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2012 ANNUAL REPORT

SOUTH-SIDE PRIVATE WELL MONITORING PROGRAM
TUCSON INTERNATIONAL AIRPORT AREA SUPERFUND SITE

Prepared for the
United States Environmental Protection Agency,
Arizona Department of Environmental Quality,
and Tucson Airport Authority

Prepared by
Pima County Department of Environmental Quality

August 10, 2012

2012 ANNUAL REPORT SOUTH-SIDE PRIVATE WELL MONITORING PROGRAM
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ACRONYMS

1,1-DCE	1,1-Dichloroethene
1,1,1-TCA	1,1,1-Trichloroethane
AANG	Arizona Air National Guard
ADEQ	Arizona Department of Environmental Quality
AFP44	Air Force Plant 44
ATSDR	United States Agency for Toxic Substances and Disease Registry
EPA	United States Environmental Protection Agency
HCl	Hydrochloric Acid
MCL	Maximum Contaminant Level
MRL	Method Reporting Limit
NPL	National Priorities List
PHD	Pima County Health Department
PDEQ	Pima County Department of Environmental Quality
ppb	Parts per billion
PRP	Potentially Responsible Party
PW	Private Well
PQL	Practical Quantitation Limit
QC	Quality Control
SAP	Sampling & Analysis Plan
TAA	Tucson Airport Authority
TARP	Tucson International Airport Area Groundwater Remediation Project
TCE	Trichloroethene or Trichloroethylene
TIAA	Tucson International Airport Area
µg/L	Micrograms per Liter
VOC	Volatile Organic Compound

EXECUTIVE SUMMARY

In February 2012, Pima County Department of Environmental Quality (PDEQ) sampled four private water wells in the vicinity of Valencia Road and Old Nogales Highway. The water samples were analyzed for trichloroethylene (TCE), chromium, 1,4-dioxane, and other volatile organic compounds (VOCs).

The following four wells were sampled by PDEQ: PW-07; PW-12; PW-13; and PW-20. Two sets of samples were collect at each well site, one at the well head and a second one from a faucet or outdoor water spigot. Additional samples were collected during the sampling process to verify quality control measures were effective.

Recent Observations

Drinking water quality standards were met for both TCE and chromium in all wells. Wells PW-07, PW-12, PW-13, and PW-20 had detectable concentrations of TCE. The highest concentration of TCE was 2.2 micrograms per liter (µg/L). Water samples from all the wells had TCE concentrations below the maximum contaminant level (MCL) of 5 µg/L. Water samples from all four wells had detectable concentrations of chromium. The highest concentration was 5.9 µg/L, which is well below the MCL of 100µg/L.

Wells PW-13, and PW-20 had detectable concentrations of 1,4-dioxane. The highest concentration was 1.7 µg/L, which is above EPA's Regional Screening Level of 0.35 µg/L. Wells PW-07 and PW-12 did not have detectable concentrations at the Method Reporting Level of 1.0 µg/L.

Long-term Trends

A comparison of the current and historical data indicates there have been no significant adverse water quality changes. In fact, contaminant concentrations appear to have either decreased or remained approximately the same in comparison with data from previous years. Regional efforts to remediate the groundwater contamination have been effective.

2012 ANNUAL REPORT
Southside Private Well Monitoring Program
Tucson International Airport Area Superfund Site

1.0 INTRODUCTION

In late February 2012, Pima County Department of Environmental Quality (PDEQ) sampled four private water wells (see Figure 1). These private water well samples were analyzed for the presence of trichloroethene (TCE), chromium, 1,4-dioxane, and other hazardous substances.

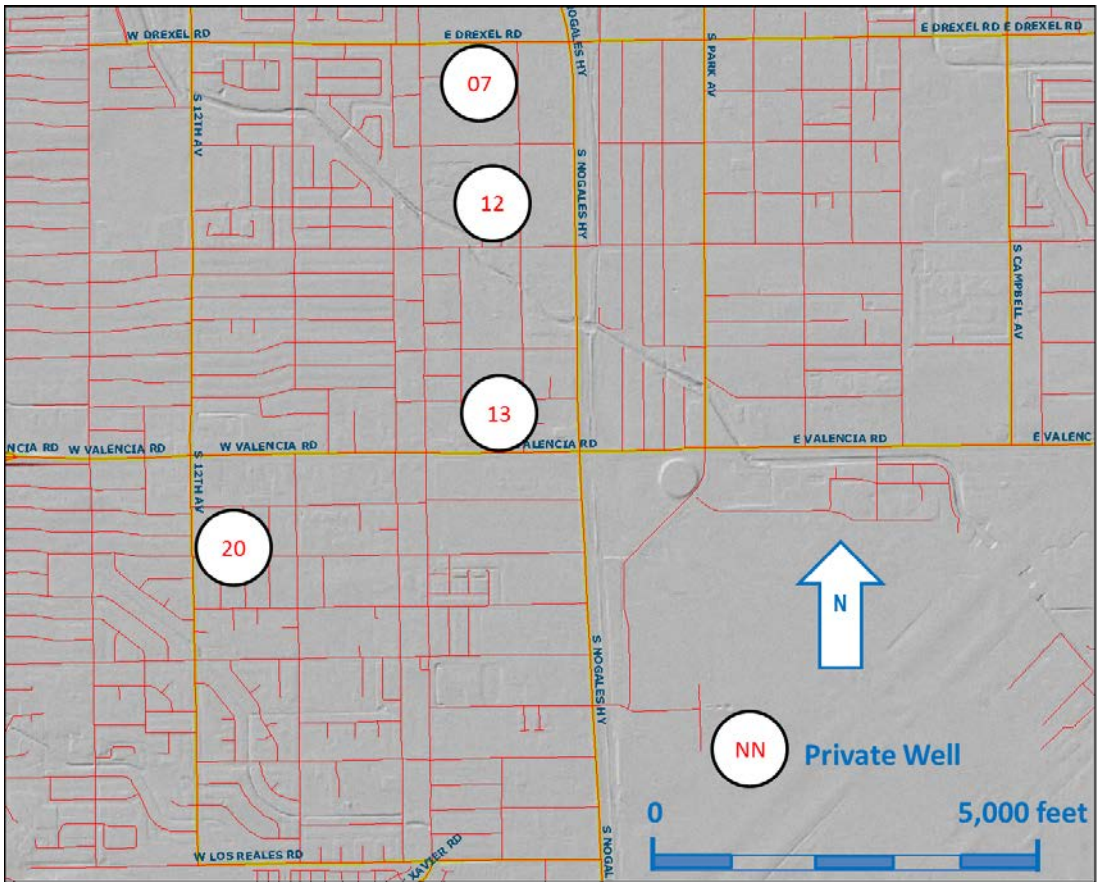

Figure 1. Southside Private Well Monitoring Map

The South-Side Private Well Monitoring Program was conducted under protocol accepted by the United States Environmental Protection Agency (EPA), as specified in the guidance document entitled *Preparation of a U.S. EPA Region 9 Field Sampling Plan for Private and State-Lead Superfund Projects* (EPA, 1993).

Sampling results were used to determine whether or not private wells were producing water containing volatile organic compounds (VOCs), solvent stabilizers, or chromium. Results will be used to support decision-making efforts implemented by EPA and the Arizona Department of Environmental Quality (ADEQ).

2.0 PURPOSE

The South-Side Private Well Monitoring Program was originally designed to gather data in support of the ongoing ground-water investigations associated with the Tucson International Airport Area (TIAA) Superfund Site. The monitoring program was also designed to address recommendations identified in the 1996 and 2000 health assessments produced by the United States Agency for Toxic Substances and Disease Registry (ATSDR).

In late 2001, EPA and ADEQ identified fourteen private water wells to be included in the ongoing South-Site Private Well Monitoring Program. Eleven of the wells are located in the area under remediation as part of the Tucson International Airport Area Groundwater Remediation Project (TARP). The other three wells are located in the vicinity of a contaminated ground-water plume designated as West Plume B.

Two of the original fourteen wells were taken out of service in the fall of 2003 (PW-15 and PW-16). These two wells were shut down by the owners in response to water quality results that indicated the presence of contaminants at levels above acceptable standards. Two other wells have not been in operation since at least 2002 (PW-23 and PW-38). Three other wells have experienced mechanical problems over the past several years and are currently out of operation (PW-17, PW-18, and PW-21). Some well owners did not respond to the request for permission to collect samples (PW-03, PW-14).

Figures 2a and 2b on the following pages show the estimated extents of ground-water contamination for trichloroethene and 1,4-dioxane, as of January 2011 and February 2008, respectively. Contaminant concentrations are shown in parentheses next to corresponding well identifications. The following private wells were sampled as part of the 2012 monitoring effort: PW-07, PW-12, PW-13 and PW-20.

The monitoring program assesses the quality of water from private water wells currently being used for domestic purposes, within the vicinity of the TIAA Superfund Site. Analytical results are reported within the context of maximum contaminant levels (MCLs) for trichloroethene (TCE), other volatile organic compounds (VOCs), and chromium. For 1,4-dioxane, the results are reported and compared to EPA's Field Screening Level.

