the southern Subunit C area has been reduced to below the MCL of 5 ug/L.

3) What does the monitoring data show? Are there any trends that show contaminant levels are decreasing?

Over the past 5-years, the monitoring data show that TCE mass within Subunit A is decreasing, especially along the perimeter of the plume. Over 90% of the initial estimated mass in Subunit A has been removed. There are no increasing trends. Due to the drop in the water table, several Subunit A monitor wells have been replaced in the past two years. The replacement wells were installed at a deeper depth than the original wells and some of these locations show higher concentrations of TCE than their shallower counterparts.

4) Is there a continuous O&M presence? If so, please describe staff and activities. If there is not a continuous on-site presence, describe staff and frequency of site inspections and activities.

During recent optimization activities there has been a field technician or construction manager on site daily. However, during routine system O&M, the site technician is present at the site on Monday, Wednesday and Friday of every week. Both the Subunit A and Subunit C treatment systems are equipped with SCADA systems which will remotely notify our field staff 24/7 of any abnormal operating conditions, allowing them to respond remotely to adjust flow rates or turn the systems off, if necessary. In addition, PGA Aviation personnel that are on site 24/7 have been educated to identify visual system deficiencies and notify the GTRC O&M technician. PGA Aviation personnel also have the authority to shut down the system in the event of a system failure. Site O&M activities typically include treatment system inspection, general compound maintenance activities, execution of the Comprehensive Groundwater Monitoring Plan, and adjusting pump rates and valves.

5) Have there been any significant changes in the O&M requirements, maintenance schedules, or sampling routines in the last five years? If so, do they affect protectiveness of the remedy? Please describe changes and impacts.

Significant upgrades to the treatment system controls were completed in December 2014. The software and hardware for the system controls were modernized with new electronic components and programming. This has simplified O&M requirements by improving system monitoring capabilities for both the Subunit A and C treatment systems.

Also completed in December 2014, the optimization of the Subunit A and Subunit C treatment systems included the addition of four

Page 1 of 2

new extraction wells, 3 piezometers and 11,625 ft of conveyance pipeline. Additionally, four monitoring wells were installed to refine the conceptual site model in the northern portion of the site. Despite the addition of monitoring wells, the change from low-flow sampling to use of Hydrasleeves to collect performance groundwater monitoring samples has reduced the level of effort required to complete system maintenance and performance monitoring over the last five years.

6) What are the annual operating costs for your organization's involvement with the site?

Annual operating costs for Goodyear's involvement with the site entail many different elements, including costs of equipment procurement and installation, infrastructure repairs, project oversight, contractor and consultant support, legal support, real property expenses, travel expenses, and agency oversight costs. All of these costs can vary widely from year to year and consequently, annual costs to the company are difficult to quantify accurately.

7) Have there been unexpected O&M difficulties or costs at the site in the last five years? If so, please give details.

The aging infrastructure of the Subunit treatment system has required maintenance and in some instances, equipment replacement. However, the engineering evaluation performed in March through May 2014 allowed GTRC to address issues in a timely manner, and was used to inform the optimization of both Subunit A and Subunit C treatment systems. For additional details please refer to the memorandum dated 15 January 2015, *Groundwater Treatment Systems Engineering Review*, by Haley & Aldrich.

8) Have there been opportunities to optimize O&M or sampling efforts? Please describe changes and resultant or desired cost savings or improved efficiency.

As mentioned above, the switch from the low-flow groundwater sampling method to use of Hydrasleeves has reduced the labor effort involved with performance monitoring by 75%. The 2014 upgrade of the system controls facilitates 24/7 remote monitoring of system conditions, reducing the need for on-site system monitoring.

9) Are you aware of any changes in Federal/State/County/Local laws and regulations that may impact the protectiveness of the remedy?

No. GTRC is not aware of any changes in applicable laws or regulations that may impact the protectiveness of the remedy.

10) Do you have any comments, suggestions, or recommendations regarding the project?

GTRC, together with the EPA and ADEQ would like to explore the possibility of alternative approaches to meet redefined remedial objectives at PGA-S. PGA-S qualifies as a large complex site where the ROD mandated remedy has been operating for 24 years with no practical end in sight. GTRC would like to continue discussions in a joint effort to establish achievable remedial action milestones.

Additional Site-Specific Questions
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Five-Year Review Interview Record			
Site:	Phoenix Goodyear Airport Superfund Site	**EPA ID No:**	AZD980695902

Interview Type: Teleconference
Location of Visit: N/A
Date: February 23, 2015
Time: 11

Interviewers

Name	Title	Organization
Catherine Brown	EPA RPM	EPA Region 9
Karah Haskins	Physical Scientist	USACE-Seattle

Interviewees

Name	Organization	Title	Telephone	Email
Tom Suriano	Clear Creek	Principle hydrogeologist		tsuriano@clearcreekassociates.com

Summary of Conversation

Representing Litchfield Park City and Avondale City. Has been with PGA North since 2006.

1) **What is your overall impression of the project?**

There has been substantial progress made in hydraulically containing the plume. Reinjection of treated groundwater has made a huge difference in containing the plume.

2) **Is the remedy functioning as expected? How well is the remedy performing?**

The remedy is functioning as expected for the current phase. The focus has been on getting hydraulic containment, but that hasn't always been focus. Right now they are focusing on Source control measure. In the future they will focus on mass removal.

The remedy is performing well at hydraulic containment. Subunit A area north of I-10 is contained. Subunit A to the south and Subunit C need work and are covered by ROD amendment.

3) **What does the monitoring data show? Are there any trends that show contaminant levels are decreasing?**

The trends are as expected. At Well 58 A there is a concern about increasing trend. Aside from isolated instances there is decreasing on the edges which is consistent with reinjection of treated water.

4) **Is there a continuous O&M presence? If so, please describe staff and activities. If there is not a continuous on-site presence, describe staff and frequency of site inspections and activities.**

No issues from the city's perspective. Notification procedures are good.

5) **Have there been any significant changes in the O&M requirements, maintenance schedules, or sampling routines in the last five years? If so, do they affect protectiveness of the remedy? Please describe changes and impacts.**

No significant changes. Separation of the two streams is a good plan and work is in progress.

The City of Litchfield Park does split sampling of well and lake. Once a year they do sampling. Early on they sampled more frequently when there was a question about containment.

6) **Are you aware of any changes in Federal/State/County/Local laws and regulations that may impact the protectiveness of the remedy?**

TCE indoor air levels have changed. Suggest that soil gas levels be revisited to ensure protectiveness.

7) **Do you have any comments, suggestions, or recommendations regarding the project?**

Current path for plume containment are good steps. Next thing to consider is are there ways the remedy can be enhanced to reduce overall time frame. There are areas north of I10 with concentrations upwards of 100ppb. Improve mass removal or mass destruction to the extent it's feasible.

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Appendix D: Site Inspection Checklist

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Site Inspection Checklist

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Five-Year Review Site Inspection Checklist

I. SITE INFORMATION	
Site name: PGA North/MTS	**Date of inspection:** 25 Feb, 2015
Location: Goodyear, AZ/Region 9	**EPA ID:** AZD980695902
Agency, office, or company leading the five-year review: AMEC & Matrix New World	**Weather/temperature** Sunny, calm, ~65° F

Remedy Includes: (Check all that apply)

- ☐ Landfill cover/containment
- ☒ Access controls
- ☒ Institutional controls
- ☒ Groundwater pump and treatment
- ☐ Surface water collection and treatment
- ☐ Other:

  Vapor phase GAC, Air Stripping, Ion Exchange
- ☐ Monitored natural attenuation
- ☒ Groundwater containment
- ☐ Vertical barrier walls

Attachments: ☒ Inspection-team roster attached ☐ Site map attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** Stephanie Koehne (Name) Project Manager (Title) 25 Feb 2015 (Date)
   Interviewed ☒ at site ☐ at office ☐ by phone Phone no. 480-734-6279
   Problems, suggestions; ☐ Report attached

2. **O&M staff** Harry Brenton (Name) Dir. of Hydrogeologic Svcs. (Title) 25 Feb 2015 (Date)
   Interviewed ☒ at site ☐ at office ☐ by phone Phone no. 623-322-7003
   Problems, suggestions; ☐ Report attached

2. **O&M staff** Tom Vanaskey (Name) Lead Operator (Title) 25 Feb 2015 (Date)
   Interviewed ☒ at site ☐ at office ☐ by phone Phone no. 855-244-8125
   Problems, suggestions; ☐ Report attached

2. **O&M staff** _____ (Name) _____ (Title) 25 Feb 2015 (Date)
   Interviewed ☒ at site ☐ at office ☐ by phone Phone no. _____
   Problems, suggestions; ☐ Report attached

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____

4. **Other interviews** (optional) ☐ Report attached.

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**

■ O&M manual	■ Readily available	■ Up to date	☐ N/A
■ As-built drawings	■ Readily available	■ Up to date	☐ N/A
■ Maintenance logs	■ Readily available	■ Up to date	☐ N/A

Remarks

2. **Site-Specific Health and Safety Plan** ■ Readily available ■ Up to date ☐ N/A
■ Contingency plan/emergency response plan ■ Readily available ■ Up to date ☐ N/A
Remarks

3.	**O&M and OSHA Training Records** Remarks	■ Readily available	☐ Up to date	☐ N/A
4.	**Permits and Service Agreements**			
	☐ Air discharge permit	☐ Readily available	☐ Up to date	■ N/A
	☐ Effluent discharge	☐ Readily available	☐ Up to date	■ N/A
	☐ Waste disposal, POTW	☐ Readily available	☐ Up to date	■ N/A
	☐ Other permits_____	☐ Readily available	☐ Up to date	☐ N/A
	Remarks			
5.	**Gas Generation Records** Remarks	☐ Readily available	☐ Up to date	■ N/A
6.	**Settlement Monument Records** Remarks	☐ Readily available	☐ Up to date	■ N/A
7.	**Groundwater Monitoring Records** Remarks	■ Readily available	■ Up to date	☐ N/A
8.	**Leachate Extraction Records** Remarks	■ Readily available	☐ Up to date	☐ N/A
9.	**Discharge Compliance Records**			
	☐ Air	☐ Readily available	☐ Up to date	■ N/A
	☐ Water (effluent)	☐ Readily available	☐ Up to date	☐ N/A
	Remarks			
10.	**Daily Access/Security Logs** Remarks	■ Readily available	■ Up to date	☐ N/A

IV. O&M COSTS

1. **O&M Organization**

☐ State in-house ☐ Contractor for State
☐ PRP in-house ☒ Contractor for PRP
☐ Federal Facility in-house ☐ Contractor for Federal Facility
☐ Other

2. **O&M Cost Records**

☐ Readily available ☐ Up to date ☐ Funding mechanism/agreement in place
Original O&M cost estimate_____ ☐ Breakdown attached

Total annual cost by year for review period if available

From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost

3. **Unanticipated or Unusually High O&M Costs During Review Period**

Describe costs and reasons:

O&M Cost was not discussed in the site interviews - this information will be requested from contractors.

V. ACCESS AND INSTITUTIONAL CONTROLS ☐ Applicable ☐ N/A

A. Fencing

1. **Fencing damaged** ☐ Location shown on site map ☒ Gates secured ☐ N/A

Remarks Fence and locked gates

B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on site map ☒ N/A

Remarks Lighting, signage and security system in place

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented ☐ Yes ■ No ☐ N/A
Site conditions imply ICs not being fully enforced ☐ Yes ■ No ☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by) drive by, remote monitoring
Frequency daily
Responsible party/agency Blue World Remediation
Contact Tom Vanaskey | Lead Operator | | 855-244-8125
Name | Title | Date | Phone no.

Reporting is up-to-date ☐ Yes ☐ No ■ N/A
Reports are verified by the lead agency ☐ Yes ☐ No ■ N/A

Specific requirements in deed or decision documents have been met ☐ Yes ☐ No ■ N/A
Violations have been reported ☐ Yes ☐ No ■ N/A
Other problems or suggestions: ☐ Report attached

2. **Adequacy** ■ ICs are adequate ☐ ICs are inadequate ☐ N/A
Remarks

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map ■ No vandalism evident
Remarks

2. **Land use changes on site** ■ N/A
Remarks

3. **Land use changes off site** ■ N/A
Remarks

VI. GENERAL SITE CONDITIONS

A. Roads ■ Applicable ☐ N/A

1. **Roads damaged** ☐ Location shown on site map ■ Roads adequate ☐ N/A
Remarks

B. Other Site Conditions
Remarks Site is in good condition, functioning properly

VII. LANDFILL COVERS ☐ Applicable ☒ N/A		
A. Landfill Surface		
1. **Settlement** (Low spots) Areal extent_____ Remarks	☐ Location shown on site map Depth_____	☐ Settlement not evident
2. **Cracks** Lengths_____ Widths_____ Depths_____ Remarks	☐ Location shown on site map	☐ Cracking not evident
3. **Erosion** Areal extent_____ Remarks	☐ Location shown on site map Depth_____	☐ Erosion not evident
4. **Holes** Areal extent_____ Remarks	☐ Location shown on site map Depth_____	☐ Holes not evident
5. **Vegetative Cover** Remarks	☐ Grass ☐ Cover properly established ☐ No signs of stress ☐ Trees/Shrubs (indicate size and locations on a diagram)	
6. **Alternative Cover (armored rock, concrete, etc.)** Remarks		☐ N/A
7. **Bulges** Areal extent_____ Remarks	☐ Location shown on site map Height_____	☐ Bulges not evident

8.	**Wet Areas/Water Damage** ☐ Wet areas ☐ Ponding ☐ Seeps ☐ Soft subgrade Remarks	☐ Wet areas/water damage not evident ☐ Location shown on site map ☐ Location shown on site map ☐ Location shown on site map ☐ Location shown on site map	 Areal extent_____ Areal extent_____ Areal extent_____ Areal extent_____
9.	**Slope Instability** ☐ Slides Areal extent_____ Remarks	☐ Location shown on site map	☐ No evidence of slope instability
B. Benches	■ N/A ☐ Applicable (Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)		
1.	**Flows Bypass Bench** Remarks	☐ Location shown on site map	☐ N/A or okay
2.	**Bench Breached** Remarks	☐ Location shown on site map	☐ N/A or okay
3.	**Bench Overtopped** Remarks	☐ Location shown on site map	☐ N/A or okay
C. Letdown Channels	☐ Applicable ■ N/A (Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)		
1.	**Settlement** Areal extent_____ Remarks	☐ Location shown on site map Depth_____	☐ No evidence of settlement
2.	**Material Degradation** Material type_____ Remarks	☐ Location shown on site map Areal extent_____	☐ No evidence of degradation
3.	**Erosion** Areal extent_____ Remarks	☐ Location shown on site map Depth_____	☐ No evidence of erosion

4. **Undercutting** ☐ Location shown on site map ☐ No evidence of undercutting
Areal extent_____ Depth_____
Remarks

5. **Obstructions** Type_____ ☐ No obstructions ☐ Location shown on site map
Areal extent_____ Size_____
Remarks

6. **Excessive Vegetative Growth** Type_____
☐ No evidence of excessive growth
☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent_____
Remarks

D. Cover Penetrations ☐ Applicable ■ N/A

1. **Gas Vents** ☐ N/A ☐ Active ☐ Passive ☐ Properly secured/locked ☐ Functioning
☐ Routinely sampled ☐ Good condition ☐ Evidence of leakage at penetration
Remarks

2. **Gas Monitoring Probes**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks

3. **Monitoring Wells** (within surface area of landfill)
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks

4. **Leachate Extraction Wells**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks