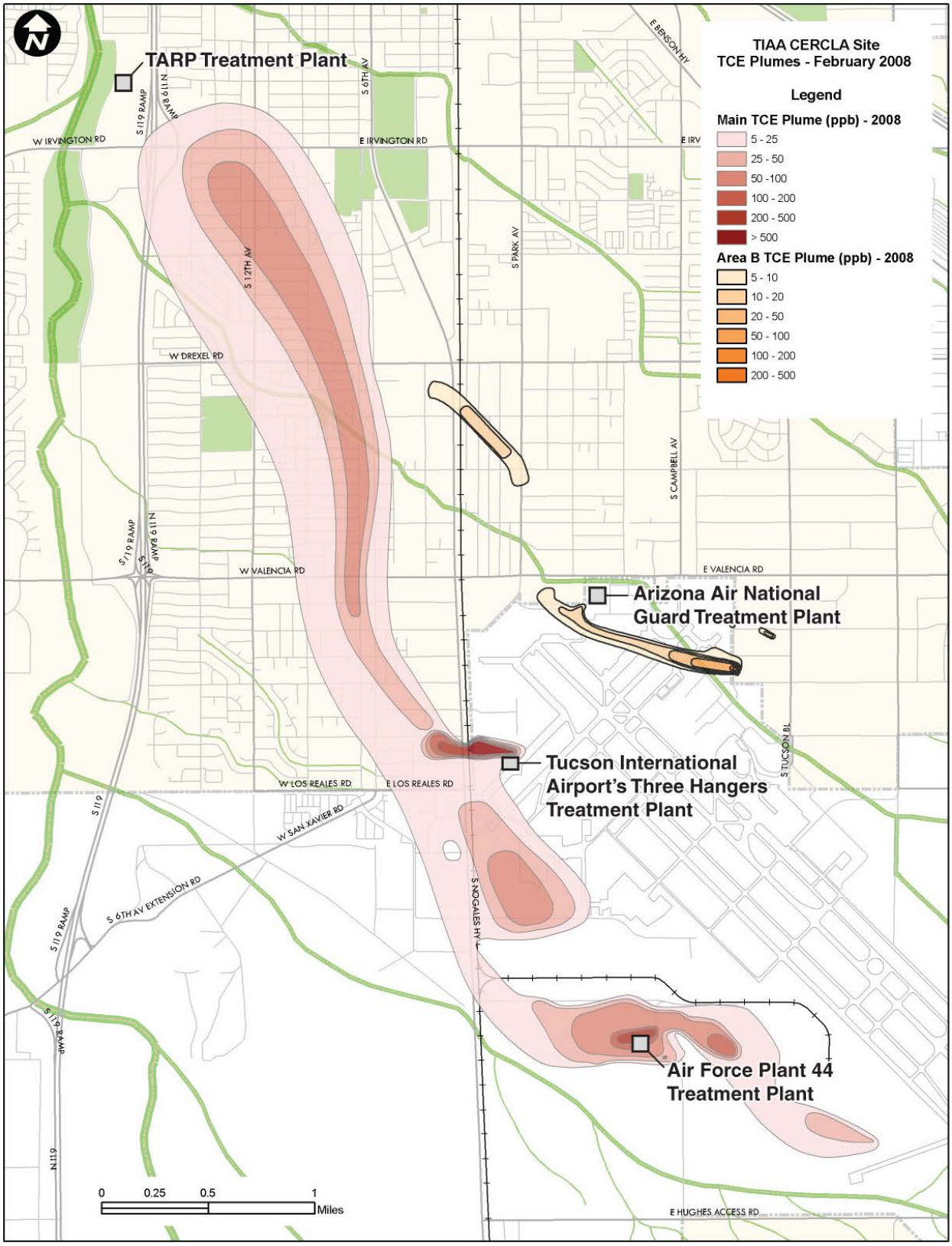

Figure 2a. Trichloroethene Groundwater Contamination Map (EPA, 2010)

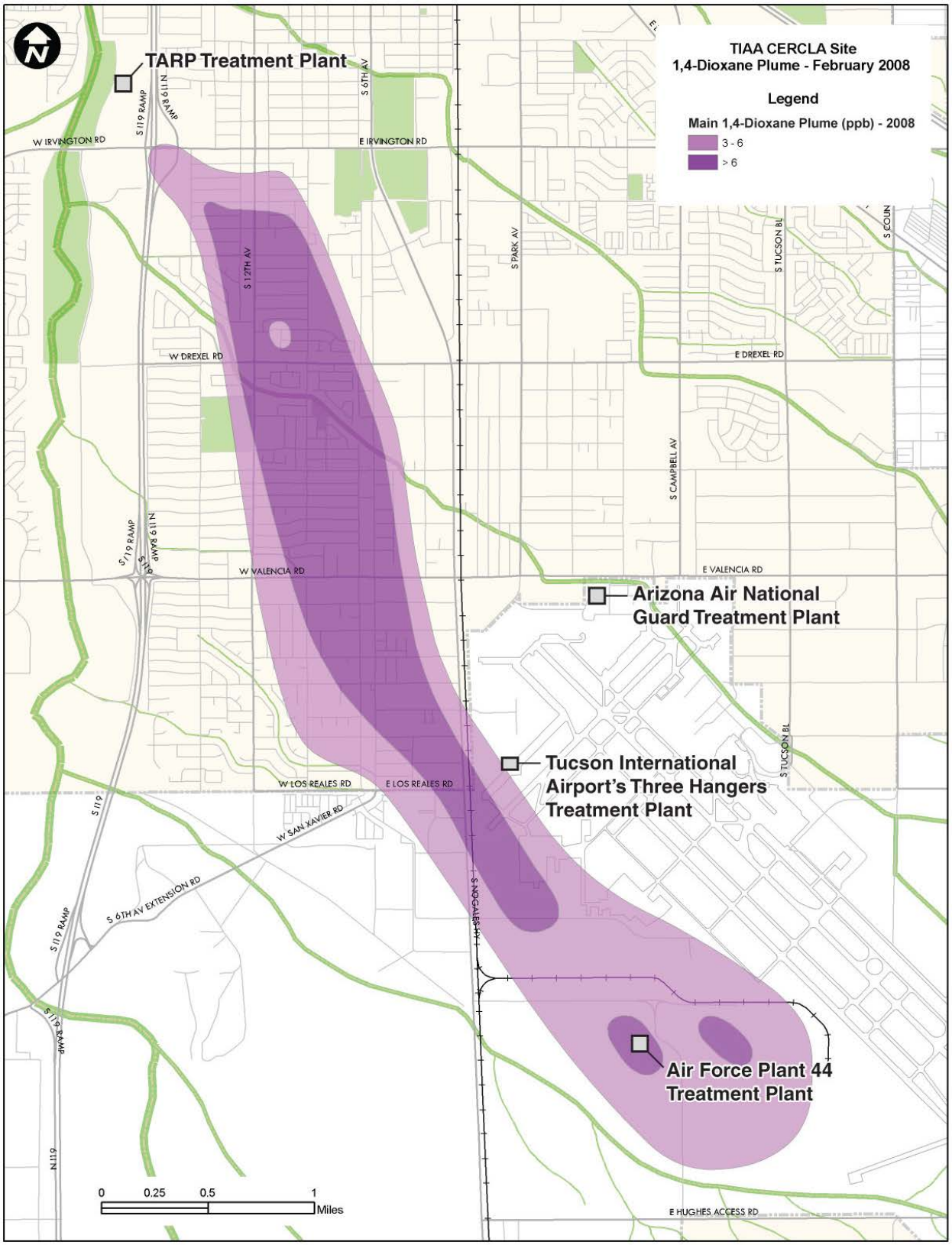

Figure 2b. 1,4-Dioxane Groundwater Contamination Map (EPA, 2010)

3.0 BACKGROUND

3.1 Location

TIAA Superfund Site (EPA ID No. AZD980737530) is located on the southwest side of the city of Tucson, Pima County, Arizona. TIAA Superfund Site is a northwest-southeast trending oval-shape bounded by Interstate-19 on the west, Ajo Way on the north, Alvernon Way on the east, and Hughes Access Road on the south (Figure 2). TIAA Superfund Site covers approximately ten square miles and includes the Tucson International Airport, northeastern portions of the San Xavier District of the Tohono O'Odham Nation, residential areas of the cities of Tucson and South Tucson, and the Air Force Plant #44 Raytheon Missile Systems Company (AFP44).

3.2 Site Description

The TIAA Superfund Site study area is primarily an urban residential area with some commercial parcels interspersed. The site is bordered on the north, west, and east by other similar residential and commercial areas and bordered on the south by predominantly undeveloped desert land. Most of the structures in the study area are private homes, with several apartment buildings and a few small commercial buildings.

Initial indications of ground-water contamination on the south side of Tucson date back to the 1950's when chromium was detected in a City of Tucson well, and some private well water near the airport was reported to have a foul odor. In 1981, volatile organic compounds (VOCs), which are used as solvents by electronic and aerospace industries, were found in City of Tucson drinking water wells. Subsequently, it was determined that there are a number of contaminant plumes within the regional aquifer. The primary organic contaminants of concern are trichloroethene (TCE) and 1,4-dioxane. The primary inorganic contaminant is chromium.

TIAA Superfund Site was placed on the National Priorities List (NPL) in 1983 and consists of a main plume of contaminated ground water and three smaller areas of ground-water contamination east of the main plume (see Figure 2). The focus of the private well monitoring program is a group of wells located directly east, adjacent to, and within the Tucson International Airport Area Groundwater Remediation Project (TARP) area.

In 1988, ATSDR issued a public health assessment for the TIAA Superfund Site. This assessment evaluated exposures to the contaminated water supply and was the result of a petition request received in July 1987 from 11 individuals who lived in southwest Tucson. In November 1991, the Pima County Health Department (PHD), on behalf of citizens' groups from the affected communities, requested that ATSDR perform a more detailed public health evaluation of the TIAA Superfund Site.

In 1994, EPA funded PDEQ to investigate selected private wells in the south side Tucson area near Tucson International Airport. This investigation was prompted by ATSDR's request to have private well-water quality data for an amended public health assessment. The 1994 investigation focused on the identification and sampling of wells within the study area as established by ASTDR. The wells targeted included those used for human consumption or irrigation purposes.

In its September 1996 public health assessment addendum entitled *Petitioned Public Health Assessment Addendum, Tucson International Airport Area, Tucson, Pima County, Arizona* (ATSDR, 1996), ATSDR made the following recommendations to eliminate future exposure of persons to contaminants in the ground water:

- Implement a routine tap-water sampling plan for the wells with treatment systems to ensure the treatment systems are removing VOCs.

- Implement a sampling plan for all private wells that remain in use for domestic or agricultural purposes, within the potentially impacted area.

- Implement a plan to ensure selected wells, which were identified in the 1994 private well survey as having water quality that exceeded the maximum contaminant level (MCL) for trichloroethene, are not used for drinking water purposes. [NOTE: Two wells were not in use; another two wells were being used for irrigation purposes].

- Survey results suggested that few southwest Tucson residences have private wells serving as drinking water sources. In addition, because community members are well aware of the groundwater contamination present at TIAA Superfund Site, the resident are unlikely to drill new private wells; however, because approximately 25% of the well owners did not respond to the survey and a contaminated private well was in use as a drinking water source as late as 1992, PDEQ was recommended to continue to locate private wells and test all wells identified.

- One well, located as a result of the private well survey, was operational but not sampled because it required repairs. The status of this well should be determined and if in use, included in the routine sampling program.

In its July 2000 public health assessment entitled *Groundwater Contamination in West Plume B, North of Valencia Road, Tucson International Airport Area, Tucson, Pima County, Arizona* (ATSDR, 2000), ATSDR addressed potential current and future exposures to contaminated ground water from private wells in the area of West Plume B. The assessment concluded that the ground water currently posed no public health hazard, but that a future potential public health hazard might exist.

In 2002, EPA and ADEQ became concerned about the possible presence of 1,4-dioxane in ground water at the TIAA Superfund Site. This chemical is used as a solvent stabilizer in 1,1,1-trichloroethane (1,1,1-TCA) and is suspected to have been used by several facilities located at the TIAA Superfund Site.

These suspicions were confirmed by reported detections of 1,1,1-TCA within ground water under the AFP44 facility and at other TIAA Superfund Site locations. Consequently, managers suspected 1,4-dioxane might also be present in the subsurface environment. At the time, EPA listed 1,4-dioxane as a Class II-B[1] carcinogen (probable human carcinogen). Therefore, EPA and ADEQ concluded testing for this compound would be appropriate. As directed by EPA and ADEQ, PDEQ added 1,4-dioxane to the list of analytes for the private well monitoring program.

[1] Based on animal studies, the chemical is considered carcinogenic; human evidence is inconclusive.

3.3 Site Contamination History

Contamination of groundwater in the vicinity of the TIAA Superfund Site is attributed to past industrial activities at five facilities: (1) the Tucson Airport Authority (TAA) encompassing the airport and associated operations; (2) the Texas Instruments Tucson property (formerly Burr-Brown Corporation and located to the north of the airport property); (3) the Arizona Air National Guard Base (AANG) located to the north of the airport property; (4) Air Force Plant 44 (AFP44) located south of the airport property; and (5) the former West Cap facility.

3.4 Previous Groundwater Investigations

Since 1981, there have been numerous sampling events involving private wells in the vicinity of the TIAA Superfund Site. Previous ground-water quality assessments completed by EPA have concluded that TCE and chromium are the two primary contaminants commonly found in the contaminated portions of the regional aquifer. Within these contaminated portions of the aquifer, concentrations of both TCE and chromium exceed the MCLs for safe drinking water. Between 1981 and 1984, local and state agencies attempted to identify all private wells [defined as wells not operated by a municipal system or regulated public water system] in this area that could have potentially been affected by the contaminant plume(s). Data collected in the early 1980's detected TCE in 32 of 57 private wells sampled.

In 1992, a resident requested PDEQ test their private well water. Test results indicated the water contained 130 micrograms per liter (µg/L) of TCE, a level 26 times higher than the current MCL of 5µg/L. This well, located within the defined contaminant plume, was providing potable water for the residence at the time the contamination was detected. To prevent further exposure, the resident was hooked-up to the Tucson Water distribution system. Further investigation into the contamination of private wells was initiated as a result of this well sampling.

In cooperation with PHD, EPA published a newsletter about the TCE contamination. The newsletter requested that anyone living within the Superfund site area, and using a private well, contact Pima County DEQ or EPA to schedule sampling and analysis of their private well.

In 1994, when the ATSDR study area was officially established, PDEQ conducted an EPA-funded private well investigation. This investigation included a survey of 768 parcels. PDEQ was able to verify through historical records and field investigations that 24 of these parcels contained private wells used for domestic purposes. Twenty-two of the 24 well owners granted PDEQ access to perform water quality testing.

For the 1994 private well sampling project, personnel from Armstrong Lab, Brooks Air Force Base, San Antonio, Texas were designated as the primary sampling team while PDEQ carried out an EPA-approved split sampling plan and provided general supervision of the project. The Brooks Air Force Base sampling team submitted their samples to BC Laboratories of Bakersfield, California and PDEQ personnel submitted their split samples to both Turner Laboratories, Inc. of Tucson, Arizona and Analytical Technologies, Inc. of San Diego, California. All laboratories used EPA Method 524.2 for VOCs and EPA Method 218.2 for total chromium and EPA Method 7196 for hexavalent chromium[2].

[2] Hexavalent (VI) chromium was only sampled for and analyzed when the total chromium concentration of a sample

In 1998, PDEQ, with additional funding from EPA and ADEQ, started a three-year project sampling specific private wells on an annual basis. PDEQ was contracted to perform this work in order to provide private well owners with ongoing information about the water quality of their wells. Results of the three-year study and the 1994 data are tabulated (Table 1).

Table 1. Comparison of Analytical Results: 1994. 1998, 1999 and 2000 (PDEQ, 2001)

		trichloroethene[1] (µg/L)					chromium, total[2] (µg/L)			
Well #	**Well Use**	**1994**	**1998**	**1999**	**2000**		**1994**	**1998**	**1999**	**2000**
PW-01	Irrigation	1.4	6	0.9 J	0.9 J		13	48.9	20	190
PW-02	Irrigation	13	16	18	24		1.2J	ND	ND	ND
PW-03	Drinking water	ND	ND	ND	ND		1J	2.2J	ND	ND
PW-04	Not Operational	36	NS	NS	NS		71.5	NS	NS	NS
PW-05	Not Operational	120	NS	NS	NS		160	NS	NS	NS
PW-06	Drinking water	ND	ND	0.8 J	NS		12	10.7	23	NS
PW-07	Drinking water	2.9	4	4	4		ND	2.2J	ND	ND
PW-08	Not Operational	ND	NS	NS	NS		4	NS	NS	NS
PW-09	Drinking water	ND	ND	ND	ND		ND	3J	ND	ND
PW-10	Drinking water	ND	ND	ND	ND		1.2J	2.8J	ND	7J
PW-11	Irrigation	ND	NS	NS	ND		2.8J	NS	NS	ND
PW-12	Drinking water	ND	ND	0.6 J	0.8 J		5.4J	6.3J	7 J	6J
PW-13	Drinking water	3.6	3	3	2		5J	4.8J	ND	7J
PW-14	Irrigation	49	50	38	39		9J	9.9J	13	10
PW-15	Drinking water	1.7	3	2	2		4.6J	6.3J	7J	6J
PW-16	Drinking water	ND	ND	0.8 J	0.8 J		6.4J	10.2	ND	10
PW-17	Drinking water	ND	ND	0.5 J	ND		1.2J	ND	ND	ND
PW-18	Drinking water	ND	ND	NS	NS		3.5J	5.6J	NS	NS
PW-19	Drinking water	ND	ND	ND	ND		2.8J	3.4J	ND	ND
PW-20	Drinking water	ND	ND	ND	0.7J		11.5	9.4J	28	10
PW-21	Domestic	ND	ND	ND	ND		ND	5.8J	6J	ND
PW-22	Irrigation	ND	ND	ND	ND		1J	3.1J	ND	ND
PW-23	Irrigation	NS	7	NS	NS		NS	4.8	NS	NS
PW-24	Irrigation	NS	ND	ND	ND		NS	ND	ND	ND
PW-25	Drinking water	NS	ND	ND	ND		NS	ND	6J	ND
PW-26	Irrigation	NS	ND	ND	ND		NS	17.5	13	10
PW-27	Irrigation	NS	ND	ND	ND		NS	ND	ND	ND
PW-28	Drinking water	NS	ND	ND	ND		NS	ND	ND	ND
PW-29	Drinking water	NS	ND	ND	ND		NS	ND	ND	ND
PW-34	Irrigation	NS	NS	ND	ND		NS	NS	ND	12
PW-35	Irrigation	NS	NS	NS	ND		NS	NS	NS	ND
PW-37	Irrigation	NS	NS	NS	ND		NS	NS	NS	ND

µg/L = microgram per liter
[1] maximum contaminant level ("MCL") for TCE = 5µg/L
[2] maximum contaminant level ("MCL") for chromium = 100µg/L
ND = compound was analyzed for, but not detected
NS = not sampled
J = amount of the compound detected is less than the quantitation limit and is only an estimated value

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was found to have exceeded the MCL of 100µg/L.

3.5 Summary of Annual Well Monitoring Program

2000: EPA asked the Tucson Airport Authority (TAA) to implement annual water-quality monitoring for eleven private wells in the area of contaminated ground water under remediation as part of TARP. The principal ground-water contaminants of concern, identified by EPA, were TCE and chromium. In 2002, 1,4-dioxane was identified as another contaminant of concern.

2001: In August, PDEQ implemented the private well monitoring program portion of TARP.

2002: In September, PDEQ entered into a contract with TAA to implement the well monitoring program for the following eleven wells: PW-07; PW-11 through PW-17; PW-20; PW-21; and PW-23.

2003: In January, PDEQ amended an existing contract with the Arizona Department of Environmental Quality (ADEQ) to implement a well monitoring program for the following three wells: PW-03, PW-18 and PW-38.

2003: In February, PDEQ sampled the following eleven wells: PW-03, PW-07, PW-11, PW-12, PW-13, PW-14, PW-15, PW-16, PW-17, PW-20 and PW-21. PDEQ did not sample three wells (PW-18, PW-23 and PW-38) due to difficulties with access or well operation. In response to high levels of TCE detected in the February samples for wells PW-07 and PW-15, these two wells were re-sampled in April.

2004: The following nine wells were sampled in early February: PW-03; PW-07; PW-11; PW-12; PW-13; PW-14; PW-17; PW-20; and PW-21. As in 2003, PDEQ was not granted access to sample either well PW-18 or well PW-23. The three remaining wells (PW-15, PW-16, and PW-38)[3] were not operational and could not be sampled.

2005: The following eight wells were sampled in early February: PW-03; PW-07; PW-11; PW-12; PW-13; PW-14; PW-17; and PW-20. Although PDEQ was granted access to a ninth well, well PW-21, this well was not operational for the 2005 sampling season. As in the years 2003 through 2005, PDEQ was not granted access to either well PW-18 or well PW-23. Finally, as in previous years, the remaining three of the original fourteen wells (PW-15, PW-16, and PW-38) were not operational.

2006: The following eight wells were sampled in early February: PW-03; PW-07; PW-11; PW-12; PW-13; PW-14; PW-17; and PW-20. Due to mechanical problems with the pump, PDEQ was unable to sample well PW-21. PDEQ was not granted access to well PW-18 and PW-23. Wells PW-15 and PW-16 have been out of service since 2003.

[3] Analytical results from the 2003 monitoring season showed well PW-15 to be in exceedance of the maximum contaminant level for TCE and PW-16 to be in exceedance of the risk-based health advisory for 1,4-dioxane. These wells were taken out of service prior to the 2004 sampling season.