5. **Settlement Monuments** ☐ Located ☐ Routinely surveyed ☐ N/A
Remarks

E. Gas Collection and Treatment	☐ Applicable	☒ N/A	
1.	**Gas Treatment Facilities** ☐ Flaring ☐ Thermal destruction ☐ Collection for reuse ☐ Good condition ☐ Needs Maintenance Remarks		
2.	**Gas Collection Wells, Manifolds and Piping** ☐ Good condition ☐ Needs Maintenance Remarks		
3.	**Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings) ☐ Good condition ☐ Needs Maintenance ☐ N/A Remarks		
F. Cover Drainage Layer	☐ Applicable	☒ N/A	
1.	**Outlet Pipes Inspected** Remarks	☐ Functioning	☐ N/A
2.	**Outlet Rock Inspected** Remarks	☐ Functioning	☐ N/A
G. Detention/Sedimentation Ponds	☐ Applicable	☒ N/A	
1.	**Siltation** ☐ N/A Areal extent_____ Depth_____ Remarks	☐ Siltation not evident	
2.	**Erosion** Areal extent_____ Depth_____ Remarks	☐ Erosion not evident	
3.	**Outlet Works** Remarks	☐ Functioning	☐ N/A
4.	**Dam** Remarks	☐ Functioning	☐ N/A

H. Retaining Walls	☐ Applicable	☒ N/A
1. **Deformations** Horizontal displacement_____ Vertical displacement_____ Rotational displacement_____ Remarks	☐ Location shown on site map	☐ Deformation not evident
2. **Degradation** Remarks	☐ Location shown on site map	☐ Degradation not evident
I. Perimeter Ditches/Off-Site Discharge	☐ Applicable	☒ N/A
1. **Siltation** Areal extent_____ Depth_____ Remarks	☐ Location shown on site map	☐ Siltation not evident
2. **Vegetative Growth** Areal extent_____ Type_____ Remarks	☐ Location shown on site map ☐ Vegetation does not impede flow	☒ N/A
3. **Erosion** Areal extent_____ Depth_____ Remarks	☐ Location shown on site map	☐ Erosion not evident
4. **Discharge Structure** Remarks	☐ Functioning	☐ N/A
VIII. VERTICAL BARRIER WALLS	☐ Applicable	☒ N/A
1. **Settlement** Areal extent_____ Depth_____ Remarks	☐ Location shown on site map	☐ Settlement not evident
2. **Performance Monitoring** Type of monitoring_____ ☐ Performance not monitored ☐ Evidence of breaching Frequency_____ Head differential_____ Remarks		
IX. GROUNDWATER/SURFACE WATER REMEDIES	☐ Applicable	☐ N/A
A. Groundwater Extraction Wells, Pumps, and Pipelines	☐ Applicable	☐ N/A
1. **Pumps, Wellhead Plumbing, and Electrical** ☒ Good condition ☒ All required wells properly operating ☐ Needs Maintenance ☐ N/A Remarks		

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
☒ Good condition ☐ Needs Maintenance
Remarks

3. **Spare Parts and Equipment**
☒ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided
Remarks

B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☒ N/A

1. **Collection Structures, Pumps, and Electrical**
☐ Good condition ☐ Needs Maintenance
Remarks

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
☒ Good condition ☐ Needs Maintenance
Remarks

3. **Spare Parts and Equipment**
☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided
Remarks

C. Treatment System ☐ Applicable ☐ N/A

1. **Treatment Train** (Check components that apply)
☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☒ Air stripping ☒ Carbon adsorbers
☒ Filters bag filters
☐ Additive (*e.g.*, chelation agent, flocculent) anti-scaling
☐ Others Ion Exchange
☒ Good condition ☐ Needs Maintenance
☒ Sampling ports properly marked and functional
☒ Sampling/maintenance log displayed and up to date
☒ Equipment properly identified
☐ Quantity of groundwater treated annually_____
☐ Quantity of surface water treated annually_____
Remarks Vapor phase carbon adsorbers

2. **Electrical Enclosures and Panels** (properly rated and functional)
☐ N/A ☐ Good condition ☐ Needs Maintenance
Remarks Good Condition

3.	**Tanks, Vaults, Storage Vessels** ☐ N/A ■ Good condition ■ Proper secondary containment ☐ Needs Maintenance Remarks
4.	**Discharge Structure and Appurtenances** ☐ N/A ■ Good condition ☐ Needs Maintenance Remarks Discharge to injection well and on-site irrigation. Infiltration gallery is being tested.
5.	**Treatment Building(s)** ☐ N/A ■ Good condition (esp. roof and doorways) ☐ Needs repair ■ Chemicals and equipment properly stored Remarks
6.	**Monitoring Wells** (pump and treatment remedy) ■ Properly secured/locked ■ Functioning ■ Routinely sampled ■ Good condition ☐ All required wells located ☐ Needs Maintenance ☐ N/A Remarks
D. Monitoring Data	
1.	Monitoring Data ■ Is routinely submitted on time ■ Is of acceptable quality
2.	Monitoring data suggests: ■ Groundwater plume is effectively contained ■ Contaminant concentrations are declining
D. Monitored Natural Attenuation	
1.	**Monitoring Wells** (natural attenuation remedy) ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition ☐ All required wells located ☐ Needs Maintenance ■ N/A Remarks
X. OTHER REMEDIES	
	If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS	
A.	**Implementation of the Remedy**
	Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).
Per information from interviews and site observations, the implemented remedy appears to be functioning as designed, the contaminant plume is being contained.	
B.	**Adequacy of O&M**
	Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.
N/A	
C.	**Early Indicators of Potential Remedy Problems**
	Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future.
N/A	
D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.
N/A	

Five-Year Review Site Inspection Checklist

I. SITE INFORMATION	
Site name: PGA North/33A Groundwater Treatment System	**Date of inspection:** 25 Feb, 2015
Location: Goodyear, AZ/Region 9	**EPA ID:** AZD980695902
Agency, office, or company leading the five-year review: AMEC & Matrix New World	**Weather/temperature** Sunny, calm, ~65° F

Remedy Includes: (Check all that apply)

- ☐ Landfill cover/containment
- ☒ Access controls
- ☒ Institutional controls
- ☒ Groundwater pump and treatment
- ☐ Surface water collection and treatment
- ☐ Other: Liquid phase GAC
- ☐ Monitored natural attenuation
- ☒ Groundwater containment
- ☐ Vertical barrier walls

Attachments: ☒ Inspection-team roster attached ☐ Site map attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** Stephanie Koehne (Name) Project Manager (Title) 25 Feb 2015 (Date)
   Interviewed ☒ at site ☐ at office ☐ by phone Phone no. 480-734-6279
   Problems, suggestions; ☐ Report attached

2. **O&M staff** Harry Brenton (Name) Dir. of Hydrogeologic Svcs. (Title) 25 Feb 2015 (Date)
   Interviewed ☒ at site ☐ at office ☐ by phone Phone no. 623-322-7003
   Problems, suggestions; ☐ Report attached

2. **O&M staff** Tom Vanaskey (Name) Lead Operator (Title) 25 Feb 2015 (Date)
   Interviewed ☒ at site ☐ at office ☐ by phone Phone no. 855-244-8125
   Problems, suggestions; ☐ Report attached

2. **O&M staff** _____ (Name) _____ (Title) 25 Feb 2015 (Date)
   Interviewed ☒ at site ☐ at office ☐ by phone Phone no. _____
   Problems, suggestions; ☐ Report attached

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____

4. **Other interviews** (optional) ☐ Report attached.

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**

■ O&M manual	■ Readily available	■ Up to date	☐ N/A
■ As-built drawings	■ Readily available	■ Up to date	☐ N/A
■ Maintenance logs	■ Readily available	■ Up to date	☐ N/A

Remarks Records available at MTS facility

2. **Site-Specific Health and Safety Plan** ■ Readily available ■ Up to date ☐ N/A
■ Contingency plan/emergency response plan ■ Readily available ■ Up to date ☐ N/A
Remarks Available at MTS facility

3.	**O&M and OSHA Training Records** Remarks Available at MTS facility	■ Readily available	☐ Up to date	☐ N/A
4.	**Permits and Service Agreements**			
	☐ Air discharge permit	☐ Readily available	☐ Up to date	■ N/A
	☐ Effluent discharge	☐ Readily available	☐ Up to date	■ N/A
	☐ Waste disposal, POTW	☐ Readily available	☐ Up to date	■ N/A
	☐ Other permits_____	☐ Readily available	☐ Up to date	■ N/A
	Remarks			
5.	**Gas Generation Records** Remarks	☐ Readily available	☐ Up to date	■ N/A
6.	**Settlement Monument Records** Remarks	☐ Readily available	☐ Up to date	■ N/A
7.	**Groundwater Monitoring Records** Remarks	■ Readily available	■ Up to date	☐ N/A
8.	**Leachate Extraction Records** Remarks	■ Readily available	☐ Up to date	☐ N/A
9.	**Discharge Compliance Records**			
	☐ Air	☐ Readily available	☐ Up to date	☐ N/A
	☐ Water (effluent)	☐ Readily available	☐ Up to date	☐ N/A
	Remarks			
10.	**Daily Access/Security Logs** Remarks	■ Readily available	■ Up to date	☐ N/A

IV. O&M COSTS

1. **O&M Organization**

☐ State in-house ☐ Contractor for State
☐ PRP in-house ☒ Contractor for PRP
☐ Federal Facility in-house ☐ Contractor for Federal Facility
☐ Other

2. **O&M Cost Records**

☐ Readily available ☐ Up to date ☐ Funding mechanism/agreement in place
Original O&M cost estimate_____ ☐ Breakdown attached

Total annual cost by year for review period if available

From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost

3. **Unanticipated or Unusually High O&M Costs During Review Period**

Describe costs and reasons:

O&M Cost was not discussed in the site interviews - this information will be requested from contractors.

V. ACCESS AND INSTITUTIONAL CONTROLS ☐ Applicable ☐ N/A

A. Fencing

1. **Fencing damaged** ☐ Location shown on site map ☒ Gates secured ☐ N/A

Remarks Concrete walls and locked gates

B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on site map ☐ N/A

Remarks Signage and security system in place

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented ☐ Yes ■ No ☐ N/A
Site conditions imply ICs not being fully enforced ☐ Yes ■ No ☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by) drive by, remote monitoring
Frequency daily
Responsible party/agency Blue World Remediation
Contact Tom Vanaskey (Name) Lead Operator (Title) (Date) 855-244-8125 (Phone no.)

Reporting is up-to-date ☐ Yes ☐ No ■ N/A
Reports are verified by the lead agency ☐ Yes ☐ No ■ N/A

Specific requirements in deed or decision documents have been met ☐ Yes ☐ No ■ N/A
Violations have been reported ☐ Yes ☐ No ■ N/A
Other problems or suggestions: ☐ Report attached

2. **Adequacy** ■ ICs are adequate ☐ ICs are inadequate ☐ N/A
Remarks

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map ■ No vandalism evident
Remarks

2. **Land use changes on site** ■ N/A
Remarks

3. **Land use changes off site** ■ N/A
Remarks

VI. GENERAL SITE CONDITIONS

A. Roads ■ Applicable ☐ N/A

1. **Roads damaged** ☐ Location shown on site map ■ Roads adequate ☐ N/A
Remarks

B. Other Site Conditions
Remarks Site is in good condition, functioning properly

VII. LANDFILL COVERS ☐ Applicable ☒ N/A		
A. Landfill Surface		
1. **Settlement** (Low spots) Areal extent_____ Remarks	☐ Location shown on site map Depth_____	☐ Settlement not evident
2. **Cracks** Lengths_____ Widths_____ Depths_____ Remarks	☐ Location shown on site map	☐ Cracking not evident
3. **Erosion** Areal extent_____ Remarks	☐ Location shown on site map Depth_____	☐ Erosion not evident
4. **Holes** Areal extent_____ Remarks	☐ Location shown on site map Depth_____	☐ Holes not evident
5. **Vegetative Cover** Remarks	☐ Grass ☐ Cover properly established ☐ No signs of stress ☐ Trees/Shrubs (indicate size and locations on a diagram)	
6. **Alternative Cover (armored rock, concrete, etc.)** Remarks		☐ N/A
7. **Bulges** Areal extent_____ Remarks	☐ Location shown on site map Height_____	☐ Bulges not evident

8.	**Wet Areas/Water Damage** ☐ Wet areas ☐ Ponding ☐ Seeps ☐ Soft subgrade Remarks	☐ Wet areas/water damage not evident ☐ Location shown on site map ☐ Location shown on site map ☐ Location shown on site map ☐ Location shown on site map	 Areal extent_____ Areal extent_____ Areal extent_____ Areal extent_____
9.	**Slope Instability** ☐ Slides Areal extent_____ Remarks	☐ Location shown on site map	☐ No evidence of slope instability
B. Benches	☐ N/A ☐ Applicable (Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)		
1.	**Flows Bypass Bench** Remarks	☐ Location shown on site map	☐ N/A or okay
2.	**Bench Breached** Remarks	☐ Location shown on site map	☐ N/A or okay
3.	**Bench Overtopped** Remarks	☐ Location shown on site map	☐ N/A or okay
C. Letdown Channels	☐ Applicable ☐ N/A (Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)		
1.	**Settlement** Areal extent_____ Remarks	☐ Location shown on site map Depth_____	☐ No evidence of settlement
2.	**Material Degradation** Material type_____ Remarks	☐ Location shown on site map Areal extent_____	☐ No evidence of degradation
3.	**Erosion** Areal extent_____ Remarks	☐ Location shown on site map Depth_____	☐ No evidence of erosion

4.	**Undercutting** ☐ Location shown on site map ☐ No evidence of undercutting Areal extent_____ Depth_____ Remarks
5.	**Obstructions** Type_____ ☐ No obstructions ☐ Location shown on site map Areal extent_____ Size_____ Remarks
6.	**Excessive Vegetative Growth** Type_____ ☐ No evidence of excessive growth ☐ Vegetation in channels does not obstruct flow ☐ Location shown on site map Areal extent_____ Remarks
D. Cover Penetrations	☐ Applicable ■ N/A
1.	**Gas Vents** ☐ N/A ☐ Active ☐ Passive ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition ☐ Evidence of leakage at penetration Remarks
2.	**Gas Monitoring Probes** ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition ☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A Remarks
3.	**Monitoring Wells** (within surface area of landfill) ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition ☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A Remarks
4.	**Leachate Extraction Wells** ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition ☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A Remarks
5.	**Settlement Monuments** ☐ Located ☐ Routinely surveyed ☐ N/A Remarks

E. Gas Collection and Treatment	☐ Applicable	☒ N/A	
1. **Gas Treatment Facilities** ☐ Flaring ☐ Thermal destruction ☐ Collection for reuse ☐ Good condition ☐ Needs Maintenance Remarks			
2. **Gas Collection Wells, Manifolds and Piping** ☐ Good condition ☐ Needs Maintenance Remarks			
3. **Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings) ☐ Good condition ☐ Needs Maintenance ☐ N/A Remarks			
F. Cover Drainage Layer	☐ Applicable	☐ N/A	
1. **Outlet Pipes Inspected** Remarks	☐ Functioning	☐ N/A	
2. **Outlet Rock Inspected** Remarks	☐ Functioning	☐ N/A	
G. Detention/Sedimentation Ponds	☐ Applicable	☒ N/A	
1. Siltation ☐ N/A Areal extent_____ Depth_____ Remarks	☐ Siltation not evident		
2. **Erosion** Areal extent_____ Depth_____ Remarks	☐ Erosion not evident		
3. **Outlet Works** Remarks	☐ Functioning	☐ N/A	
4. **Dam** Remarks	☐ Functioning	☐ N/A	