2007: The following six wells were sampled in late February: PW-03; PW-11; PW-12; PW-13; PW-14; and PW-20. Wells PW-07 and PW-17, which in previous years had been sampled, were damaged prior to February 2007 and were not operational. Well PW-21 has not been in operation for several years and was not sampled. As in the past five years, PDEQ was not granted access to either well PW-18 or well PW-23. Wells PW-15, PW-16, and PW-38 have been out of service since at least 2003.

2008: The following six wells were sampled in early March: PW-03; PW-11; PW-12; PW-13; PW-14; and PW-20. Wells PW-17 and PW-21 remained inoperable. Although well PW-07 was operational, it was not sampled because of scheduling conflicts with the well owner. The new owner of well PW-18 initially indicated a desire to have the well tested. However, the well was found to be inoperable and repair costs were determined to be prohibitive. The other four wells (PW-15, PW-16, PW-23, and PW-38) remain out of service since at least 2003.

2009: The following seven wells were sampled in February: PW-03; PW-07; PW-11; PW-12; PW-13; PW-14; and PW-20. Wells PW-17, PW-18, and PW-21 were out of operation. The other four wells (PW-15, PW-16, PW-23, and PW-38) remain out of service since at least 2003.

2010: The following six wells were sampled in February: PW-03; PW-07; PW-12; PW-13; PW-14; and PW-20. PDEQ was not granted access to well PW-11. Wells PW-17, PW-18, and PW-21 were not operational. The other four wells (PW-15, PW-16, PW-23, and PW-38) remain out of service since at least 2003.

2011: The following six wells were sampled in February: PW-03, PW-07, PW-12, PW-13, PW-14 and PW-20. PDEQ was not granted access to well PW-11. Wells PW-17, PW-18, and PW-21 were not operational. The other four wells (PW-15, PW-16, PW-23, and PW-38) remain out of service since at least 2003.

2012: The following four wells were sampled on February 29, 2012: PW-07, PW-12, PW-13 and PW-20. PDEQ was not granted access to wells PW-03, PW-11, or PW-14. Wells PW-17, PW-18, and PW-21 were not operational. The other four wells (PW-15, PW-16, PW-23, and PW-38) remain out of service since at least 2003. The results of this sampling event have been tabulated (Table 5).

4.0 OVERVIEW OF MONITORING PROGRAM

4.1 Contaminants of Concern

TCE, chromium, and 1,4-dioxane have been detected in private wells within the TIAA Superfund Site study area for years. TCE concentrations in private wells have been detected as high as 130 µg/L, chromium concentrations as high as 160 µg/L, and 1,4-dioxane concentrations as high as 10 µg/L. Additionally, detectable levels of 1,1,1-trichloroethane (1,1,1-TCA), 1,1-dichloroethene (1,1-DCE), and 1,2-dichloroethane (1,2-DCA) have been observed in ground-water samples collected within the boundaries of the TIAA Superfund Site.

4.2 Private Wells to be Sampled

In early 2002, fourteen wells were selected for inclusion in the monitoring program (Table 2). The location of each of the fourteen private water wells is shown in Figure 3.

Table 2. Well Construction Information

Well #	Well Use	Well Depth (feet)	Screened Interval (feet)	Land Surface Elevation (feet)	Ground-Water Elevation[a] (feet)	Depth to Ground Water[a] (feet)
PW-03	Drinking Water	unknown	unknown	2,539	2,440	99
PW-07	Irrigation[b]	150	unknown	2,510	2,427	83
PW-11	Irrigation	223	unknown	2,539	2,435	105
PW-12	Drinking Water	212	unknown	2,515	2,412	104
PW-13	Drinking Water	unknown	unknown	2,525	2,424	101
PW-14	Irrigation	unknown	unknown	unknown	unknown	Unknown
PW-15	Not Operational	240	unknown	2,510	2,409	101
PW-16	Not Operational	120	unknown	2,515	unknown	Unknown
PW-17	Not Operational[c]	99	unknown	2,517	2,431	86
PW-18	Domestic	265	unknown	2,523	2,418	105
PW-20	Domestic[b]	140	unknown	2,513	2,425	88
PW-21	Not Operational[d]	212	unknown	2,521	2,435	86
PW-23	Irrigation	170	unknown	unknown	unknown	unknown
PW-38	Not Operational	unknown	unknown	2,535	unknown	92

[a] August 1993 well inventory data compiled by Pima County DEQ
[b] pre-2004 the well was used as a drinking water source; subsequently, the well has been used for irrigation only
[c] prior to the 2007 sampling season, this well was used for drinking water purposes
[d] prior to the 2005 sampling season, this well was used for irrigation purposes

Depths of the screened intervals for the wells are not known. Based on total well depth information, however, all wells appear to have been completed within the regional aquifer system. The lithologic characteristics of the regional aquifer system vary both horizontally and vertically. The regional aquifer is hydraulically continuous (U.S. Geological Survey, 1997).

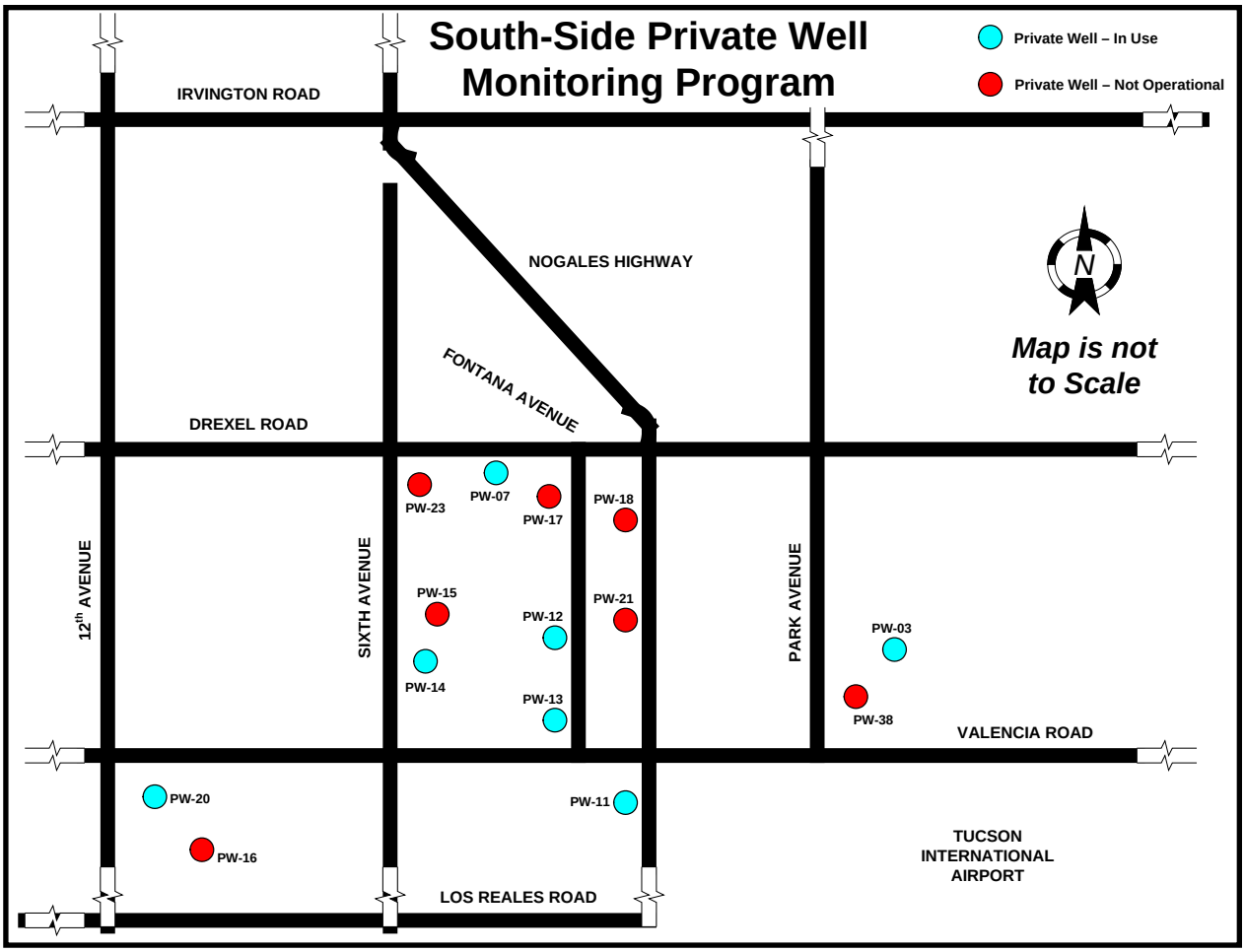

Figure 3. Private Wells Identified for Sampling in 2002 (PDEQ, 2010)

The primary purpose of the Southside Private Well Monitoring Program is to determine whether or not the water from privately-owned wells contains concentrations of TCE, 1,4-dioxane, or chromium in exceedance of acceptable levels. As a result, it is not crucial that the exact depth of each screened interval be known. For a more detailed discussion of TIAA Superfund Site hydrogeology, please refer to the report entitled *Remedial Investigation Report, Phase II, Former West-Cap Property and Vicinity, Area B Tucson International Airport Area CERCLA Site* (ADEQ, 1998).

The fourteen wells were originally selected based on their proximity to either the main TARP plume (PW-7, PW-11 through PW-17, PW-20, PW-21, and PW-23) or West Plume B (PW-03, PW-18, PW-38), and because the wells were potentially being used for drinking, bathing, cooking, evaporative cooling, or for other purposes such as irrigation.

PDEQ has historically mailed a semi-annual notification to well owners with active wells. The notification states a final report has been prepared for the current year and PDEQ plans to sample their well in the following February. While this notification did not take place this year, the semi-annual notification will be re-instated next year.

In January 2012, PDEQ mailed a letter to each of the eleven private well owners (Appendix A). These letters requested information about the wells and permission to collect water samples in February 2012. Enclosed with the letter was an *Authorization to Sample* form (Appendix B).

PDEQ received permission from owners of the following four wells: PW-07, PW-12, PW-13 and PW-20. The owners of wells PW-03, PW-11, PW-14 and PW-23 did not respond to the mailing. Phone calls were placed to these well owners. The phones for owners of PW-03 and PW-14 had been disconnected. An out-of-state address was found for the previous owner of PW-14; however, no response was received. PDEQ was unable to make a phone contact with the well owners of PW-11 and PW-23 due to non-response to messages left or the phone not having voice mail. Well sites PW-17, PW-18 and PW-21 are non-operational and the owners did not respond to the mailing.