H. Retaining Walls	☐ Applicable	☒ N/A
1. **Deformations** Horizontal displacement_____ Vertical displacement_____ Rotational displacement_____ Remarks	☐ Location shown on site map	☐ Deformation not evident
2. **Degradation** Remarks	☐ Location shown on site map	☐ Degradation not evident
I. Perimeter Ditches/Off-Site Discharge	☐ Applicable	☒ N/A
1. **Siltation** Areal extent_____ Depth_____ Remarks	☐ Location shown on site map	☐ Siltation not evident
2. **Vegetative Growth** Areal extent_____ Type_____ Remarks	☐ Location shown on site map ☐ Vegetation does not impede flow	☒ N/A
3. **Erosion** Areal extent_____ Depth_____ Remarks	☐ Location shown on site map	☐ Erosion not evident
4. **Discharge Structure** Remarks	☐ Functioning	☐ N/A
VIII. VERTICAL BARRIER WALLS	☐ Applicable	☒ N/A
1. **Settlement** Areal extent_____ Depth_____ Remarks	☐ Location shown on site map	☐ Settlement not evident
2. **Performance Monitoring** Type of monitoring_____ ☐ Performance not monitored ☐ Evidence of breaching Frequency_____ Head differential_____ Remarks		
IX. GROUNDWATER/SURFACE WATER REMEDIES	☐ Applicable	☒ N/A
A. Groundwater Extraction Wells, Pumps, and Pipelines	☐ Applicable	☐ N/A
1. **Pumps, Wellhead Plumbing, and Electrical** ☒ Good condition ☒ All required wells properly operating ☐ Needs Maintenance ☐ N/A Remarks		

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
☒ Good condition ☐ Needs Maintenance
Remarks

3. **Spare Parts and Equipment**
☒ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided
Remarks

B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☐ N/A

1. **Collection Structures, Pumps, and Electrical**
☐ Good condition ☐ Needs Maintenance
Remarks

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
☐ Good condition ☐ Needs Maintenance
Remarks

3. **Spare Parts and Equipment**
☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided
Remarks

C. Treatment System ☐ Applicable ☐ N/A

1. **Treatment Train** (Check components that apply)
☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☐ Air stripping ☒ Carbon adsorbers
☒ Filters_____
☐ Additive (*e.g.*, chelation agent, flocculent) anti-scaling
☐ Others_____
☒ Good condition ☐ Needs Maintenance
☒ Sampling ports properly marked and functional
☒ Sampling/maintenance log displayed and up to date
☒ Equipment properly identified
☐ Quantity of groundwater treated annually_____
☐ Quantity of surface water treated annually_____
Remarks

2. **Electrical Enclosures and Panels** (properly rated and functional)
☐ N/A ☐ Good condition ☐ Needs Maintenance
Remarks Good Condition

3.	**Tanks, Vaults, Storage Vessels** ☐ N/A ■ Good condition ■ Proper secondary containment ☐ Needs Maintenance Remarks
4.	**Discharge Structure and Appurtenances** ☐ N/A ■ Good condition ☐ Needs Maintenance Remarks Discharge to park or injection well & chruch heat exchanger
5.	**Treatment Building(s)** ☐ N/A ■ Good condition (esp. roof and doorways) ☐ Needs repair ■ Chemicals and equipment properly stored Remarks
6.	**Monitoring Wells** (pump and treatment remedy) ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition ☐ All required wells located ☐ Needs Maintenance ■ N/A Remarks Monitoring wells were not inspected at this location - data on the plume is available
D. Monitoring Data	
1.	Monitoring Data ■ Is routinely submitted on time ■ Is of acceptable quality
2.	Monitoring data suggests: ■ Groundwater plume is effectively contained ■ Contaminant concentrations are declining
D. Monitored Natural Attenuation	
1.	**Monitoring Wells** (natural attenuation remedy) ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition ☐ All required wells located ☐ Needs Maintenance ■ N/A Remarks
X. OTHER REMEDIES	
	If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS	
A.	**Implementation of the Remedy**
	Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).
Per information from interviews and site observations, the implemented remedy appears to be functioning as designed, the contaminant plume is being contained.	
B.	**Adequacy of O&M**
	Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.
N/A	
C.	**Early Indicators of Potential Remedy Problems**
	Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future.
N/A	
D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.
N/A	

Five-Year Review Site Inspection Checklist

I. SITE INFORMATION	
Site name: PGA North/EA-06	**Date of inspection:** 25 Feb, 2015
Location: Goodyear, AZ/Region 9	**EPA ID:** AZD980695902
Agency, office, or company leading the five-year review: AMEC & Matrix New World	**Weather/temperature** Sunny, calm, ~65° F

Remedy Includes: (Check all that apply)

- ☐ Landfill cover/containment
- ☒ Access controls
- ☒ Institutional controls
- ☒ Groundwater pump and treatment
- ☐ Surface water collection and treatment
- ☐ Other: Liquid phase GAC
- ☐ Monitored natural attenuation
- ☒ Groundwater containment
- ☐ Vertical barrier walls

Attachments: ☒ Inspection-team roster attached ☐ Site map attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** Stephanie Koehne (Name) Project Manager (Title) 25 Feb 2015 (Date)
   Interviewed ☒ at site ☐ at office ☐ by phone Phone no. 480-734-6279
   Problems, suggestions; ☐ Report attached

2. **O&M staff** Harry Brenton (Name) Dir. of Hydrogeologic Svcs. (Title) 25 Feb 2015 (Date)
   Interviewed ☒ at site ☐ at office ☐ by phone Phone no. 623-322-7003
   Problems, suggestions; ☐ Report attached

2. **O&M staff** Tom Vanaskey (Name) Lead Operator (Title) 25 Feb 2015 (Date)
   Interviewed ☒ at site ☐ at office ☐ by phone Phone no. 855-244-8125
   Problems, suggestions; ☐ Report attached

2. **O&M staff** _____ (Name) _____ (Title) 25 Feb 2015 (Date)
   Interviewed ☒ at site ☐ at office ☐ by phone Phone no. _____
   Problems, suggestions; ☐ Report attached

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____

4. **Other interviews** (optional) ☐ Report attached.

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**

■ O&M manual	■ Readily available	■ Up to date	☐ N/A
■ As-built drawings	■ Readily available	■ Up to date	☐ N/A
■ Maintenance logs	■ Readily available	■ Up to date	☐ N/A

Remarks Records available at MTS facility

2. **Site-Specific Health and Safety Plan** ■ Readily available ■ Up to date ☐ N/A
■ Contingency plan/emergency response plan ■ Readily available ■ Up to date ☐ N/A
Remarks Available at MTS facility

3.	**O&M and OSHA Training Records** Remarks Available at MTS facility	■ Readily available	☐ Up to date	☐ N/A
4.	**Permits and Service Agreements**			
	☐ Air discharge permit	☐ Readily available	☐ Up to date	■ N/A
	☐ Effluent discharge	☐ Readily available	☐ Up to date	■ N/A
	☐ Waste disposal, POTW	☐ Readily available	☐ Up to date	■ N/A
	☐ Other permits_____	☐ Readily available	☐ Up to date	☐ N/A
	Remarks			
5.	**Gas Generation Records** Remarks	☐ Readily available	☐ Up to date	■ N/A
6.	**Settlement Monument Records** Remarks	☐ Readily available	☐ Up to date	■ N/A
7.	**Groundwater Monitoring Records** Remarks	■ Readily available	■ Up to date	☐ N/A
8.	**Leachate Extraction Records** Remarks	■ Readily available	☐ Up to date	☐ N/A
9.	**Discharge Compliance Records**			
	☐ Air	☐ Readily available	☐ Up to date	■ N/A
	☐ Water (effluent)	☐ Readily available	☐ Up to date	☐ N/A
	Remarks			
10.	**Daily Access/Security Logs** Remarks	■ Readily available	■ Up to date	☐ N/A

IV. O&M COSTS

1. **O&M Organization**

☐ State in-house ☐ Contractor for State
☐ PRP in-house ☒ Contractor for PRP
☐ Federal Facility in-house ☐ Contractor for Federal Facility
☐ Other

2. **O&M Cost Records**

☐ Readily available ☐ Up to date ☐ Funding mechanism/agreement in place
Original O&M cost estimate_____ ☐ Breakdown attached

Total annual cost by year for review period if available

From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost

3. **Unanticipated or Unusually High O&M Costs During Review Period**

Describe costs and reasons:

O&M Cost was not discussed in the site interviews - this information will be requested from contractors.

V. ACCESS AND INSTITUTIONAL CONTROLS ☐ Applicable ☐ N/A

A. Fencing

1. **Fencing damaged** ☐ Location shown on site map ☒ Gates secured ☐ N/A

Remarks Concrete walls and locked gates

B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on site map ☒ N/A

Remarks Signage and security system in place

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented ☐ Yes ■ No ☐ N/A
Site conditions imply ICs not being fully enforced ☐ Yes ■ No ☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by) drive by, remote monitoring
Frequency daily
Responsible party/agency Blue World Remediation
Contact Tom Vanaskey | Lead Operator | | 855-244-8125
Name | Title | Date | Phone no.

Reporting is up-to-date ☐ Yes ☐ No ■ N/A
Reports are verified by the lead agency ☐ Yes ☐ No ■ N/A

Specific requirements in deed or decision documents have been met ☐ Yes ☐ No ■ N/A
Violations have been reported ☐ Yes ☐ No ■ N/A
Other problems or suggestions: ☐ Report attached

2. **Adequacy** ■ ICs are adequate ☐ ICs are inadequate ☐ N/A
Remarks

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map ■ No vandalism evident
Remarks

2. **Land use changes on site** ■ N/A
Remarks

3. **Land use changes off site** ■ N/A
Remarks

VI. GENERAL SITE CONDITIONS

A. Roads ■ Applicable ☐ N/A

1. **Roads damaged** ☐ Location shown on site map ■ Roads adequate ☐ N/A
Remarks

B. Other Site Conditions
Remarks Site is in good condition, functioning properly

VII. LANDFILL COVERS ☐ Applicable ☒ N/A		
A. Landfill Surface		
1. **Settlement** (Low spots) Areal extent_____ Remarks	☐ Location shown on site map Depth_____	☐ Settlement not evident
2. **Cracks** Lengths_____ Widths_____ Depths_____ Remarks	☐ Location shown on site map	☐ Cracking not evident
3. **Erosion** Areal extent_____ Remarks	☐ Location shown on site map Depth_____	☐ Erosion not evident
4. **Holes** Areal extent_____ Remarks	☐ Location shown on site map Depth_____	☐ Holes not evident
5. **Vegetative Cover** Remarks	☐ Grass ☐ Cover properly established ☐ No signs of stress ☐ Trees/Shrubs (indicate size and locations on a diagram)	
6. **Alternative Cover (armored rock, concrete, etc.)** Remarks		☐ N/A
7. **Bulges** Areal extent_____ Remarks	☐ Location shown on site map Height_____	☐ Bulges not evident

8.	**Wet Areas/Water Damage** ☐ Wet areas ☐ Ponding ☐ Seeps ☐ Soft subgrade Remarks	☐ Wet areas/water damage not evident ☐ Location shown on site map ☐ Location shown on site map ☐ Location shown on site map ☐ Location shown on site map	 Areal extent_____ Areal extent_____ Areal extent_____ Areal extent_____
9.	**Slope Instability** ☐ Slides Areal extent_____ Remarks	☐ Location shown on site map	☐ No evidence of slope instability
B. Benches	■ N/A	☐ Applicable	
	(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)		
1.	**Flows Bypass Bench** Remarks	☐ Location shown on site map	☐ N/A or okay
2.	**Bench Breached** Remarks	☐ Location shown on site map	☐ N/A or okay
3.	**Bench Overtopped** Remarks	☐ Location shown on site map	☐ N/A or okay
C. Letdown Channels	☐ Applicable	■ N/A	
	(Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)		
1.	**Settlement** Areal extent_____ Remarks	☐ Location shown on site map Depth_____	☐ No evidence of settlement
2.	**Material Degradation** Material type_____ Remarks	☐ Location shown on site map Areal extent_____	☐ No evidence of degradation
3.	**Erosion** Areal extent_____ Remarks	☐ Location shown on site map Depth_____	☐ No evidence of erosion

4.	**Undercutting** ☐ Location shown on site map ☐ No evidence of undercutting Areal extent_____ Depth_____ Remarks
5.	**Obstructions** Type_____ ☐ No obstructions ☐ Location shown on site map Areal extent_____ Size_____ Remarks
6.	**Excessive Vegetative Growth** Type_____ ☐ No evidence of excessive growth ☐ Vegetation in channels does not obstruct flow ☐ Location shown on site map Areal extent_____ Remarks
D. Cover Penetrations	☐ Applicable ■ N/A
1.	**Gas Vents** ☐ N/A ☐ Active ☐ Passive ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition ☐ Evidence of leakage at penetration Remarks
2.	**Gas Monitoring Probes** ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition ☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A Remarks
3.	**Monitoring Wells** (within surface area of landfill) ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition ☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A Remarks
4.	**Leachate Extraction Wells** ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition ☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A Remarks
5.	**Settlement Monuments** ☐ Located ☐ Routinely surveyed ☐ N/A Remarks

E. Gas Collection and Treatment	☐ Applicable	☒ N/A	
1.	**Gas Treatment Facilities** ☐ Flaring ☐ Thermal destruction ☐ Collection for reuse ☐ Good condition ☐ Needs Maintenance Remarks		
2.	**Gas Collection Wells, Manifolds and Piping** ☐ Good condition ☐ Needs Maintenance Remarks		
3.	**Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings) ☐ Good condition ☐ Needs Maintenance ☐ N/A Remarks		
F. Cover Drainage Layer	☐ Applicable	☐ N/A	
1.	**Outlet Pipes Inspected** Remarks	☐ Functioning	☐ N/A
2.	**Outlet Rock Inspected** Remarks	☐ Functioning	☐ N/A
G. Detention/Sedimentation Ponds	☐ Applicable	☒ N/A	
1.	**Siltation** ☐ N/A Areal extent_____ Depth_____ Remarks	☐ Siltation not evident	
2.	**Erosion** Areal extent_____ Depth_____ Remarks	☐ Erosion not evident	
3.	**Outlet Works** Remarks	☐ Functioning	☐ N/A
4.	**Dam** Remarks	☐ Functioning	☐ N/A

H. Retaining Walls	☐ Applicable	☒ N/A
1. **Deformations** Horizontal displacement_____ Vertical displacement_____ Rotational displacement_____ Remarks	☐ Location shown on site map	☐ Deformation not evident
2. **Degradation** Remarks	☐ Location shown on site map	☐ Degradation not evident
I. Perimeter Ditches/Off-Site Discharge	☐ Applicable	☒ N/A
1. **Siltation** Areal extent_____ Depth_____ Remarks	☐ Location shown on site map	☐ Siltation not evident
2. **Vegetative Growth** Areal extent_____ Type_____ Remarks	☐ Location shown on site map ☐ Vegetation does not impede flow	☒ N/A
3. **Erosion** Areal extent_____ Depth_____ Remarks	☐ Location shown on site map	☐ Erosion not evident
4. **Discharge Structure** Remarks	☐ Functioning	☐ N/A
VIII. VERTICAL BARRIER WALLS	☐ Applicable	☒ N/A
1. **Settlement** Areal extent_____ Depth_____ Remarks	☐ Location shown on site map	☐ Settlement not evident
2. **Performance Monitoring** Type of monitoring_____ ☐ Performance not monitored ☐ Evidence of breaching Frequency_____ Head differential_____ Remarks		
IX. GROUNDWATER/SURFACE WATER REMEDIES	☐ Applicable	☐ N/A
A. Groundwater Extraction Wells, Pumps, and Pipelines	☐ Applicable	☐ N/A
1. **Pumps, Wellhead Plumbing, and Electrical** ☒ Good condition ☒ All required wells properly operating ☐ Needs Maintenance ☐ N/A Remarks		

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
☒ Good condition ☐ Needs Maintenance
Remarks

3. **Spare Parts and Equipment**
☒ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided
Remarks