PDEQ used the sampling & analysis plan entitled *"PDEQ**1** Sampling & Analysis Plan, South-Side Private Well Monitoring Program, Tucson International Airport Area Superfund Site"* (PDEQ1 SAP) (PDEQ, 2004b).

4.3 Sampling Routine

4.3.1 Sample Sets

A sample set consisted of one water sample for each of the following parameters: volatile organic compounds (VOCs); 1,4-dioxane; and chromium. Two sets of samples were collected at each property. Unless otherwise noted, these sets consisted of either indoor/outdoor tap and well head, or outdoor tap/well head and well head.

In addition to the above-mentioned samples, the following sets were collected each day of sampling: field blank; duplicate; and laboratory quality control (QC). Each of these sample sets was analyzed for VOCs, chromium, and 1,4-dioxane.

4.3.2 Owner Authorization

PDEQ obtains verbal and/or written authorizations from well owners prior to sample collection. See Appendix D for the authorization form that is used to obtain written permission.

4.3.3 Sample Preservation

4.3.3.1 Volatile Organic Compounds

For samples collected from chlorinated potable water systems, EPA standard method (SM) 6010B recommends that a reducing agent be added to eliminate any residual chlorine. Adding a reducing agent to a chlorinated sample prevents the formation of halogenated hydrocarbons.

Sample containers (40 milliliter vials) were pre-treated with ascorbic acid, which is a reducing agent. The ascorbic acid did not adversely affect samples collected from non-chlorinated water systems, nor did it interfere with laboratory analyses.

Although both hydrochloric acid (HCl) and ascorbic acid were needed to preserve the samples, adverse reactions could have occurred if the vials were pre-treated with both the acid and the reducing agent. Therefore, ascorbic acid was added to sample containers at the laboratory and the HCl was added to partially filled vials in the field.

4.3.3.2 1,4-Dioxane

For 1,4-dioxane analyses, sample containers (250 milliliter amber bottles) required no preservation or pre-treatment.

4.3.3.3 Inorganics

For chromium analyses, 250-ml plastic bottles were pre-rinsed with nitric acid. The nitric acid reduces the pH of the chromium samples (i.e., preserve the samples) to less than 2.

4.3.4 Field Parameters

The field parameters pH, temperature, and electrical conductivity were collected at 5-minute intervals during a 10-minute purging period[1]. For all other wells, the second sample set was collected following the 10-minute purging period.

Pertinent sampling information for each sample set was recorded on a *Private Water Well Sampling Record* (Appendix C). Field measurements and other associated information are documented in the field log book (Appendix D).

4.4 Participating Agencies, Laboratories, and Contractors

The Tucson Airport Authority (TAA) and ADEQ both provided funding directly to PDEQ. All samples were analyzed by Columbia Analytical Services. The laboratory submitted a Level I data package to PDEQ (Appendix E).

4.5 Analytes and Test Methods

Water samples were tested for TCE, 1,4-dioxane, and total chromium with specific detection limits (Table 3). Local laboratories were contacted to assess their detection limits for 1,4-dioxane and none were discovered that would be equal to or lower than EPA's Regional Screening Level.

Table 3. Analytes and Test Methods

Method	Contaminant	Detection Limit (µg/L)	MCL (µg/L)	Regional Screening Level (µg/L)
EPA 524.2	TCE	0.5	5	----
EPA 200.8	Chromium, total	0.2	100	----
EPA 8270C	1,4-dioxane	1	----	0.35

MCL = maximum contaminant level

Regional Screening Level = drinking water concentration that would increase cancer risk by one in one million over a lifetime of water consumption [excess cancer risk of $1x10^{-6}$]

µg/L = micrograms per liter or parts per billion = ppb

4.6 Quality Assurance / Quality Control Samples

Trip blanks were used to assess the potential for cross contamination of VOC samples[2] during transport. Trip and temperature blanks were carried in the coolers.

Duplicate samples were collected using the same protocols that were used for other sample sets. Field blanks were collected to assess the potential for contamination during sample collection.

[1] The pump for well PW-13 is set to run when there is a water demand from users. At the time of sample collection, there was low water demand. As a result, the well was unable to provide a continuous flow of water for the 10 minutes necessary to purge the system. Field measurements could not be collected.

[2] Trip blanks for 1,4-dioxane were not necessary because of the analytical method used for this chemical.

In addition to the duplicate samples, one set of laboratory QC samples were collected each day. A laboratory QC sample is a subset of a given field sample. Two sets of water sample containers were filled and all containers were labeled with the same sample number. The double volume of sampled water was of sufficient quantity for both routine sample analysis and laboratory QC analysis. In order to alert the laboratory as to which samples were to be used for QC analyses, QC sample containers were labeled with an "L" (i.e., 11-PW12-02***L***).

4.7 Sample Collection

Both sample sets at well PW-07 were collected at the well head. For well PW-12, which is used for drinking water purposes, one sample was collected at a kitchen tap and a second sample was collected at the well head. Access a kitchen tap was not available for well PW-13; consequently, the first sample for well PW-13 was collected at an outdoor spigot; and the second sample was collected at the well head. For well PW-20, which is used for domestic purposes, the first sample was collected at a restroom sink and the second sample was collected at the well head.

The first sample set at each location was collected without purging the water system. The term "location" refers to either an indoor or outdoor tap (i.e. kitchen tap, outside tap, or well head). The second sample set was collected after purging the system for approximately 10 minutes. For sites where both sample sets were collected at the well head – the first well head sample was collected without purging the system. Pima County DEQ delivered the samples directly to the Columbia Analytical Services sample receiving facility in Tucson, Arizona. Chain-of-custody forms were included with sample coolers.

4.8 Re-Sample Collection

PDEQ compared the 2012 sampling results to historical records for each of the wells. The purpose of this comparison was to determine if any unexpected contaminant concentrations had been discovered. A comparison of new and existing data indicated that there were no significant adverse water quality changes from the previous year. Therefore, it was not necessary for any of the wells to be re-sampled.

4.9 Data Validation

All laboratory data were validated in accordance with the following EPA-guidance: *USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review* (EPA, 1999); and *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (EPA, 2004). Specifically, all sample sets underwent data validation according to Level IV data validation requirements. Malcolm Pirnie, Inc. provided data validation services for the analytical results from the four wells (Appendix F).

4.10 Deviations from Sampling & Analysis Plan(s)

TCE and 1,4-dioxane were not detecting in the field blank 12-PW-13-03; however, chromium was reported at a concentration of 0.3 µg/L. The field blank was filled in the parking lot of Columbia Analytical Services, rather than at the well site. A possible source of the chromium is air borne material from a chrome plating company 1800 feet west southwest of the laboratory. An inspection of wind direction and velocity data from PDEQ's Air Quality Program shows the wind was coming from the west at the time the field blank was filled. The Level IV data validation report identified chromium was detected in the field blank and there were no laboratory qualifiers indicating the source of the chromium was likely to have originated from the laboratory (ARCADIS, 2012).

As in previous years, well PW-13 had insufficient water supply for obtaining field parameters (i.e., temperature, pH, electrical conductivity) during the purging stage of sampling events. No field measurements were collected at the well head of well PW-13 prior to sample collection.

5.0 LABORATORY ANALYTICAL RESULTS

5.1 Sampling Results

Four wells were sampled. Three of the four wells are used for drinking water purposes. The fourth well is used for either landscape irrigation or other domestic purposes (Table 4).

The analytical results, MCLs, and Regional Screening Level for water samples collected during the 2012 sampling season were summarized (Table 5). The following contaminants of concern were detected: trichloroethene; chromium; and 1,4-dioxane. Laboratory data packages contain all the sample results and quality control information (Appendix E).

Table 4. 2012 Sample Dates & Locations

well #	well use	sample date	lab ID number	sample number	sample location
PW-03	drinking water	Not sampled			---
PW-07	irrigation[1]	02.29.12	T1200304-001 T1200304-002 T1200304-003	12-PW07-01 12-PW07-02 12-PW07-03	Well head Well head Well head-duplicate
PW-11	irrigation	Not sampled			---
PW-12	drinking water	02.29.12	T1200304-004 T1200304-005	12-PW12-01 12-PW12-02 12-PW12-02L	Kitchen tap Well head Travel Blank
PW-13	drinking water	02.29.12	T1200304-006 T1200304-007 T1200304-008	12-PW13-01 12-PW13-02 12-PW13-03	Outdoor tap Well head Field Blank
PW-14	irrigation	Not Sampled			---
PW-17	drinking water	Not sampled			---
PW-18	domestic	Not sampled			---
PW-20	domestic[2]	02.29.12	T1200304-009 T1200304-010	12-PW20-01 12-PW20-02	Bathroom sink tap Well head

[1] Well was converted from drinking water to irrigation in the later half of calendar year 2003
[2] Well owner uses bottled water; Well is used for irrigation and other non-drinking purposes.
Travel blank = prepared using de-ionized water for both organic and inorganic parameters

5.1.1 Trichloroethene

Samples from wells PW-07, PW-12, PW-13, and PW-20 had detectable concentrations of TCE (Table 5). Samples from the irrigation well #07 contained the highest TCE concentration of 2.1 µg/L. All TCE concentrations were below the MCL of 5 µg/L.

5.1.2 Total Chromium

Samples from wells PW-07, PW-12, PW-13, and PW-20 had detectable concentrations of total chromium (Table 5). Samples from the drinking water well #13 contained the highest total chromium of 5.9 µg/L. All chromium concentrations were below the MCL of 100 µg/L.

5.1.3 1,4-Dioxane

Samples from wells PW-13 and PW-20 had detectable concentrations of 1,4-dioxane ranging between 1.5 and 1.7 µg/L. (Table 5). Both samples were higher than EPA's RSL of 0.35 µg/L. As the water from these wells is used as a source of drinking water, the well owners have been advised to drink bottled water. They have also been advised the water is safe for bathing and showering, based on information from a Connecticut Department of Public Health fact sheet (What you need to know about 1,4-Dioxane in Well Water).

Samples from wells PW-07 and PW-12 had no detectable concentrations of 1,4-dioxane at the Method Reporting Limit (MRL) of 1.0 µg/L. The means the laboratory's ability to quantify the amount of 1,4-dioxane was at a higher concentration than EPA's RSL concentration; therefore, we do not know if the water meets the RSL or is below this level. One of these wells is used for landscape irrigation, which is a safe use for this water. We advised the other well owner who uses their water for drinking purposes that they may want to take the precaution of drinking bottled water and also informed them that bathing and showering is safe at these concentrations, as noted above.

Table 5. 2012 Analytical Results Summary

Well #			TCE (µg/L)		chromium		1,4-dioxane		1,1-DCE		
Sample Date	Well Use	sample site	result	MCL	result	MCL	result	RSL	result	MCL	sample number
PW-03		Not sampled									
		well head	2.2		0.8		ND 1.0		ND 0.5		12-PW07-01
PW-07	IRR	well head	2.1	5.0	0.8	100	ND 1.0	0.35	ND 0.5	7.0	12-PW07-02
02.29.12		well head (dup)	2.0		0.8		ND 1.0		ND 0.5		12-PW07-03
PW-11		Not sampled									
PW-12	DW	kitchen tap	0.66		5.0		ND 1.0		ND 0.5		12-PW12-01
		well head	0.64	5.0	5.4	100	ND 1.0	0.35	ND 0.5	7.0	12-PW12-02
02.29.12			ND		-		-		ND 0.5		12-PW12-02L
		outdoor tap	1.1		5.9		1.6		ND 0.5		12-PW13-01
PW-13	DW	well head	1.4	5.0	5.8	100	1.6	0.35	ND 0.5	7.0	12-PW13-02
02.29.12		Field blank	ND 0.5		0.3		ND 1.0		ND 0.5		12-PW13-03
PW-14	IRR	Not sampled									
PW-17	DW	Not sampled									
PW-18	IRR	Not sampled									
		bathroom sink	0.62		2.7		1.7		ND 0.5		12-PW20-01
PW-20	Domestic[1]	well head	0.54	5.0	2.8	100	1.5	0.35	ND 0.5	7.0	12-PW20-02
02.29.12		Travel blank	ND 0.5		ND 0.2		ND 1.0		ND 0.5		12-PW20-03

DW = drinking water
IRR = irrigation
Field blank = samples were prepared using de-ionized water
[1] well owner is using bottled water; well is used for irrigation and other non-drinking purposes
1,1-DCE = 1,1-dichloroethene
ND = non-detect with detection limits (i.e ND 0.5 means non-detectable at 0.5)
(dup) = duplicate sample
MCL = maximum contaminant level
RSL = Regional Screening Level

5.1.4 1,1-Dichloroethene

This parameters was not detected in the four wells sampled.

5.2 Re-Sampling Results

None of the wells required re-sampling.

5.3 Comparison of Historical Data

5.3.1 Trichloroethene

Historically, water samples from wells PW-07, PW-12, PW-13 and PW-20 have had detectable concentrations of TCE (Table 6a). In addition to all meeting the 5.0 µg/L MCL for TCE, the concentrations for three of four were lower than recent years. Concentrations of TCE for the fourth well PW-13 were near the lowest historical concentrations. The long-term trend since 2003 is a steady decline.

Table 6a. Historical Analytical Results for Trichloroethene (µg/L)

Well	Use	1994	1998	1999	2002[A]	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
PW-03	DW	ND	ND	ND	+++	ND	ND	ND	ND	ND	ND	ND	ND	ND	---
PW-07	IRR	2.9	4.0	4.0	+++	7.0	4.0	4.4	3.8	---	---	4.0	4.1	3.8	2.1
PW-11	IRR	ND	---	---	+++	ND	0.6	0.5	ND	ND	ND	ND	---	---	---
PW-12	DW	ND	ND	0.6J	+++	1.5	1.3	1.1	1.1	1.1	1.0	0.8	0.8	0.7	0.7
PW-13	DW	3.6	3.0	3.0	+++	1.7	1.3	1.2	1.0	1.1	1.3	1.4	1.6	1.5	1.3
PW-14	IRR	49.0	50.0	38.0	+++	25.0	16.0	14.0	10.0	8.5	6.3	5.0J	4.9	4.2	---
PW-15	DW	1.7	3.0	2.0	+++	6.2	A	A	A	A	A	A	A	A	A
PW-16	DW	ND	ND	0.8J	+++	0.6	A	A	A	A	A	A	A	A	A
PW-17	NO	ND	ND	0.5J	+++	ND	ND	ND	0.5	---	---	I	I	I	I
PW-18	IRR	ND	ND	---	+++	---	---	---	---	---	---	Unk	I	I	I
PW-20	DM	ND	ND	ND	+++	0.8	0.6	0.5	0.6	0.7	0.9	0.7	0.8	0.7	0.6
PW-21	IRR	ND	ND	ND	+++	ND	ND	A	A	A	A	A	A	A	A
PW-23	IRR	---	0.7	---	+++	---	---	---	---	---	---	---	---	---	---
PW-38	I	---	---	---	+++	---	---	---	---	---	---	I	I	I	I

[Pima County DEQ, 1994, 1999, 2000, 2001, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012]

[A] ADEQ , exclusively, collected water samples for 1,4-dioxane. PDEQ did not collect water samples in 2002.

--- = not sampled	
+++ = not analyzed for	Notes:
A = Abandonned	MCL for TCE is 5µg/L
DM = Domestic	MCL for chromium is 100µg/L
DW = drinking water	Regional Screening Level for 1,4-dioxane is 0.35µg/L
I - inoperable	Detection limit for TCE is 0.5µg/L
IRR = irrigation	Detection Limit for Total Chromium is 5µg/L
J = Result is estimated	Detection Limit for 1,4-dioxane is 1µg/L
MCL = Maximum Contaminant Level	Red text identifies results higher than MCL or RSL
ND = Non-detect	
µg/L = micrograms per liter = parts per billion (ppb)	
UJ = Reporting limit is an estimated value	
Unk = Unknown	

5.3.2 Total Chromium

In 2012, PDEQ contracted with a new laboratory using Method 200.8 and a Method Reporting Limit (MRL) of 0.2 µg/L. At this low MRL, very low levels of chromium were detected in all the wells (Table 6b). All concentrations were below the MCL of 100 µg/L.

The detection limit has been higher in previous years. In 2003 and 2004, EPA Method 200.7 was used and the detection limit was 10 µg/L. In years 2005 through 2008, EPA Method 200.8 was used and the detection limit was 1 µg/L. In 2009 and 2010, PDEQ's contracted laboratory reported a detection limit of 5 µg/L. A detection limit of 5 µg/L was used in 2011. The detection limit in 2012 was 0.2 µg/L. In all sampling events, the both the chromium concentration and chromium detection limit have been well below the MCL of 100 µg/L.

Table 6b. Historical Analytical Results for Chromium (µg/L)

Well	Use	1994	1998	1999	2000	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
PW-03	DW	1.0	2.2J	ND	ND	ND	ND	ND	1.2	1.2	ND	ND	ND	ND	---
PW-07	IRR	ND	2.2J	ND	ND	ND	ND	2.3	1.1	---	---	ND	5.8	ND	0.8
PW-11	IRR	2.8J	---	---	ND	ND	ND	3.4	3.4	1.7	ND	ND	---	---	---
PW-12	DW	5.4J	6.3J	7J	6J	ND	ND	5.8	5.5	6.8	5.0	6.1	5.0	7.8	5.2
PW-13	DW	5J	4.8J	ND	7J	ND	ND	5.9	6.3	6.2	6.5	6.5	7.3	6.1	5.9
PW-14	IRR	9J	9.9J	13.0	10.0	ND	11.0	12.0	12.0	11.0	12.0	11.4	10.2	10.2	
PW-15	DW	4.6J	6.3J	7J	6J	ND	A	A	A	A	A	A	A	A	A
PW-16	DW	6.4J	10.2	ND	10.0	14.0	A	A	A	A	A	A	A	A	A
PW-17	DW	1.2	ND	ND	ND	ND	ND	1.0	1.3	---	---	I	I	I	I
PW-18	IRR	3.5J	5.6J	---	---	---	---	---	---	---	---	Unk	I	I	I
PW-20	DM	11.5	9.4J	28.0	10.0	12.0	12.0	15.0	11.0	8.4	6.9	5.2	ND	ND	3.3
PW-21	IRR	ND	5.8J	6J	ND	20.0	45.0	A	A	A	A	A	A	A	A
PW-23	IRR	---	4.8	---	---	---	---	---	---	---	---	---	---	---	---
PW-38	I	---	---	---	---	---	---	---	---	---	---	I	I	I	I

[Pima County DEQ, 1994, 1999, 2000, 2001, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012]

[A] ADEQ , exclusively, collected water samples for 1,4-dioxane. PDEQ did not collect water samples in 2002.

--- = not sampled	
+++ = not analyzed for	Notes:
A = Abandonned	MCL for TCE is 5µg/L
DM = Domestic	MCL for chromium is 100µg/L
DW = drinking water	Regional Screening Level for 1,4-dioxane is 0.35µg/L
I - inoperable	Detection limit for TCE is 0.5µg/L
IRR = irrigation	Detection Limit for Total Chromium is 5µg/L
J = Result is estimated	Detection Limit for 1,4-dioxane is 1µg/L
MCL = Maximum Contaminant Level	Red text identifies results higher than MCL or RSL
ND = Non-detect	
µg/L = micrograms per liter = parts per billion (ppb)	
UJ = Reporting limit is an estimated value	
Unk = Unknown	

5.3.3 1,4-Dioxane

Detectable concentrations of 1,4-dioxane were observed in water samples from wells PW-13 and PW-20 while PW-07 and PW12 remained non-detectable (Table 6c). The detectable concentrations averaged 1.6 µg/L, which is above the Regional Screening Level of 0.35 µg/L.

Water samples from PW-07 and PW-12 had no detectable concentrations of 1,4-dioxane at the Method Reporting Limit (MRL) of 1.0 µg/L. The means the laboratory's ability to quantify the amount of 1,4-dioxane was at a higher concentration than EPA's RSL; therefore, we do not know if the water meets the RSL or is below this level. Well PW-07 is used for landscape irrigation, which is a safe use for this water. The owners were also advised to drink bottled water rather than the well water. PDEQ advised the other well owner, who uses their water for drinking purposes, that they may want to take the precaution of drinking bottled water and also informed them bathing and showering is safe at these concentrations, based on information from a public health fact sheet (Connecticut Department of Public Health, 2012).