B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☒ N/A

1. **Collection Structures, Pumps, and Electrical**
☐ Good condition ☐ Needs Maintenance
Remarks

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
☒ Good condition ☐ Needs Maintenance
Remarks

3. **Spare Parts and Equipment**
☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided
Remarks

C. Treatment System ☐ Applicable ☐ N/A

1. **Treatment Train** (Check components that apply)
☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☐ Air stripping ☒ Carbon adsorbers
☒ Filters_____
☐ Additive (*e.g.*, chelation agent, flocculent) anti-scaling
☐ Others_____
☒ Good condition ☐ Needs Maintenance
☒ Sampling ports properly marked and functional
☒ Sampling/maintenance log displayed and up to date
☒ Equipment properly identified
☐ Quantity of groundwater treated annually_____
☐ Quantity of surface water treated annually_____
Remarks

2. **Electrical Enclosures and Panels** (properly rated and functional)
☐ N/A ☐ Good condition ☐ Needs Maintenance
Remarks Good Condition

3. **Tanks, Vaults, Storage Vessels**
☐ N/A ■ Good condition ■ Proper secondary containment ☐ Needs Maintenance
Remarks

4. **Discharge Structure and Appurtenances**
☐ N/A ■ Good condition ☐ Needs Maintenance
Remarks Discharge to golf course or injection well

5. **Treatment Building(s)**
☐ N/A ■ Good condition (esp. roof and doorways) ☐ Needs repair
■ Chemicals and equipment properly stored
Remarks

6. **Monitoring Wells** (pump and treatment remedy)
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs Maintenance ■ N/A
Remarks Monitoring wells were not inspected at this location - data on the plume is available

D. Monitoring Data

1. Monitoring Data
■ Is routinely submitted on time ■ Is of acceptable quality

2. Monitoring data suggests:
■ Groundwater plume is effectively contained ■ Contaminant concentrations are declining

D. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs Maintenance ■ N/A
Remarks

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS	
A.	**Implementation of the Remedy**
	Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).
Per information from interviews and site observations, the implemented remedy appears to be functioning as designed, the contaminant plume is being contained.	
B.	**Adequacy of O&M**
	Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.
N/A	
C.	**Early Indicators of Potential Remedy Problems**
	Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future.
N/A	
D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.
N/A	

Five-Year Review Site Inspection Checklist

I. SITE INFORMATION	
Site name: PGA North/EA-08	**Date of inspection:** 25 Feb, 2015
Location: Goodyear, AZ/Region 9	**EPA ID:** AZD980695902
Agency, office, or company leading the five-year review: AMEC & Matrix New World	**Weather/temperature** Sunny, calm, ~65° F

Remedy Includes: (Check all that apply)

- ☐ Landfill cover/containment
- ☒ Access controls
- ☒ Institutional controls
- ☒ Groundwater pump and treatment
- ☐ Surface water collection and treatment
- ☐ Other: Liquid phase GAC
- ☐ Monitored natural attenuation
- ☒ Groundwater containment
- ☐ Vertical barrier walls

Attachments: ☒ Inspection-team roster attached ☐ Site map attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** Stephanie Koehne (Name) Project Manager (Title) 25 Feb 2015 (Date)
   Interviewed ☒ at site ☐ at office ☐ by phone Phone no. 480-734-6279
   Problems, suggestions; ☐ Report attached

2. **O&M staff** Harry Brenton (Name) Dir. of Hydrogeologic Svcs. (Title) 25 Feb 2015 (Date)
   Interviewed ☒ at site ☐ at office ☐ by phone Phone no. 623-322-7003
   Problems, suggestions; ☐ Report attached

2. **O&M staff** Tom Vanaskey (Name) Lead Operator (Title) 25 Feb 2015 (Date)
   Interviewed ☒ at site ☐ at office ☐ by phone Phone no. 855-244-8125
   Problems, suggestions; ☐ Report attached

2. **O&M staff** _____ (Name) _____ (Title) 25 Feb 2015 (Date)
   Interviewed ☒ at site ☐ at office ☐ by phone Phone no. _____
   Problems, suggestions; ☐ Report attached

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____

4. **Other interviews** (optional) ☐ Report attached.

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**

■ O&M manual	■ Readily available	■ Up to date	☐ N/A
■ As-built drawings	■ Readily available	■ Up to date	☐ N/A
■ Maintenance logs	■ Readily available	■ Up to date	☐ N/A

Remarks Records available at MTS facility

2. **Site-Specific Health and Safety Plan** ■ Readily available ■ Up to date ☐ N/A
■ Contingency plan/emergency response plan ■ Readily available ■ Up to date ☐ N/A
Remarks Available at MTS facility

3.	**O&M and OSHA Training Records** Remarks Available at MTS facility	■ Readily available	☐ Up to date	☐ N/A
4.	**Permits and Service Agreements**			
	☐ Air discharge permit	☐ Readily available	☐ Up to date	■ N/A
	☐ Effluent discharge	☐ Readily available	☐ Up to date	■ N/A
	☐ Waste disposal, POTW	☐ Readily available	☐ Up to date	■ N/A
	☐ Other permits_____	☐ Readily available	☐ Up to date	☐ N/A
	Remarks			
5.	**Gas Generation Records** Remarks	☐ Readily available	☐ Up to date	■ N/A
6.	**Settlement Monument Records** Remarks	☐ Readily available	☐ Up to date	■ N/A
7.	**Groundwater Monitoring Records** Remarks	■ Readily available	■ Up to date	☐ N/A
8.	**Leachate Extraction Records** Remarks	■ Readily available	☐ Up to date	■ N/A
9.	**Discharge Compliance Records**			
	☐ Air	☐ Readily available	☐ Up to date	■ N/A
	☐ Water (effluent)	☐ Readily available	☐ Up to date	☐ N/A
	Remarks			
10.	**Daily Access/Security Logs** Remarks	■ Readily available	■ Up to date	☐ N/A

IV. O&M COSTS

1. **O&M Organization**

☐ State in-house ☐ Contractor for State
☐ PRP in-house ☒ Contractor for PRP
☐ Federal Facility in-house ☐ Contractor for Federal Facility
☐ Other

2. **O&M Cost Records**

☐ Readily available ☐ Up to date ☐ Funding mechanism/agreement in place
Original O&M cost estimate_____ ☐ Breakdown attached

Total annual cost by year for review period if available

From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost

3. **Unanticipated or Unusually High O&M Costs During Review Period**

Describe costs and reasons:

O&M Cost was not discussed in the site interviews - this information will be requested from contractors.

V. ACCESS AND INSTITUTIONAL CONTROLS ☐ Applicable ☐ N/A

A. Fencing

1. **Fencing damaged** ☐ Location shown on site map ☒ Gates secured ☐ N/A

Remarks Concrete walls and locked gates

B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on site map ☒ N/A

Remarks Signage and security system in place

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented ☐ Yes ■ No ☐ N/A
Site conditions imply ICs not being fully enforced ☐ Yes ■ No ☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by) drive by, remote monitoring
Frequency daily
Responsible party/agency Blue World Remediation
Contact Tom Vanaskey | Lead Operator | | 855-244-8125
Name | Title | Date | Phone no.

Reporting is up-to-date ☐ Yes ☐ No ■ N/A
Reports are verified by the lead agency ☐ Yes ☐ No ■ N/A

Specific requirements in deed or decision documents have been met ☐ Yes ☐ No ■ N/A
Violations have been reported ☐ Yes ☐ No ■ N/A
Other problems or suggestions: ☐ Report attached

2. **Adequacy** ■ ICs are adequate ☐ ICs are inadequate ☐ N/A
Remarks

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map ■ No vandalism evident
Remarks

2. **Land use changes on site** ■ N/A
Remarks

3. **Land use changes off site** ■ N/A
Remarks

VI. GENERAL SITE CONDITIONS

A. Roads ■ Applicable ☐ N/A

1. **Roads damaged** ☐ Location shown on site map ■ Roads adequate ☐ N/A
Remarks

B. Other Site Conditions
Remarks Site is in good condition, functioning properly

VII. LANDFILL COVERS ☐ Applicable ☒ N/A		
A. Landfill Surface		
1. **Settlement** (Low spots) Areal extent_____ Remarks	☐ Location shown on site map Depth_____	☐ Settlement not evident
2. **Cracks** Lengths_____ Widths_____ Depths_____ Remarks	☐ Location shown on site map	☐ Cracking not evident
3. **Erosion** Areal extent_____ Remarks	☐ Location shown on site map Depth_____	☐ Erosion not evident
4. **Holes** Areal extent_____ Remarks	☐ Location shown on site map Depth_____	☐ Holes not evident
5. **Vegetative Cover** Remarks	☐ Grass ☐ No signs of stress	☐ Cover properly established ☐ Trees/Shrubs (indicate size and locations on a diagram)
6. **Alternative Cover (armored rock, concrete, etc.)** Remarks		☐ N/A
7. **Bulges** Areal extent_____ Remarks	☐ Location shown on site map Height_____	☐ Bulges not evident

8.	**Wet Areas/Water Damage** ☐ Wet areas ☐ Ponding ☐ Seeps ☐ Soft subgrade Remarks	☐ Wet areas/water damage not evident ☐ Location shown on site map ☐ Location shown on site map ☐ Location shown on site map ☐ Location shown on site map	 Areal extent_____ Areal extent_____ Areal extent_____ Areal extent_____
9.	**Slope Instability** ☐ Slides Areal extent_____ Remarks	☐ Location shown on site map	☐ No evidence of slope instability
B. Benches	■ N/A	☐ Applicable	
	(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)		
1.	**Flows Bypass Bench** Remarks	☐ Location shown on site map	☐ N/A or okay
2.	**Bench Breached** Remarks	☐ Location shown on site map	☐ N/A or okay
3.	**Bench Overtopped** Remarks	☐ Location shown on site map	☐ N/A or okay
C. Letdown Channels	☐ Applicable	■ N/A	
	(Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)		
1.	**Settlement** Areal extent_____ Remarks	☐ Location shown on site map Depth_____	☐ No evidence of settlement
2.	**Material Degradation** Material type_____ Remarks	☐ Location shown on site map Areal extent_____	☐ No evidence of degradation
3.	**Erosion** Areal extent_____ Remarks	☐ Location shown on site map Depth_____	☐ No evidence of erosion

4.	**Undercutting** ☐ Location shown on site map ☐ No evidence of undercutting Areal extent_____ Depth_____ Remarks
5.	**Obstructions** Type_____ ☐ No obstructions ☐ Location shown on site map Areal extent_____ Size_____ Remarks
6.	**Excessive Vegetative Growth** Type_____ ☐ No evidence of excessive growth ☐ Vegetation in channels does not obstruct flow ☐ Location shown on site map Areal extent_____ Remarks
D. Cover Penetrations	☐ Applicable ■ N/A
1.	**Gas Vents** ☐ N/A ☐ Active ☐ Passive ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition ☐ Evidence of leakage at penetration Remarks
2.	**Gas Monitoring Probes** ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition ☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A Remarks
3.	**Monitoring Wells** (within surface area of landfill) ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition ☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A Remarks
4.	**Leachate Extraction Wells** ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition ☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A Remarks
5.	**Settlement Monuments** ☐ Located ☐ Routinely surveyed ☐ N/A Remarks

E. Gas Collection and Treatment	☐ Applicable	☒ N/A	
1.	**Gas Treatment Facilities** ☐ Flaring ☐ Thermal destruction ☐ Collection for reuse ☐ Good condition ☐ Needs Maintenance Remarks		
2.	**Gas Collection Wells, Manifolds and Piping** ☐ Good condition ☐ Needs Maintenance Remarks		
3.	**Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings) ☐ Good condition ☐ Needs Maintenance ☐ N/A Remarks		
F. Cover Drainage Layer	☐ Applicable	☐ N/A	
1.	**Outlet Pipes Inspected** Remarks	☐ Functioning	☐ N/A
2.	**Outlet Rock Inspected** Remarks	☐ Functioning	☐ N/A
G. Detention/Sedimentation Ponds	☐ Applicable	☒ N/A	
1.	**Siltation** ☐ N/A ☐ Siltation not evident Areal extent_____ Depth_____ Remarks		
2.	**Erosion** Areal extent_____ Depth_____ ☐ Erosion not evident Remarks		
3.	**Outlet Works** Remarks	☐ Functioning	☐ N/A
4.	**Dam** Remarks	☐ Functioning	☐ N/A

H. Retaining Walls	☐ Applicable	☒ N/A
1. **Deformations** Horizontal displacement_____ Vertical displacement_____ Rotational displacement_____ Remarks	☐ Location shown on site map	☐ Deformation not evident
2. **Degradation** Remarks	☐ Location shown on site map	☐ Degradation not evident
I. Perimeter Ditches/Off-Site Discharge	☐ Applicable	☒ N/A
1. **Siltation** Areal extent_____ Depth_____ Remarks	☐ Location shown on site map	☐ Siltation not evident
2. **Vegetative Growth** Areal extent_____ Type_____ Remarks	☐ Location shown on site map ☐ Vegetation does not impede flow	☒ N/A
3. **Erosion** Areal extent_____ Depth_____ Remarks	☐ Location shown on site map	☐ Erosion not evident
4. **Discharge Structure** Remarks	☐ Functioning	☐ N/A
VIII. VERTICAL BARRIER WALLS	☐ Applicable	☒ N/A
1. **Settlement** Areal extent_____ Depth_____ Remarks	☐ Location shown on site map	☐ Settlement not evident
2. **Performance Monitoring** Type of monitoring_____ ☐ Performance not monitored ☐ Evidence of breaching Frequency_____ Head differential_____ Remarks		
IX. GROUNDWATER/SURFACE WATER REMEDIES	☐ Applicable	☐ N/A
A. Groundwater Extraction Wells, Pumps, and Pipelines	☐ Applicable	☐ N/A
1. **Pumps, Wellhead Plumbing, and Electrical** ☒ Good condition ☒ All required wells properly operating ☐ Needs Maintenance ☐ N/A Remarks		

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
☒ Good condition ☐ Needs Maintenance
Remarks

3. **Spare Parts and Equipment**
☒ Readily available ☐ Good condition ☒ Requires upgrade ☐ Needs to be provided
Remarks

B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☒ N/A

1. **Collection Structures, Pumps, and Electrical**
☐ Good condition ☐ Needs Maintenance
Remarks

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
☒ Good condition ☐ Needs Maintenance
Remarks

3. **Spare Parts and Equipment**
☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided
Remarks

C. Treatment System ☐ Applicable ☐ N/A

1. **Treatment Train** (Check components that apply)
☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☐ Air stripping ■ Carbon adsorbers
☒ Filters_____
☐ Additive (*e.g.*, chelation agent, flocculent) anti-scaling
☐ Others_____
■ Good condition ☐ Needs Maintenance
■ Sampling ports properly marked and functional
■ Sampling/maintenance log displayed and up to date
■ Equipment properly identified
☐ Quantity of groundwater treated annually_____
☐ Quantity of surface water treated annually_____
Remarks

2. **Electrical Enclosures and Panels** (properly rated and functional)
☐ N/A ☐ Good condition ☐ Needs Maintenance
Remarks Good Condition

3.	**Tanks, Vaults, Storage Vessels** ☐ N/A ■ Good condition ■ Proper secondary containment ☐ Needs Maintenance Remarks
4.	**Discharge Structure and Appurtenances** ☐ N/A ■ Good condition ☐ Needs Maintenance Remarks Discharge to injection well
5.	**Treatment Building(s)** ☐ N/A ■ Good condition (esp. roof and doorways) ☐ Needs repair ■ Chemicals and equipment properly stored Remarks
6.	**Monitoring Wells** (pump and treatment remedy) ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition ☐ All required wells located ☐ Needs Maintenance ■ N/A Remarks Monitoring wells were not inspected at this location - data on the plume is available
D. Monitoring Data	
1.	Monitoring Data ■ Is routinely submitted on time ■ Is of acceptable quality
2.	Monitoring data suggests: ■ Groundwater plume is effectively contained ■ Contaminant concentrations are declining
D. Monitored Natural Attenuation	
1.	**Monitoring Wells** (natural attenuation remedy) ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition ☐ All required wells located ☐ Needs Maintenance ■ N/A Remarks
X. OTHER REMEDIES	
	If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS	
A.	**Implementation of the Remedy**
	Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).
Per information from interviews and site observations, the implemented remedy appears to be functioning as designed, the contaminant plume is being contained.	
B.	**Adequacy of O&M**
	Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.
N/A	
C.	**Early Indicators of Potential Remedy Problems**
	Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future.
N/A	
D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.
N/A	

Five-Year Review Site Inspection Checklist

I. SITE INFORMATION	
Site name: PGA North/SVE System	**Date of inspection:** 25 Feb, 2015
Location: Goodyear, AZ/Region 9	**EPA ID:** AZD980695902
Agency, office, or company leading the five-year review: AMEC & Matrix New World	**Weather/temperature** Sunny, calm, ~65° F

Remedy Includes: (Check all that apply)

- ☐ Landfill cover/containment
- ☒ Access controls
- ☒ Institutional controls
- ☐ Groundwater pump and treatment
- ☐ Surface water collection and treatment
- ☒ Other:

  Soil Vapor Extraction and Treatment System, Vapor phase GAC
- ☐ Monitored natural attenuation
- ☐ Groundwater containment
- ☐ Vertical barrier walls

Attachments: ☒ Inspection-team roster attached ☐ Site map attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** Stephanie Koehne (Name) Project Manager (Title) 25 Feb 2015 (Date)
   Interviewed ☒ at site ☐ at office ☐ by phone Phone no. 480-734-6279
   Problems, suggestions; ☐ Report attached

2. **O&M staff** Harry Brenton (Name) Dir. of Hydrogeologic Svcs. (Title) 25 Feb 2015 (Date)
   Interviewed ☒ at site ☐ at office ☐ by phone Phone no. 623-322-7003
   Problems, suggestions; ☐ Report attached

2. **O&M staff** Tom Vanaskey (Name) Lead Operator (Title) 25 Feb 2015 (Date)
   Interviewed ☒ at site ☐ at office ☐ by phone Phone no. 855-244-8125
   Problems, suggestions; ☐ Report attached

2. **O&M staff** _____ (Name) _____ (Title) 25 Feb 2015 (Date)
   Interviewed ☒ at site ☐ at office ☐ by phone Phone no. _____
   Problems, suggestions; ☐ Report attached

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____

4. **Other interviews** (optional) ☐ Report attached.

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**

■ O&M manual	■ Readily available	☐ Up to date	☐ N/A
■ As-built drawings	■ Readily available	■ Up to date	☐ N/A
■ Maintenance logs	■ Readily available	■ Up to date	☐ N/A

Remarks O&M Manual to be updated

2. **Site-Specific Health and Safety Plan** ■ Readily available ■ Up to date ☐ N/A
■ Contingency plan/emergency response plan ■ Readily available ■ Up to date ☐ N/A
Remarks

3.	**O&M and OSHA Training Records** Remarks	■ Readily available	☐ Up to date	☐ N/A
4.	**Permits and Service Agreements** ☐ Air discharge permit ☐ Effluent discharge ☐ Waste disposal, POTW ☐ Other permits_____ Remarks Air Permit no longer required	 ☐ Readily available ☐ Readily available ☐ Readily available ☐ Readily available	 ☐ Up to date ☐ Up to date ☐ Up to date ☐ Up to date	 ■ N/A ■ N/A ■ N/A ■ N/A
5.	**Gas Generation Records** Remarks	☐ Readily available	☐ Up to date	■ N/A
6.	**Settlement Monument Records** Remarks	☐ Readily available	☐ Up to date	■ N/A
7.	**Groundwater Monitoring Records** Remarks N/A	☐ Readily available	☐ Up to date	☐ N/A
8.	**Leachate Extraction Records** Remarks N/A	☐ Readily available	☐ Up to date	☐ N/A
9.	**Discharge Compliance Records** ☐ Air ☐ Water (effluent) Remarks N/A	 ☐ Readily available ☐ Readily available	 ☐ Up to date ☐ Up to date	 ☐ N/A ☐ N/A
10.	**Daily Access/Security Logs** Remarks	■ Readily available	■ Up to date	☐ N/A

IV. O&M COSTS

1. **O&M Organization**

☐ State in-house ☐ Contractor for State
☐ PRP in-house ☒ Contractor for PRP
☐ Federal Facility in-house ☐ Contractor for Federal Facility
☐ Other

2. **O&M Cost Records**

☐ Readily available ☐ Up to date ☐ Funding mechanism/agreement in place
Original O&M cost estimate_____ ☐ Breakdown attached

Total annual cost by year for review period if available

From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost

3. **Unanticipated or Unusually High O&M Costs During Review Period**

Describe costs and reasons:

O&M Cost was not discussed in the site interviews - this information will be requested from contractors.

V. ACCESS AND INSTITUTIONAL CONTROLS ☐ Applicable ☐ N/A

A. Fencing

1. **Fencing damaged** ☐ Location shown on site map ☐ Gates secured ☐ N/A

Remarks Fence and locked gates

B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on site map ☐ N/A

Remarks Lighting, signage and security system in place

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented ☐ Yes ■ No ☐ N/A
Site conditions imply ICs not being fully enforced ☐ Yes ■ No ☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by) drive by, remote monitoring
Frequency daily
Responsible party/agency Blue World Remediation
Contact Tom Vanaskey (Name) Lead Operator (Title) (Date) 855-244-8125 (Phone no.)

Reporting is up-to-date ☐ Yes ☐ No ■ N/A
Reports are verified by the lead agency ☐ Yes ☐ No ■ N/A

Specific requirements in deed or decision documents have been met ☐ Yes ☐ No ■ N/A
Violations have been reported ☐ Yes ☐ No ■ N/A
Other problems or suggestions: ☐ Report attached

2. **Adequacy** ■ ICs are adequate ☐ ICs are inadequate ☐ N/A
Remarks

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map ■ No vandalism evident
Remarks

2. **Land use changes on site** ■ N/A
Remarks

3. **Land use changes off site** ■ N/A
Remarks

VI. GENERAL SITE CONDITIONS

A. Roads ■ Applicable ☐ N/A

1. **Roads damaged** ☐ Location shown on site map ■ Roads adequate ☐ N/A
Remarks

B. Other Site Conditions
Remarks Site is in good condition, functioning properly

VII. LANDFILL COVERS ☐ Applicable ☒ N/A		
A. Landfill Surface		
1. **Settlement** (Low spots) Areal extent_____ Remarks	☐ Location shown on site map Depth_____	☐ Settlement not evident
2. **Cracks** Lengths_____ Widths_____ Depths_____ Remarks	☐ Location shown on site map	☐ Cracking not evident
3. **Erosion** Areal extent_____ Remarks	☐ Location shown on site map Depth_____	☐ Erosion not evident
4. **Holes** Areal extent_____ Remarks	☐ Location shown on site map Depth_____	☐ Holes not evident
5. **Vegetative Cover** Remarks	☐ Grass ☐ Cover properly established ☐ No signs of stress ☐ Trees/Shrubs (indicate size and locations on a diagram)	
6. **Alternative Cover (armored rock, concrete, etc.)** Remarks		☐ N/A
7. **Bulges** Areal extent_____ Remarks	☐ Location shown on site map Height_____	☐ Bulges not evident

8.	**Wet Areas/Water Damage** ☐ Wet areas ☐ Ponding ☐ Seeps ☐ Soft subgrade Remarks	☐ Wet areas/water damage not evident ☐ Location shown on site map ☐ Location shown on site map ☐ Location shown on site map ☐ Location shown on site map	 Areal extent_____ Areal extent_____ Areal extent_____ Areal extent_____
9.	**Slope Instability** ☐ Slides Areal extent_____ Remarks	☐ Location shown on site map	☐ No evidence of slope instability
B. Benches	■ N/A	☐ Applicable	
	(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)		
1.	**Flows Bypass Bench** Remarks	☐ Location shown on site map	☐ N/A or okay
2.	**Bench Breached** Remarks	☐ Location shown on site map	☐ N/A or okay
3.	**Bench Overtopped** Remarks	☐ Location shown on site map	☐ N/A or okay
C. Letdown Channels	☐ Applicable	■ N/A	
	(Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)		
1.	**Settlement** Areal extent_____ Remarks	☐ Location shown on site map Depth_____	☐ No evidence of settlement
2.	**Material Degradation** Material type_____ Remarks	☐ Location shown on site map Areal extent_____	☐ No evidence of degradation
3.	**Erosion** Areal extent_____ Remarks	☐ Location shown on site map Depth_____	☐ No evidence of erosion

4.	**Undercutting** ☐ Location shown on site map ☐ No evidence of undercutting Areal extent_____ Depth_____ Remarks
5.	**Obstructions** Type_____ ☐ No obstructions ☐ Location shown on site map Areal extent_____ Size_____ Remarks
6.	**Excessive Vegetative Growth** Type_____ ☐ No evidence of excessive growth ☐ Vegetation in channels does not obstruct flow ☐ Location shown on site map Areal extent_____ Remarks
D. Cover Penetrations	☐ Applicable ■ N/A
1.	**Gas Vents** ☐ N/A ☐ Active ☐ Passive ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition ☐ Evidence of leakage at penetration Remarks
2.	**Gas Monitoring Probes** ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition ☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A Remarks
3.	**Monitoring Wells** (within surface area of landfill) ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition ☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A Remarks
4.	**Leachate Extraction Wells** ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition ☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A Remarks
5.	**Settlement Monuments** ☐ Located ☐ Routinely surveyed ☐ N/A Remarks

E. Gas Collection and Treatment	☐ Applicable	☐ N/A	
1.	**Gas Treatment Facilities** ☐ Flaring ☐ Thermal destruction ☐ Collection for reuse ☐ Good condition ☐ Needs Maintenance Remarks		
2.	**Gas Collection Wells, Manifolds and Piping** ☐ Good condition ☐ Needs Maintenance Remarks		
3.	**Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings) ☐ Good condition ☐ Needs Maintenance ☐ N/A Remarks		
F. Cover Drainage Layer	☐ Applicable	☐ N/A	
1.	**Outlet Pipes Inspected** Remarks	☐ Functioning	☐ N/A
2.	**Outlet Rock Inspected** Remarks	☐ Functioning	☐ N/A
G. Detention/Sedimentation Ponds	☐ Applicable	☐ N/A	
1.	**Siltation** ☐ N/A Areal extent_____ Depth_____ Remarks	☐ Siltation not evident	
2.	**Erosion** Areal extent_____ Depth_____ Remarks	☐ Erosion not evident	
3.	**Outlet Works** Remarks	☐ Functioning	☐ N/A
4.	**Dam** Remarks	☐ Functioning	☐ N/A

H. Retaining Walls	☐ Applicable	☒ N/A
1. **Deformations** Horizontal displacement_____ Vertical displacement_____ Rotational displacement_____ Remarks	☐ Location shown on site map	☐ Deformation not evident
2. **Degradation** Remarks	☐ Location shown on site map	☐ Degradation not evident
I. Perimeter Ditches/Off-Site Discharge	☐ Applicable	☒ N/A
1. **Siltation** Areal extent_____ Depth_____ Remarks	☐ Location shown on site map	☐ Siltation not evident
2. **Vegetative Growth** Areal extent_____ Type_____ Remarks	☐ Location shown on site map ☐ Vegetation does not impede flow	☒ N/A
3. **Erosion** Areal extent_____ Depth_____ Remarks	☐ Location shown on site map	☐ Erosion not evident
4. **Discharge Structure** Remarks	☐ Functioning	☐ N/A
VIII. VERTICAL BARRIER WALLS	☐ Applicable	☒ N/A
1. **Settlement** Areal extent_____ Depth_____ Remarks	☐ Location shown on site map	☐ Settlement not evident
2. **Performance Monitoring** Type of monitoring_____ ☐ Performance not monitored ☐ Evidence of breaching Frequency_____ Head differential_____ Remarks		
IX. GROUNDWATER/SURFACE WATER REMEDIES	☐ Applicable	☒ N/A
A. Groundwater Extraction Wells, Pumps, and Pipelines	☐ Applicable	☐ N/A
1. **Pumps, Wellhead Plumbing, and Electrical** ☐ Good condition ☐ All required wells properly operating ☐ Needs Maintenance ☐ N/A Remarks		

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
☐ Good condition ☐ Needs Maintenance
Remarks

3. **Spare Parts and Equipment**
☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided
Remarks

B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☐ N/A

1. **Collection Structures, Pumps, and Electrical**
☐ Good condition ☐ Needs Maintenance
Remarks

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
☐ Good condition ☐ Needs Maintenance
Remarks

3. **Spare Parts and Equipment**
☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided
Remarks

C. Treatment System ☐ Applicable ☐ N/A

1. **Treatment Train** (Check components that apply)
☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☐ Air stripping ☐ Carbon adsorbers
☐ Filters_____
☐ Additive (*e.g.*, chelation agent, flocculent)_____
☐ Others_____
☐ Good condition ☐ Needs Maintenance
☐ Sampling ports properly marked and functional
☐ Sampling/maintenance log displayed and up to date
☐ Equipment properly identified
☐ Quantity of groundwater treated annually_____
☐ Quantity of surface water treated annually_____
Remarks

2. **Electrical Enclosures and Panels** (properly rated and functional)
☐ N/A ☐ Good condition ☐ Needs Maintenance
Remarks

3.	**Tanks, Vaults, Storage Vessels** ☐ N/A ☐ Good condition ☐ Proper secondary containment ☐ Needs Maintenance Remarks
4.	**Discharge Structure and Appurtenances** ☐ N/A ☐ Good condition ☐ Needs Maintenance Remarks
5.	**Treatment Building(s)** ☐ N/A ☐ Good condition (esp. roof and doorways) ☐ Needs repair ☐ Chemicals and equipment properly stored Remarks
6.	**Monitoring Wells** (pump and treatment remedy) ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition ☐ All required wells located ☐ Needs Maintenance ☐ N/A Remarks
D. Monitoring Data	
1.	Monitoring Data ☐ Is routinely submitted on time ☐ Is of acceptable quality
2.	Monitoring data suggests: ☐ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining
D. Monitored Natural Attenuation	
1.	**Monitoring Wells** (natural attenuation remedy) ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition ☐ All required wells located ☐ Needs Maintenance ☐ N/A Remarks
X. OTHER REMEDIES	
	If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

	X. SOIL VAPOR EXTRACTION & TREATMENT REMEDIES ■ **Applicable** □ N/A
A. Soil Vapor Extraction Wells, Pumps, and Pipelines ■ **Applicable** □ N/A	
1.	**Blowers, Wellhead Plumbing, and Electrical** ■ Good condition ■ All required wells properly operating □ Needs Maintenance □ N/A Remarks **System recently optimized, new muffler**
2.	**Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances** ■ **Good condition** □ Needs Maintenance Remarks **Manifold has been redesigned and replaced, system pipelines buried**
3.	**Spare Parts and Equipment** ■ **Readily available** □ Good condition □ Requires upgrade □ Needs to be provided Remarks

XI. OVERALL OBSERVATIONS	
A.	**Implementation of the Remedy**
	Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).
Per information from interviews and site observations, the implemented remedy appears to be functioning as designed, the contaminant plume is being contained.	
B.	**Adequacy of O&M**
	Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.
N/A	
C.	**Early Indicators of Potential Remedy Problems**
	Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future.
N/A	
D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.
N/A	

Five-Year Review Site Inspection Checklist

I. SITE INFORMATION	
Site name: PGA-South/ Subunit A GWTS	**Date of inspection:** 25 Feb, 2015
Location: Goodyear, AZ/Region 9	**EPA ID:** AZD980695902
Agency, office, or company leading the five-year review: Haley Aldrich	**Weather/temperature** Sunny, calm, ~55° F

Remedy Includes: (Check all that apply)

- ☐ Landfill cover/containment
- ☒ Access controls
- ☒ Institutional controls
- ☒ Groundwater pump and treatment
- ☐ Surface water collection and treatment
- ☐ Other: Air Stripping
- ☐ Monitored natural attenuation
- ☒ Groundwater containment
- ☐ Vertical barrier walls

Attachments: ☒ Inspection-team roster attached ☐ Site map attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** Paula Panzino (Name) Program Manager (Title) 25 Feb 2015 (Date)
   Interviewed ☒ at site ☐ at office ☐ by phone Phone no. 602-760-2418
   Problems, suggestions; ☐ Report attached

2. **O&M staff** Scott Zachary (Name) Vice President (Title) 25 Feb 2015 (Date)
   Interviewed ☒ at site ☐ at office ☐ by phone Phone no. 619-285-7103
   Problems, suggestions; ☐ Report attached

2. **O&M staff** Mark Argall (Name) Senior Technician (Title) 25 Feb 2015 (Date)
   Interviewed ☒ at site ☐ at office ☐ by phone Phone no. 602-760-2440
   Problems, suggestions; ☐ Report attached

2. **O&M staff** Ron Clark (Name) Environmental Consultant (Title) 25 Feb 2015 (Date)
   Interviewed ☒ at site ☐ at office ☐ by phone Phone no. 330-668-4600
   Problems, suggestions; ☐ Report attached

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____

4. **Other interviews** (optional) ☐ Report attached.