Table 6c. Historical Analytical Results for 1,4-dioxane (ug/L)

Well	Use	1994	1998	1999	2000	2002[A]	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
PW-03	DW	+++	+++	+++	+++	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	---
PW-07	IRR	+++	+++	+++	+++	ND	ND	ND	ND	ND	---	---	ND	ND	ND	ND
PW-11	IRR	+++	+++	+++	+++	---	ND	ND	ND	ND	ND	ND	ND	---	---	---
PW-12	DW	+++	+++	+++	+++	ND	ND	ND	ND	ND	ND	ND	<1 UJ	ND	ND	ND
PW-13	DW	+++	+++	+++	+++	1.7	1.8	1.5	1.9	1.7	2.3J	2.0	<1 UJ	ND	ND	1.6
PW-14	IRR	+++	+++	+++	+++	6.8	7.1	7.1	6.6	7	6.8	6.1	1.6	1.9	1.2	---
PW-15	DW	+++	+++	+++	+++	ND	ND	A	A	A	A	A	A	A	A	A
PW-16	DW	+++	+++	+++	+++	9.2	9.4	A	A	A	A	A	A	A	A	A
PW-17	DW	+++	+++	+++	+++	ND	ND	ND	ND	ND	---	---	I	I	I	I
PW-18	IRR	+++	+++	+++	+++	---	---	---	---	---	---	---	Unk	I	I	I
PW-20	DM	+++	+++	+++	+++	8.5	10	10	8	7.2	6.4	4.2	ND	ND	ND	1.6
PW-21	IRR	+++	+++	+++	+++	ND	ND	ND	A	A	A	A	A	A	A	A
PW-23	IRR	+++	+++	+++	+++	---	---	---	---	---	---	---	---	---	---	---
PW-38	I	+++	+++	+++	+++	---	---	---	---	---	---	---	I	I	I	I

[Pima County DEQ, 1994, 1999, 2000, 2001, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012]

[A] ADEQ , exclusively, collected water samples for 1,4-dioxane. PDEQ did not collect water samples in 2002.

--- = not sampled	
+++ = not analyzed for	Notes:
A = Abandonned	MCL for TCE is 5µg/L
DM = Domestic	MCL for chromium is 100µg/L
DW = drinking water	Regional Screening Level for 1,4-dioxane is 0.35µg/L
I - inoperable	Detection limit for TCE is 0.5µg/L
IRR = irrigation	Detection Limit for Total Chromium is 5µg/L
J = Result is estimated	Detection Limit for 1,4-dioxane is 1µg/L
MCL = Maximum Contaminant Level	Red text identifies results higher than MCL or RSL
ND = Non-detect	
µg/L = micrograms per liter = parts per billion (ppb)	
UJ = Reporting limit is an estimated value	
Unk = Unknown	

5.3.4 1,1-Dichloroethene

In past years, well PW-14 was the only well of the wells sampled that showed detectable levels of 1,1-DCE. Well PW-14 was not sampled this.

5.4 Validation of Analytical Data

The samples were processed within the required holding times (Table 7). The Level IV data package was validated in accordance with procedures identified within relevant EPA guidance documents (EPA, 2004 and 2008) by ARCADIS (Appendix F, ARCADIS, 2012). Data validation shows the data is useable for the intended purpose and meets project quality objectives.

Table 7. Sampling & Laboratory Analyses Dates

well #	sampling date	Dates of the laboratory analyses		
		organic compounds	Chromium	1,4-dioxane
		hold time < 14 days	hold time < 6 months	hold time < 14 days
PW-07, PW-12, PW-13, PW-20	02.29.12	03.07.12	03.08.12	03.07.12

5.5 Summary of Sampling Results

TCE and total chromium results for wells PW-07, PW-12, PW-13 and PW-20 were all below the MCL. Wells PW-13 and PW-20 had 1,4-dioxane concentrations that exceeded the Regional Screening Level while wells PW-07 and PW-12 had non-detectable concentrations at the MRL of 1.0 µg/L. The spatial distribution of wells with exceedances for 1,4-dioxane is consistent with the contamination plumes (Figure 4). Figures 5 through 10 provide graphical representations of historical laboratory analytical results for private wells PW-07, PW-12, PW-13 and PW-20.