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**

■ O&M manual	■ Readily available	■ Up to date	☐ N/A
■ As-built drawings	■ Readily available	■ Up to date	☐ N/A
■ Maintenance logs	■ Readily available	■ Up to date	☐ N/A

Remarks

2. **Site-Specific Health and Safety Plan** ■ Readily available ■ Up to date ☐ N/A
■ Contingency plan/emergency response plan ■ Readily available ■ Up to date ☐ N/A
Remarks

3.	**O&M and OSHA Training Records** Remarks	■ Readily available	☐ Up to date	☐ N/A
4.	**Permits and Service Agreements**			
	☐ Air discharge permit	☐ Readily available	☐ Up to date	■ N/A
	☐ Effluent discharge	☐ Readily available	☐ Up to date	■ N/A
	☐ Waste disposal, POTW	☐ Readily available	☐ Up to date	■ N/A
	☐ Other permits_____	☐ Readily available	☐ Up to date	☐ N/A
	Remarks			
5.	**Gas Generation Records** Remarks	☐ Readily available	☐ Up to date	■ N/A
6.	**Settlement Monument Records** Remarks	☐ Readily available	☐ Up to date	■ N/A
7.	**Groundwater Monitoring Records** Remarks	■ Readily available	■ Up to date	☐ N/A
8.	**Leachate Extraction Records** Remarks	■ Readily available	☐ Up to date	☐ N/A
9.	**Discharge Compliance Records**			
	☐ Air	☐ Readily available	☐ Up to date	☐ N/A
	☐ Water (effluent)	☐ Readily available	☐ Up to date	☐ N/A
	Remarks			
10.	**Daily Access/Security Logs** Remarks	■ Readily available	■ Up to date	☐ N/A

IV. O&M COSTS

1. **O&M Organization**

☐ State in-house ☐ Contractor for State
☐ PRP in-house ☒ Contractor for PRP
☐ Federal Facility in-house ☐ Contractor for Federal Facility
☐ Other

2. **O&M Cost Records**

☐ Readily available ☐ Up to date ☐ Funding mechanism/agreement in place
Original O&M cost estimate_____ ☐ Breakdown attached

Total annual cost by year for review period if available

From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost

3. **Unanticipated or Unusually High O&M Costs During Review Period**

Describe costs and reasons:

O&M Cost was not discussed in the site interviews - this information will be requested from contractors.

V. ACCESS AND INSTITUTIONAL CONTROLS ☐ Applicable ☐ N/A

A. Fencing

1. **Fencing damaged** ☐ Location shown on site map ☒ Gates secured ☐ N/A

Remarks Concrete walls and locked gates

B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on site map ☒ N/A

Remarks Signage and security system in place

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented ☐ Yes ■ No ☐ N/A
Site conditions imply ICs not being fully enforced ☐ Yes ■ No ☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by) drive by, remote monitoring
Frequency daily
Responsible party/agency Haley Aldrich
Contact Mark Argall (Name) Senior Technician (Title) (Date) 602-760-2440 (Phone no.)

Reporting is up-to-date ☐ Yes ☐ No ■ N/A
Reports are verified by the lead agency ☐ Yes ☐ No ■ N/A

Specific requirements in deed or decision documents have been met ☐ Yes ☐ No ■ N/A
Violations have been reported ☐ Yes ☐ No ■ N/A
Other problems or suggestions: ☐ Report attached

2. **Adequacy** ■ ICs are adequate ☐ ICs are inadequate ☐ N/A
Remarks

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map ■ No vandalism evident
Remarks

2. **Land use changes on site** ■ N/A
Remarks

3. **Land use changes off site** ■ N/A
Remarks

VI. GENERAL SITE CONDITIONS

A. Roads ■ Applicable ☐ N/A

1. **Roads damaged** ☐ Location shown on site map ■ Roads adequate ☐ N/A
Remarks

B. Other Site Conditions
Remarks Site is in good condition, functioning properly

VII. LANDFILL COVERS ☐ Applicable ☒ N/A		
A. Landfill Surface		
1. **Settlement** (Low spots) Areal extent_____ Remarks	☐ Location shown on site map Depth_____	☐ Settlement not evident
2. **Cracks** Lengths_____ Widths_____ Depths_____ Remarks	☐ Location shown on site map	☐ Cracking not evident
3. **Erosion** Areal extent_____ Remarks	☐ Location shown on site map Depth_____	☐ Erosion not evident
4. **Holes** Areal extent_____ Remarks	☐ Location shown on site map Depth_____	☐ Holes not evident
5. **Vegetative Cover** Remarks	☐ Grass ☐ No signs of stress	☐ Cover properly established ☐ Trees/Shrubs (indicate size and locations on a diagram)
6. **Alternative Cover (armored rock, concrete, etc.)** Remarks		☐ N/A
7. **Bulges** Areal extent_____ Remarks	☐ Location shown on site map Height_____	☐ Bulges not evident

8.	**Wet Areas/Water Damage** ☐ Wet areas ☐ Ponding ☐ Seeps ☐ Soft subgrade Remarks	☐ Wet areas/water damage not evident ☐ Location shown on site map ☐ Location shown on site map ☐ Location shown on site map ☐ Location shown on site map	 Areal extent_____ Areal extent_____ Areal extent_____ Areal extent_____
9.	**Slope Instability** ☐ Slides Areal extent_____ Remarks	☐ Location shown on site map	☐ No evidence of slope instability
B. Benches	☐ N/A ☐ Applicable (Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)		
1.	**Flows Bypass Bench** Remarks	☐ Location shown on site map	☐ N/A or okay
2.	**Bench Breached** Remarks	☐ Location shown on site map	☐ N/A or okay
3.	**Bench Overtopped** Remarks	☐ Location shown on site map	☐ N/A or okay
C. Letdown Channels	☐ Applicable ☐ N/A (Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)		
1.	**Settlement** Areal extent_____ Remarks	☐ Location shown on site map Depth_____	☐ No evidence of settlement
2.	**Material Degradation** Material type_____ Remarks	☐ Location shown on site map Areal extent_____	☐ No evidence of degradation
3.	**Erosion** Areal extent_____ Remarks	☐ Location shown on site map Depth_____	☐ No evidence of erosion

4. **Undercutting** ☐ Location shown on site map ☐ No evidence of undercutting
Areal extent_____ Depth_____
Remarks

5. **Obstructions** Type_____ ☐ No obstructions ☐ Location shown on site map
Areal extent_____ Size_____
Remarks

6. **Excessive Vegetative Growth** Type_____
☐ No evidence of excessive growth
☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent_____
Remarks

D. Cover Penetrations ☐ Applicable ☐ N/A

1. **Gas Vents** ☐ N/A ☐ Active ☐ Passive ☐ Properly secured/locked ☐ Functioning
☐ Routinely sampled ☐ Good condition ☐ Evidence of leakage at penetration
Remarks

2. **Gas Monitoring Probes**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks

3. **Monitoring Wells** (within surface area of landfill)
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks

4. **Leachate Extraction Wells**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks

5. **Settlement Monuments** ☐ Located ☐ Routinely surveyed ☐ N/A
Remarks

E. Gas Collection and Treatment	☐ Applicable	☐ N/A	
1.	**Gas Treatment Facilities** ☐ Flaring ☐ Thermal destruction ☐ Collection for reuse ☐ Good condition ☐ Needs Maintenance Remarks		
2.	**Gas Collection Wells, Manifolds and Piping** ☐ Good condition ☐ Needs Maintenance Remarks		
3.	**Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings) ☐ Good condition ☐ Needs Maintenance ☐ N/A Remarks		
F. Cover Drainage Layer	☐ Applicable	☐ N/A	
1.	**Outlet Pipes Inspected** Remarks	☐ Functioning	☐ N/A
2.	**Outlet Rock Inspected** Remarks	☐ Functioning	☐ N/A
G. Detention/Sedimentation Ponds	☐ Applicable	☐ N/A	
1.	**Siltation** ☐ N/A Areal extent_____ Depth_____ Remarks	☐ Siltation not evident	
2.	**Erosion** Areal extent_____ Depth_____ Remarks	☐ Erosion not evident	
3.	**Outlet Works** Remarks	☐ Functioning	☐ N/A
4.	**Dam** Remarks	☐ Functioning	☐ N/A

H. Retaining Walls	☐ Applicable	☒ N/A
1. **Deformations** Horizontal displacement_____ Vertical displacement_____ Rotational displacement_____ Remarks	☐ Location shown on site map	☐ Deformation not evident
2. **Degradation** Remarks	☐ Location shown on site map	☐ Degradation not evident
I. Perimeter Ditches/Off-Site Discharge	☐ Applicable	☒ N/A
1. **Siltation** Areal extent_____ Depth_____ Remarks	☐ Location shown on site map	☐ Siltation not evident
2. **Vegetative Growth** Areal extent_____ Type_____ Remarks	☐ Location shown on site map ☐ Vegetation does not impede flow	☒ N/A
3. **Erosion** Areal extent_____ Depth_____ Remarks	☐ Location shown on site map	☐ Erosion not evident
4. **Discharge Structure** Remarks	☐ Functioning	☐ N/A
VIII. VERTICAL BARRIER WALLS	☐ Applicable	☒ N/A
1. **Settlement** Areal extent_____ Depth_____ Remarks	☐ Location shown on site map	☐ Settlement not evident
2. **Performance Monitoring** Type of monitoring_____ ☐ Performance not monitored ☐ Evidence of breaching Frequency_____ Head differential_____ Remarks		
IX. GROUNDWATER/SURFACE WATER REMEDIES	☐ Applicable	☐ N/A
A. Groundwater Extraction Wells, Pumps, and Pipelines	☐ Applicable	☐ N/A
1. **Pumps, Wellhead Plumbing, and Electrical** ☒ Good condition ☒ All required wells properly operating ☐ Needs Maintenance ☐ N/A Remarks		

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
☒ Good condition ☐ Needs Maintenance
Remarks

3. **Spare Parts and Equipment**
☒ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided
Remarks

B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☒ N/A

1. **Collection Structures, Pumps, and Electrical**
☐ Good condition ☐ Needs Maintenance
Remarks

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
☐ Good condition ☐ Needs Maintenance
Remarks

3. **Spare Parts and Equipment**
☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided
Remarks

C. Treatment System ☐ Applicable ☐ N/A

1. **Treatment Train** (Check components that apply)
☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☒ Air stripping ☐ Carbon adsorbers
☒ Filters_____
☐ Additive (*e.g.*, chelation agent, flocculent) anti-scaling
☐ Others_____
☒ Good condition ☐ Needs Maintenance
☒ Sampling ports properly marked and functional
☒ Sampling/maintenance log displayed and up to date
☒ Equipment properly identified
☐ Quantity of groundwater treated annually_____
☐ Quantity of surface water treated annually_____
Remarks

2. **Electrical Enclosures and Panels** (properly rated and functional)
☐ N/A ☐ Good condition ☐ Needs Maintenance
Remarks Good Condition

3.	**Tanks, Vaults, Storage Vessels** ☐ N/A ■ Good condition ■ Proper secondary containment ☐ Needs Maintenance Remarks
4.	**Discharge Structure and Appurtenances** ☐ N/A ■ Good condition ☐ Needs Maintenance Remarks Discharge to injection well field
5.	**Treatment Building(s)** ☐ N/A ■ Good condition (esp. roof and doorways) ☐ Needs repair ■ Chemicals and equipment properly stored Remarks
6.	**Monitoring Wells** (pump and treatment remedy) ■ Properly secured/locked ■ Functioning ■ Routinely sampled ■ Good condition ☐ All required wells located ☐ Needs Maintenance ☐ N/A Remarks
D. Monitoring Data	
1.	Monitoring Data ■ Is routinely submitted on time ■ Is of acceptable quality
2.	Monitoring data suggests: ■ Groundwater plume is effectively contained ■ Contaminant concentrations are declining
D. Monitored Natural Attenuation	
1.	**Monitoring Wells** (natural attenuation remedy) ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition ☐ All required wells located ☐ Needs Maintenance ■ N/A Remarks
X. OTHER REMEDIES	
	If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS	
A.	**Implementation of the Remedy**
	Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).
Per information from interviews and site observations, the implemented remedy appears to be functioning as designed, the contaminant plume is being contained.	
B.	**Adequacy of O&M**
	Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.
N/A	
C.	**Early Indicators of Potential Remedy Problems**
	Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future.
N/A	
D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.
N/A	

Five-Year Review Site Inspection Checklist

I. SITE INFORMATION	
Site name: PGA-South/Northern Sub C GWTS	**Date of inspection:** 25 Feb, 2015
Location: Goodyear, AZ/Region 9	**EPA ID:** AZD980695902
Agency, office, or company leading the five-year review: Haley Aldrich	**Weather/temperature** Sunny, calm, ~55° F

Remedy Includes: (Check all that apply)

- ☐ Landfill cover/containment
- ☒ Access controls
- ☒ Institutional controls
- ☒ Groundwater pump and treatment
- ☐ Surface water collection and treatment
- ☒ Other:
  Liquid phase GAC
- ☐ Monitored natural attenuation
- ☒ Groundwater containment
- ☐ Vertical barrier walls

Attachments: ☒ Inspection-team roster attached ☐ Site map attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** Paula Panzino (Name) Program Manager (Title) 25 Feb 2015 (Date)
   Interviewed ☒ at site ☐ at office ☐ by phone Phone no. 602-760-2418
   Problems, suggestions; ☐ Report attached

2. **O&M staff** Scott Zachary (Name) Vice President (Title) 25 Feb 2015 (Date)
   Interviewed ☒ at site ☐ at office ☐ by phone Phone no. 619-285-7103
   Problems, suggestions; ☐ Report attached

2. **O&M staff** Mark Argall (Name) Senior Technician (Title) 25 Feb 2015 (Date)
   Interviewed ☒ at site ☐ at office ☐ by phone Phone no. 602-760-2440
   Problems, suggestions; ☐ Report attached

2. **O&M staff** Ron Clark (Name) Environmental Consultant (Title) 25 Feb 2015 (Date)
   Interviewed ☒ at site ☐ at office ☐ by phone Phone no. 330-668-4600
   Problems, suggestions; ☐ Report attached

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____

4. **Other interviews** (optional) ☐ Report attached.

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**

■ O&M manual	■ Readily available	■ Up to date	☐ N/A
■ As-built drawings	■ Readily available	■ Up to date	☐ N/A
■ Maintenance logs	■ Readily available	■ Up to date	☐ N/A

Remarks

2. **Site-Specific Health and Safety Plan** ■ Readily available ■ Up to date ☐ N/A
■ Contingency plan/emergency response plan ■ Readily available ■ Up to date ☐ N/A
Remarks

3.	**O&M and OSHA Training Records** Remarks Available and up to date	■ Readily available	☐ Up to date	☐ N/A
4.	**Permits and Service Agreements**			
	☐ Air discharge permit	☐ Readily available	☐ Up to date	■ N/A
	☐ Effluent discharge	☐ Readily available	☐ Up to date	■ N/A
	☐ Waste disposal, POTW	☐ Readily available	☐ Up to date	■ N/A
	☐ Other permits_____	☐ Readily available	☐ Up to date	☐ N/A
	Remarks			
5.	**Gas Generation Records** Remarks	☐ Readily available	☐ Up to date	■ N/A
6.	**Settlement Monument Records** Remarks	☐ Readily available	☐ Up to date	■ N/A
7.	**Groundwater Monitoring Records** Remarks	■ Readily available	■ Up to date	☐ N/A
8.	**Leachate Extraction Records** Remarks	☐ Readily available	☐ Up to date	■ N/A
9.	**Discharge Compliance Records**			
	☐ Air	☐ Readily available	☐ Up to date	☐ N/A
	☐ Water (effluent)	☐ Readily available	☐ Up to date	☐ N/A
	Remarks			
10.	**Daily Access/Security Logs** Remarks	■ Readily available	■ Up to date	☐ N/A

IV. O&M COSTS

1. **O&M Organization**

☐ State in-house ☐ Contractor for State
☐ PRP in-house ☒ Contractor for PRP
☐ Federal Facility in-house ☐ Contractor for Federal Facility
☐ Other

2. **O&M Cost Records**

☐ Readily available ☐ Up to date ☐ Funding mechanism/agreement in place
Original O&M cost estimate_____ ☐ Breakdown attached

Total annual cost by year for review period if available

From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost

3. **Unanticipated or Unusually High O&M Costs During Review Period**

Describe costs and reasons:

O&M Cost was not discussed in the site interviews - this information will be requested from contractors.

V. ACCESS AND INSTITUTIONAL CONTROLS ☐ Applicable ☐ N/A

A. Fencing

1. **Fencing damaged** ☐ Location shown on site map ☒ Gates secured ☐ N/A

Remarks Fence with slats and locked gates

B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on site map ☐ N/A

Remarks Signage and security system in place

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented ☐ Yes ■ No ☐ N/A
Site conditions imply ICs not being fully enforced ☐ Yes ■ No ☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by) drive by, remote monitoring
Frequency daily
Responsible party/agency Haley Aldrich
Contact Mark Argall (Name) Senior Technician (Title) (Date) 602-760-2440 (Phone no.)

Reporting is up-to-date ☐ Yes ☐ No ■ N/A
Reports are verified by the lead agency ☐ Yes ☐ No ■ N/A

Specific requirements in deed or decision documents have been met ☐ Yes ☐ No ■ N/A
Violations have been reported ☐ Yes ☐ No ■ N/A
Other problems or suggestions: ☐ Report attached

2. **Adequacy** ■ ICs are adequate ☐ ICs are inadequate ☐ N/A
Remarks

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map ■ No vandalism evident
Remarks

2. **Land use changes on site** ■ N/A
Remarks

3. **Land use changes off site** ■ N/A
Remarks

VI. GENERAL SITE CONDITIONS

A. Roads ■ Applicable ☐ N/A

1. **Roads damaged** ☐ Location shown on site map ■ Roads adequate ☐ N/A
Remarks

B. Other Site Conditions

Remarks

Site is in good condition, functioning properly

VII. LANDFILL COVERS ☐ Applicable ☒ N/A

A. Landfill Surface

1. **Settlement** (Low spots) ☐ Location shown on site map ☐ Settlement not evident
   Areal extent_____ Depth_____
   Remarks

2. **Cracks** ☐ Location shown on site map ☐ Cracking not evident
   Lengths_____ Widths_____ Depths_____
   Remarks

3. **Erosion** ☐ Location shown on site map ☐ Erosion not evident
   Areal extent_____ Depth_____
   Remarks

4. **Holes** ☐ Location shown on site map ☐ Holes not evident
   Areal extent_____ Depth_____
   Remarks

5. **Vegetative Cover** ☐ Grass ☐ Cover properly established
   ☐ No signs of stress ☐ Trees/Shrubs (indicate size and locations on a diagram)
   Remarks

6. **Alternative Cover (armored rock, concrete, etc.)** ☐ N/A
   Remarks

7. **Bulges** ☐ Location shown on site map ☐ Bulges not evident
   Areal extent_____ Height_____
   Remarks

8.	**Wet Areas/Water Damage** ☐ Wet areas ☐ Ponding ☐ Seeps ☐ Soft subgrade Remarks	☐ Wet areas/water damage not evident ☐ Location shown on site map ☐ Location shown on site map ☐ Location shown on site map ☐ Location shown on site map	 Areal extent_____ Areal extent_____ Areal extent_____ Areal extent_____
9.	**Slope Instability** ☐ Slides Areal extent_____ Remarks	☐ Location shown on site map	☐ No evidence of slope instability
B. Benches	☐ N/A ☐ Applicable (Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)		
1.	**Flows Bypass Bench** Remarks	☐ Location shown on site map	☐ N/A or okay
2.	**Bench Breached** Remarks	☐ Location shown on site map	☐ N/A or okay
3.	**Bench Overtopped** Remarks	☐ Location shown on site map	☐ N/A or okay
C. Letdown Channels	☐ Applicable ☐ N/A (Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)		
1.	**Settlement** Areal extent_____ Remarks	☐ Location shown on site map Depth_____	☐ No evidence of settlement
2.	**Material Degradation** Material type_____ Remarks	☐ Location shown on site map Areal extent_____	☐ No evidence of degradation
3.	**Erosion** Areal extent_____ Remarks	☐ Location shown on site map Depth_____	☐ No evidence of erosion

4.	**Undercutting** ☐ Location shown on site map ☐ No evidence of undercutting Areal extent_____ Depth_____ Remarks
5.	**Obstructions** Type_____ ☐ No obstructions ☐ Location shown on site map Areal extent_____ Size_____ Remarks
6.	**Excessive Vegetative Growth** Type_____ ☐ No evidence of excessive growth ☐ Vegetation in channels does not obstruct flow ☐ Location shown on site map Areal extent_____ Remarks
D. Cover Penetrations	☐ Applicable ☐ N/A
1.	**Gas Vents** ☐ N/A ☐ Active ☐ Passive ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition ☐ Evidence of leakage at penetration Remarks
2.	**Gas Monitoring Probes** ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition ☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A Remarks
3.	**Monitoring Wells** (within surface area of landfill) ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition ☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A Remarks
4.	**Leachate Extraction Wells** ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition ☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A Remarks
5.	**Settlement Monuments** ☐ Located ☐ Routinely surveyed ☐ N/A Remarks

E. Gas Collection and Treatment	☐ Applicable	☐ N/A	
1.	**Gas Treatment Facilities** ☐ Flaring ☐ Thermal destruction ☐ Collection for reuse ☐ Good condition ☐ Needs Maintenance Remarks		
2.	**Gas Collection Wells, Manifolds and Piping** ☐ Good condition ☐ Needs Maintenance Remarks		
3.	**Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings) ☐ Good condition ☐ Needs Maintenance ☐ N/A Remarks		
F. Cover Drainage Layer	☐ Applicable	☐ N/A	
1.	**Outlet Pipes Inspected** Remarks	☐ Functioning	☐ N/A
2.	**Outlet Rock Inspected** Remarks	☐ Functioning	☐ N/A
G. Detention/Sedimentation Ponds	☐ Applicable	☐ N/A	
1.	**Siltation** ☐ N/A Areal extent_____ Depth_____ Remarks	☐ Siltation not evident	
2.	**Erosion** Areal extent_____ Depth_____ Remarks	☐ Erosion not evident	
3.	**Outlet Works** Remarks	☐ Functioning	☐ N/A
4.	**Dam** Remarks	☐ Functioning	☐ N/A

H. Retaining Walls	☐ Applicable	☒ N/A
1. **Deformations** Horizontal displacement_____ Vertical displacement_____ Rotational displacement_____ Remarks	☐ Location shown on site map	☐ Deformation not evident
2. **Degradation** Remarks	☐ Location shown on site map	☐ Degradation not evident
I. Perimeter Ditches/Off-Site Discharge	☐ Applicable	☒ N/A
1. **Siltation** Areal extent_____ Depth_____ Remarks	☐ Location shown on site map	☐ Siltation not evident
2. **Vegetative Growth** Areal extent_____ Type_____ Remarks	☐ Location shown on site map ☐ Vegetation does not impede flow	☒ N/A
3. **Erosion** Areal extent_____ Depth_____ Remarks	☐ Location shown on site map	☐ Erosion not evident
4. **Discharge Structure** Remarks	☐ Functioning	☐ N/A
VIII. VERTICAL BARRIER WALLS	☐ Applicable	☒ N/A
1. **Settlement** Areal extent_____ Depth_____ Remarks	☐ Location shown on site map	☐ Settlement not evident
2. **Performance Monitoring** Type of monitoring_____ ☐ Performance not monitored ☐ Evidence of breaching Frequency_____ Head differential_____ Remarks		
IX. GROUNDWATER/SURFACE WATER REMEDIES	☐ Applicable	☐ N/A
A. Groundwater Extraction Wells, Pumps, and Pipelines	☐ Applicable	☐ N/A
1. **Pumps, Wellhead Plumbing, and Electrical** ☒ Good condition ☒ All required wells properly operating ☐ Needs Maintenance ☐ N/A Remarks		

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
☒ Good condition ☐ Needs Maintenance
Remarks

3. **Spare Parts and Equipment**
☐ Readily available ☐ Good condition ☒ Requires upgrade ☐ Needs to be provided
Remarks
readily available

B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☐ N/A

1. **Collection Structures, Pumps, and Electrical**
☐ Good condition ☐ Needs Maintenance
Remarks

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
☐ Good condition ☐ Needs Maintenance
Remarks

3. **Spare Parts and Equipment**
☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided
Remarks

C. Treatment System ☐ Applicable ☐ N/A

1. **Treatment Train** (Check components that apply)
☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☐ Air stripping ☒ Carbon adsorbers
☒ Filters_____
☐ Additive (*e.g.*, chelation agent, flocculent) anti-scaling
☐ Others_____
☒ Good condition ☐ Needs Maintenance
☒ Sampling ports properly marked and functional
☒ Sampling/maintenance log displayed and up to date
☒ Equipment properly identified
☐ Quantity of groundwater treated annually_____
☐ Quantity of surface water treated annually_____
Remarks

2. **Electrical Enclosures and Panels** (properly rated and functional)
☐ N/A ☐ Good condition ☐ Needs Maintenance
Remarks Good Condition

3.	**Tanks, Vaults, Storage Vessels** ☐ N/A ■ Good condition ■ Proper secondary containment ☐ Needs Maintenance Remarks Vessels have been re-lined and weak spots repaired
4.	**Discharge Structure and Appurtenances** ☐ N/A ■ Good condition ☐ Needs Maintenance Remarks Discharge to City of Goodyear
5.	**Treatment Building(s)** ☐ N/A ■ Good condition (esp. roof and doorways) ☐ Needs repair ■ Chemicals and equipment properly stored Remarks
6.	**Monitoring Wells** (pump and treatment remedy) ■ Properly secured/locked ■ Functioning ■ Routinely sampled ■ Good condition ☐ All required wells located ☐ Needs Maintenance ☐ N/A Remarks
D. Monitoring Data	
1.	Monitoring Data ■ Is routinely submitted on time ■ Is of acceptable quality
2.	Monitoring data suggests: ■ Groundwater plume is effectively contained ■ Contaminant concentrations are declining
D. Monitored Natural Attenuation	
1.	**Monitoring Wells** (natural attenuation remedy) ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition ☐ All required wells located ☐ Needs Maintenance ■ N/A Remarks
X. OTHER REMEDIES	
	If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS	
A.	**Implementation of the Remedy**
	Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).
Per information from interviews and site observations, the implemented remedy appears to be functioning as designed, the contaminant plume is being contained.	
B.	**Adequacy of O&M**
	Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.
N/A	
C.	**Early Indicators of Potential Remedy Problems**
	Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future.
N/A	
D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.
N/A	

Appendix E: Trip Report and Photographs from Site Inspection

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Trip Report and Photographs from Site Inspection

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DRAFT Trip Report
Phoenix Goodyear Airport North and Phoenix Goodyear Airport South

1. INTRODUCTION

a. Date of Visit: 25 February 2015

b. Location: Goodyear, AZ

c. Purpose: A site visit was conducted to visually inspect and document the conditions of the remedy, the site, and the surrounding area for inclusion into the Five-Year Review Report.

d. Participants:

Matthew Masten	US Army Corps of Engineers, Environmental Engineer	602-230-6873
PGA South:		
Paula Panzino	Haley Aldrich, Remediation Program Manager	602-760-2418
Scott Zachary	Haley Aldrich, Vice President	619-285-7103
Mark Argall	Haley Aldrich, Senior Technician	602-760-2440
Ron Clark	Goodyear Tire, Environmental Consultant	330-668-4600
PGA North:		
Stephanie Koehne	AMEC, Project Manager	480-734-6279
Harry Brenton	Matrix New World, Dir. of Hydrogeologic Svcs.	623-322-7003
Tom Vanaskey	Blue World Remediation, Lead Operator	855-244-8125

2. SUMMARY

A site visit to the Phoenix Goodyear Airport (PGA) North and South Superfund Site was conducted on 25 February 2015. The Superfund Site is split into two areas; PGA South was inspected in the morning, PGA North in the afternoon. The distinct sites have separate plumes, team members, stakeholders, and treatment systems. At each site, the participants toured the groundwater treatment plants after an overview of the site and the remedial history. The groundwater treatment plants are manned daily by the respective site managers.

3. DISCUSSION

On 25 February, Mr. Masten arrived at the Phoenix Goodyear Airport at 0800. The other PGA South site visit participants met at the airport lobby. The weather was sunny, calm, and approximately 55 degrees Fahrenheit. A meeting was held in the conference room of the airport where Mr. Masten interviewed all participants. Ms. Panzino, Mr. Zachary and Mr. Argall gave an overview and history of the project and site. A tailgate safety meeting was held prior to the site inspection.

After the discussion, the team proceeded to inspect the various treatment systems of the PGA South site. Once outside of the airport building, Mr. Argall pointed out a nearby valve box, on the south side of the airport lobby, where there had been a release of groundwater last March. The water was from well E-16, which is outside the contaminant plume. The airport staff first noticed the leak and tried to close the valve, which in turn worsened the problem, and created back pressure. Haley Aldrich staff were notified and were able to quickly turn the pumps off and stop the leak. According to Mr. Zachary and Mr. Argall, the release was not large enough to be a "reportable" release, and was "clean" water from well E-16. In response to this incident, the leak was repaired, emergency kill switches have been installed on all systems, and airport staff have been trained to properly respond.

The team proceeded to inspect a nearby extraction well, E-07R, this is a replacement well for E-07. The well head is secured in a below grade vault. The well and vault were in good condition and appeared to be functioning normally.

The spent chromium remediation media beds were inspected next. They are fenced off with an intact single-strand wire fence, 'Restricted Area' signage is in place. The beds appear to be in fair condition, no erosion problems were noted. The surface is hard packed with gravel covering the site, except for a few bare spots. Low-growing vegetation covers much of the area; recent precipitation most likely assisted this. One old, dry monitoring well was noted in the center of the beds. This may need to be properly abandoned.

The team next stopped by extraction well E-20 and adjacent observation well EO-20. This extraction well, much like E-17 is in a new vault, and is in good condition. Observation well EO-20 did not have a lock on the well cap, however, it was noted that this well is inside a secured area within the Phoenix Goodyear Airport boundary. This extraction well (as well as E-18 & E-19) came on line in December 2014.

The team drove to inspect the PGA South Subunit A air stripping treatment (AST) system next. The new pipeline from the newer extraction wells to the remediation system was noted to follow a meandering path, this was to avoid burrowing owl nests. The newly installed emergency kill switch was noted on the exterior of the remediation facility. The system operation was described by Operator, Mark Argall. The sulfuric acid tank was noted to have a double containment system. Mr. Argall demonstrated the newly equipped supervisory control and data acquisition (SCADA) system, which allows for remote systems control and monitoring. The air stripper appeared to be in good working order, and is continuing to operate at approximately 475 gallons per minute. The facility has new fencing and paint, and is in overall good condition. O&M manuals, training certificates, emergency action plans were all in place.

Next the team traveled to the injection well field. The pipeline leading to the injection wells is visually inspected monthly, according to Mr. Argall. Injection well vault I-16 was examined. The well head and vault were in good condition. The valve vault for the discharge to the Bullard Wash was also inspected. This is a new piping system that allows for beneficial reuse of treated water by the City of Goodyear as needed.

The PGA South Southern Subunit C GAC-2 remediation system was inspected. The facility has a new emergency kill-switch and is secured by chain-link fencing. The fence has plastic privacy slats that are in remarkably good condition, showing no sun damage. The GAC vessels were re-lined in 2012 and 2013. The interiors were sand-blasted and pin-holes and weak spots were repaired. These patches can be seen on the exterior. New carbon material was added and the GAC vessels are now operating normally in Lead/Lag mode. The effluent is no longer being reinjected, the old connection to injection wells was noted. The system now has a holding/equilibration tank and the treated water is pumped to the City of Goodyear for beneficial reuse.

Extraction well E-17A (E-17) was inspected next. It is contained in a vault, in good condition. The well head has some rust, but the well is one of the best producers on the site at about 145 gpm.

The final system piece inspected at PGA South was Subunit C extraction well E-103. This well is off Airport property, and is secured with a chain link fence topped with barbed-wire. The well and well house were in good condition and were functioning normally. The control system for the well pump was connected to the SCADA system for remote monitoring and control.

All components of the remedial action at PGA South appeared to be in good condition and operating as intended.

The team returned to the terminal at 1100 hrs.

At 1130, Mr. Masten arrived at the PGA North Site, Main Treatment System. The weather was sunny, calm, and approximately 65 degrees Fahrenheit. A meeting was held in the office trailer at the Main Treatment System where Mr. Masten interviewed all participants. Ms. Koehne, Mr. Brenton and Mr. Vanaskey gave an overview and history of the project and site. A tailgate safety meeting was held prior to the site inspection.

The Main Treatment System (MTS) was inspected first. The system consists of three air stripper towers as well as a low-profile air stripper. There are also two ion exchange vessels for treating perchlorate. Contaminated groundwater treated at the Main Treatment System (MTS) is supplied by eight extraction wells which supply contaminated groundwater to the MTS for volatile organic compound (VOC) and perchlorate removal. Groundwater that only requires VOC remediation is pumped to one of three air stripping treatment towers or the low-profile stripper. Groundwater that requires perchlorate treatment first is diverted to the Ion-Exchange resin vessels for remediation. Following treatment, the groundwater is discharged to a series of injection wells or used for on-site irrigation. VOC laden vapors from the air stripping process are conveyed to a series of vapor phase granular activated carbon filters to remove VOCs from the vapor stream prior to discharging to the atmosphere.

The MTS and the PGA North team was notable for its use of the "Kaizen" process, which is a continuous improvement process designed to discover flaws, potential optimization and areas for improvement and to implement positive changes. An easily observable example of this was the color-coded pipelines and well-marked potential safety hazards at the MTS. O&M manuals for all systems, training records and emergency action plans were all available at the MTS.

The team next inspected the newly constructed infiltration gallery, the work on the gallery had recently finished. The Contractor was currently testing the capacity of the system; the initial infiltration rate was reported to be ~120 gpm.

The soil vapor extraction (SVE) system was visited next. It is comprised of nine SVE wells (SVE-01 through SVE-09) and one converted monitoring well (MW-07) serving as an SVE well. The system has seen upgrades; in 2013 as a result of the Kaizen process, a new vertical manifold was constructed. This design focused on ease of operation, and reducing tripping hazards, while also placing all aboveground piping underground, resulting in reduced temperature induced condensation. A new noise-muffler has been installed and has not yet been tested. The system appeared to be in like-new condition. The O&M manual has not yet been updated to reflect the recent updates and optimizations to the system. The SVE system was not running at the time of the site visit.

Near the SVE system was a monitoring well, MW-03. This well was secured with a lock and protected with bollards. Also nearby was extraction well EB-01, a Subunit B extraction well. The well had a newer digital flow meter indicating a flow of approximately 44 gpm.

The team traveled to the 33A Groundwater Treatment System, which consists of four 20,000 pound GAC vessels with an influent particulate filter. This system has a capacity of approx. 1,000 gpm and is distributing treated water to a local golf course, on demand, or feeding the Roosevelt Irrigation District (RID) canal. This system is in a residential neighborhood, and surrounded by a block wall. Pipes have been color-coded, per the Kaizen process, but the pipes visible above the wall have been painted beige for local aesthetic reasons. The GAC tanks were internally recoated in 2014, fixing any weak spots. The system was in good condition.

Next, the EA-08 Groundwater Treatment System was inspected. This system consists of two 10,000 pound GAC vessels fed by one extraction well. The vessels operate in series in lead/lag configuration. As of last year, treated water is discharged to two injection wells, where previously it was let into the RID canal. Due to the Kaizen process and local citizen input, a secure block wall and a trellis for climbing plants has been installed at EA-08. The system was in good condition and operating at approx. 640 gpm at time of visit.

EA-06 Groundwater Treatment System is a short drive up the RID canal from EA-08. EA-06 GTS consists of two 20,000 pound GAC vessels with contaminated groundwater introduced via two extraction wells. Treated water can be fed to a series of up to five injection wells, or be beneficially used as irrigation water for the adjacent City of Goodyear park. Effluent water sent to the injection well network is first routed through a closed loop heat exchanger at a local church for air conditioning. The system was in good condition, operating at approximately 640 gpm. Two particulate bag filters were refurbished in 2014 due to the corrosive water.

The final remediation system inspected was Groundwater Treatment System EA-05. This system consists of two 20,000 pound GAC vessels with contaminated groundwater extracted from Subunit A via a single extraction well for VOC removal. The treated effluent is reinjected into Subunit A through injection well IA-10. The system was secured with a chain link fence with

privacy slats. As this system is located in a more commercial area, the system is secured with an electronic security system with keypad. The system was in good condition and operating at approx. 400 gpm.

The team returned to the Main Treatment System and Mr. Masten departed the site at 1600 hrs.

All components of the remedial action for PGA North and PGA South appear to be in good condition and are currently operating as intended, with the exception of the PGA North SVE system, which is in like-new condition and scheduled to be turned on in the near future. All systems and wells were found to be well secured and free from vandalism. No indication of trespassing was noted.

4. ACTIONS

The USACE will incorporate information obtained from the site visit into the Five Year Review report.

Matthew Masten, P.E.
Environmental Engineer
CESPL-TESB

Site Visit Photos - PGA South

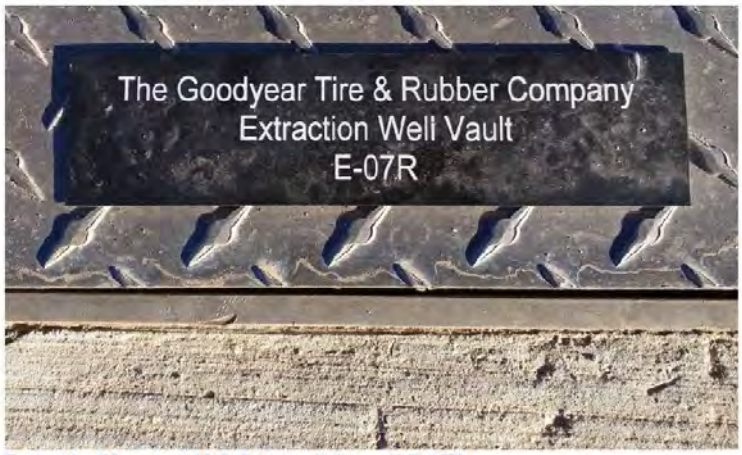

Figure 1- -Close-up of label on vault for well E-07R

Figure 2 - Interior of vault for well E-07R

Figure 3 - Chromium beds, looking northwest, showing fencing

Figure 4 - Chromium beds, looking west, showing signage & vegetation

Site Visit Photos - PGA South

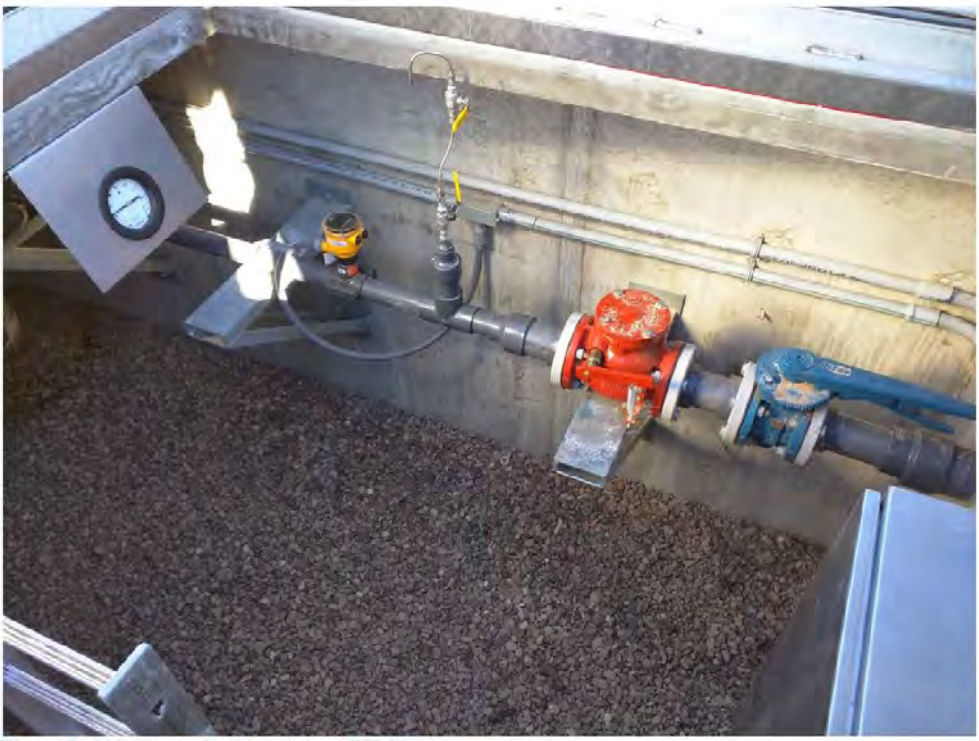

Figure 5 - Interior vault, extraction well E-20

Figure 6 - Monitoring well EO-20 (foreground) and extraction well E-20 vault

Site Visit Photos - PGA South

Figure 7 - Kill-switch at Subunit A air stripping treatment (AST) system

Figure 8 - Air stripper tower

Figure 9 - Dual spill containment at AST

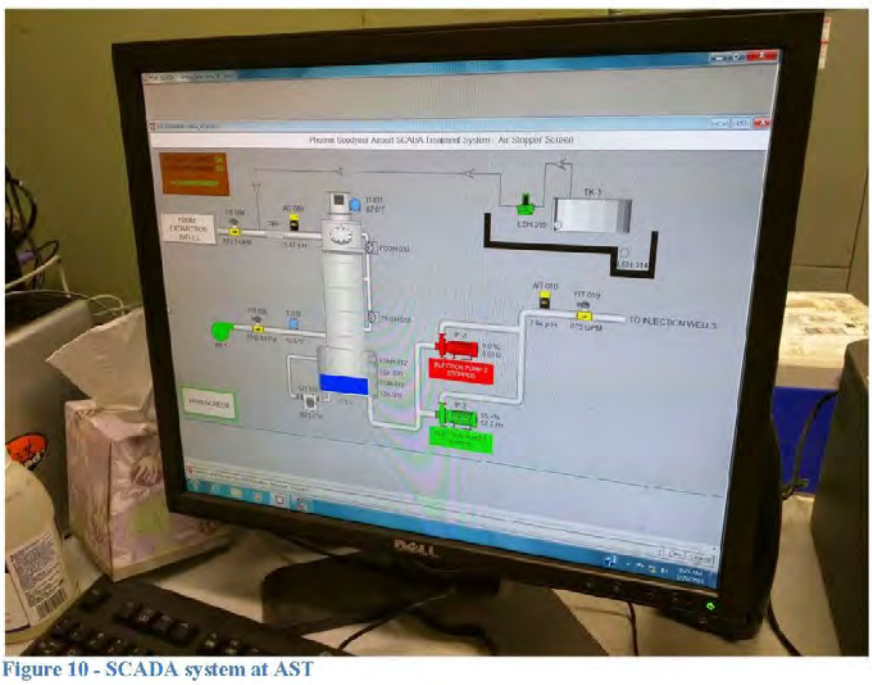

Figure 10 - SCADA system at AST

Site Visit Photos - PGA South

Figure 11 - Southern Subunit C GAC-2 remediation system

Figure 12 - Southern Subunit C GAC vessel showing repairs

Site Visit Photos - PGA South

Figure 13 - Extraction well E-17A (E-17) showing rust

Figure 14 - Exterior of Subunit C Well E-103 facing south

Figure 15 - Subunit C Well E-103 facing southwest

Figure 16 - Signage at PGA North Main Treatment System (MTS), showing pipe color ID

Figure 17 - MTS ion exchange vessels

Figure 18 - MTS air stripper towers

Figure 19 - MTS low-profile air stripper

Figure 20 - MTS effluent valve - locked out

Figure 21 - MTS irrigation field

Site Visit Photos - PGA North

Figure 22 - Infiltration gallery, looking down the line, facing north

Figure 23 - SVE system, new vertical manifold on the left

Figure 24 - Heat exchanger and vacuum gauge on SVE. The red shading on the gauge is for operator to easily and quickly read if operating in correct range (a Kaizen event product)

Figure 25 - Monitoring well MW-2

Site Visit Photos - PGA North

Figure 26 - Extraction well EB-01

Figure 27 - 33A Groundwater treatment system looking northeast, extraction well 33A is visible in blue on left side of photo

Figure 28 - Exterior of EA-08 groundwater treatment system looking northeast, visible is the trellis for climbing plants

Figure 29 - Interior of EA-08 groundwater treatment system

Figure 30 - EA-06 groundwater treatment system (GTS)

Figure 31 - EA-06 GTS refurbished bag filters

Figure 32 - Exterior of EA-05 groundwater treatment facility, security signage, and keypad in bottom left

Figure 33 - EA-05 GTS GAC vessel

Figure 34 - EA-05 bag filter unit

Figure 35 - EA-05 GTS sampling port, locked out /tagged out