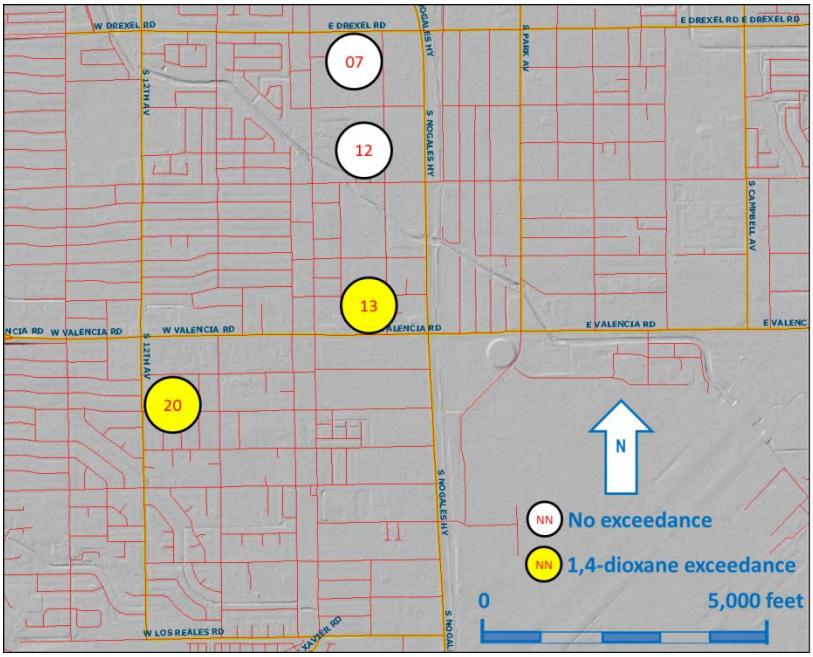

Figure 4. Southside Private Well Monitoring Exceedance Map

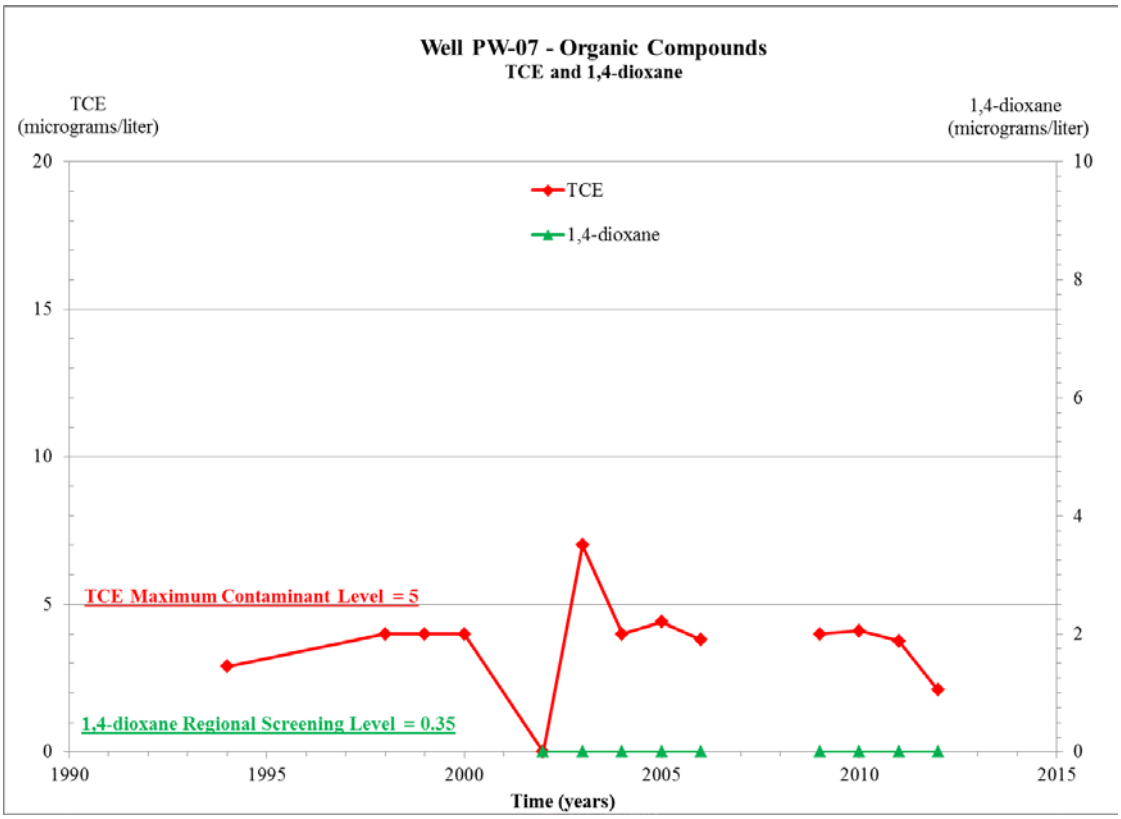

Figure 5a. Well PW-07 – Organic Compounds TCE and 1,4-Dioxane

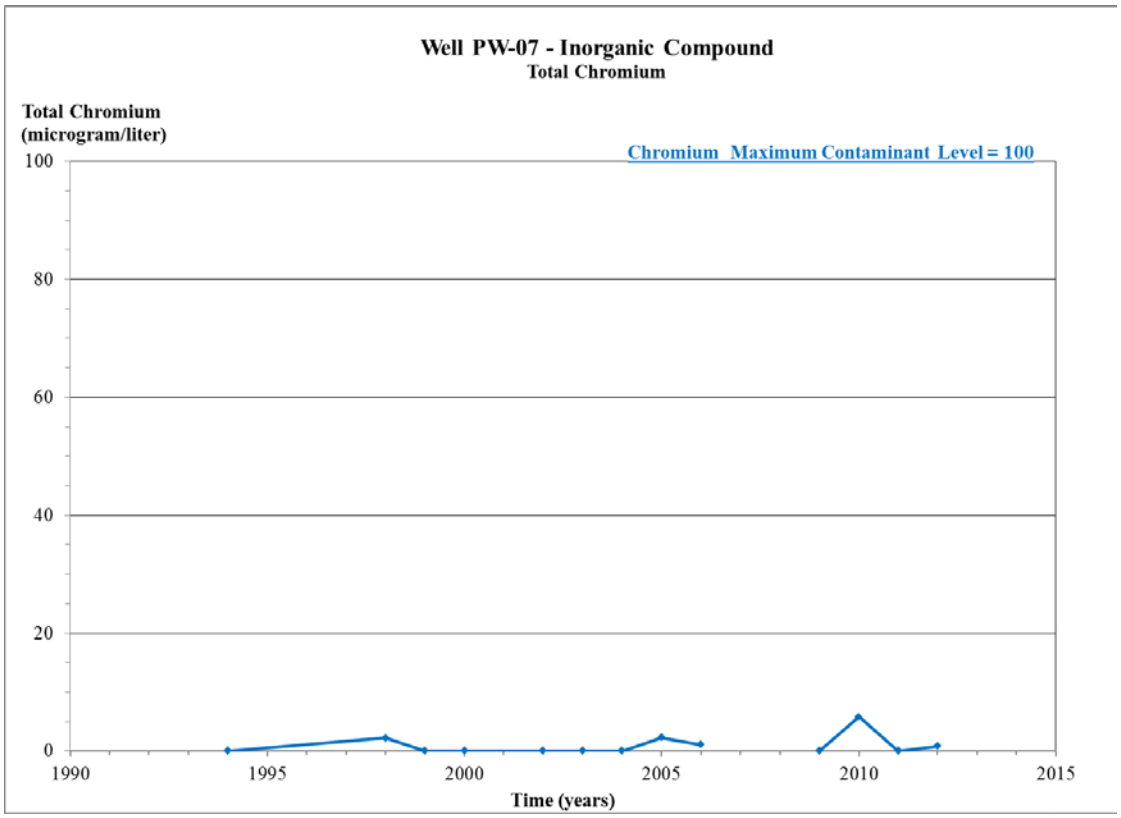

Figure 5b. Well PW-07 – Inorganic Compounds Total Chromium

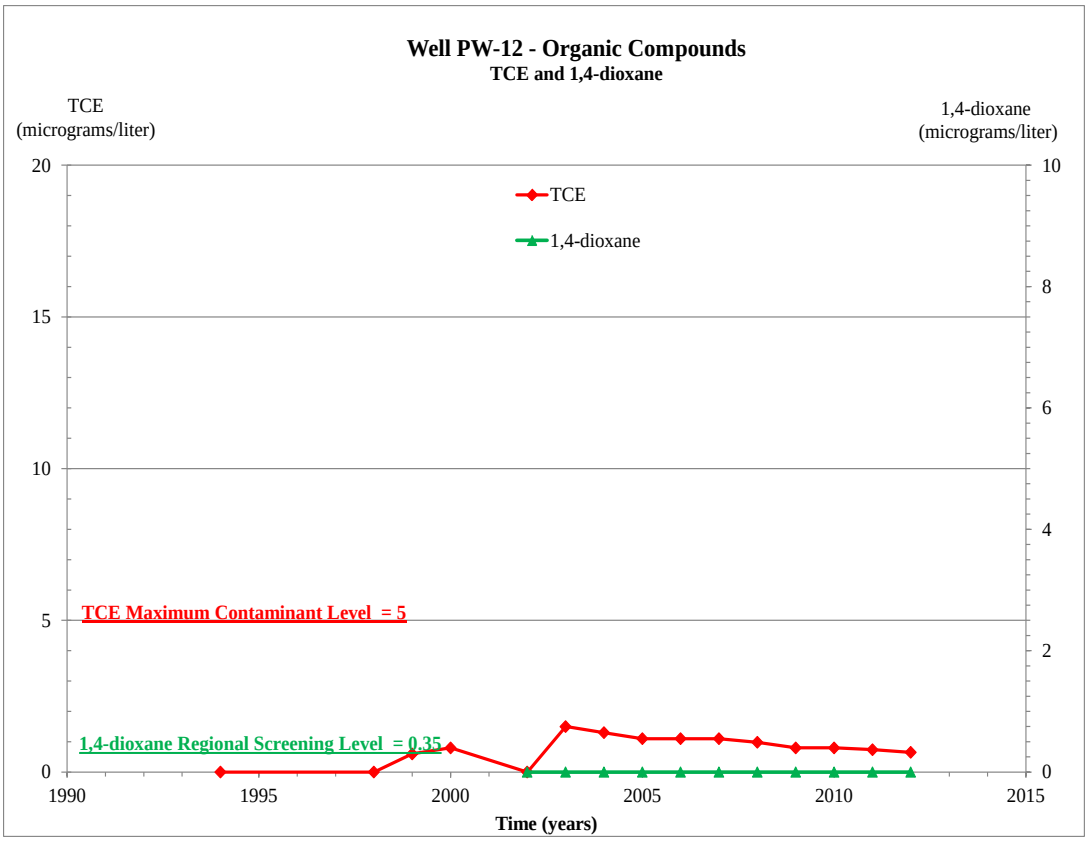

Figure 6a. Well PW-12- Organic Compounds TCE and 1,4-Dioxane

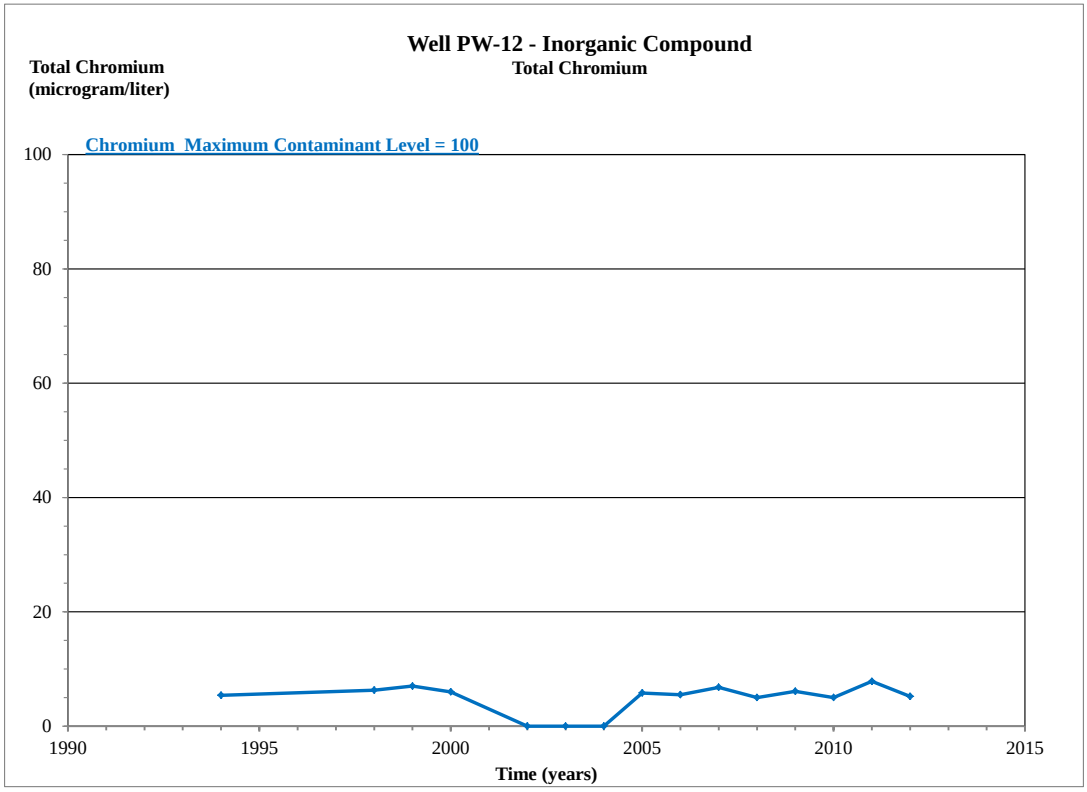

Figure 6b. Well PW-12 - Inorganic Compounds Total Chromium

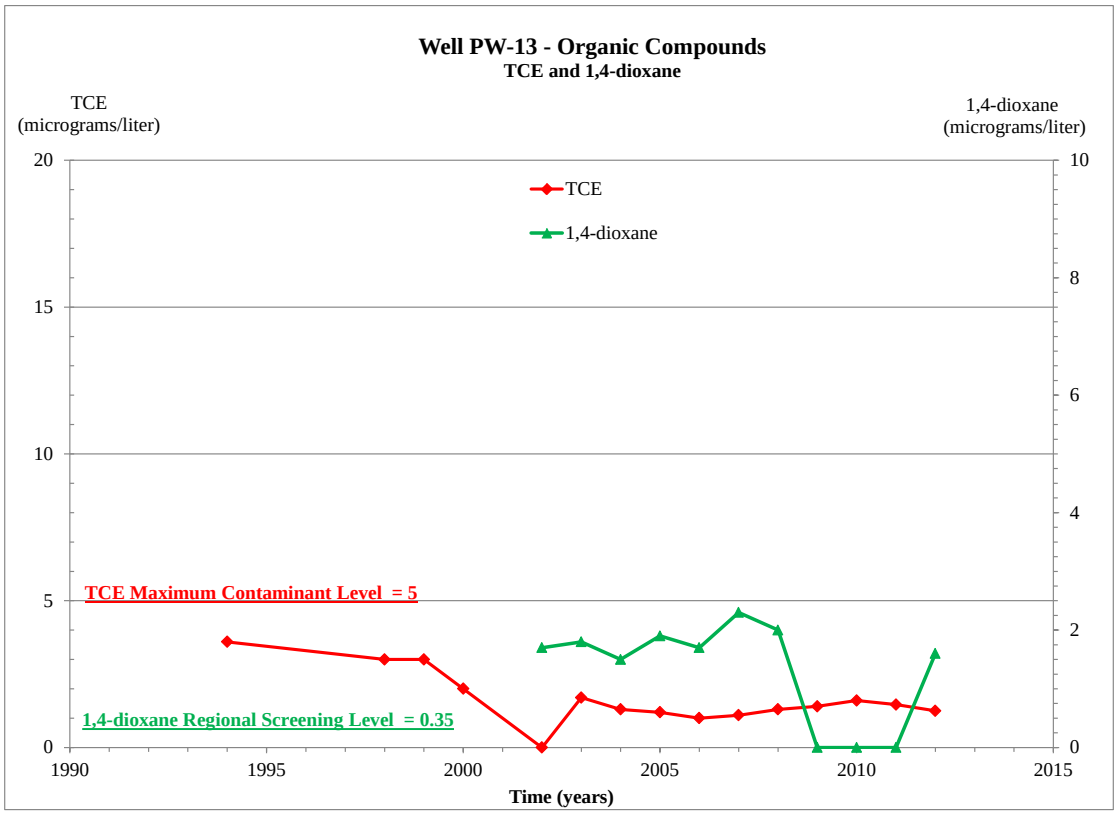

Figure 7a. Well PW-13- Organic Compounds TCE and 1,4-Dioxane

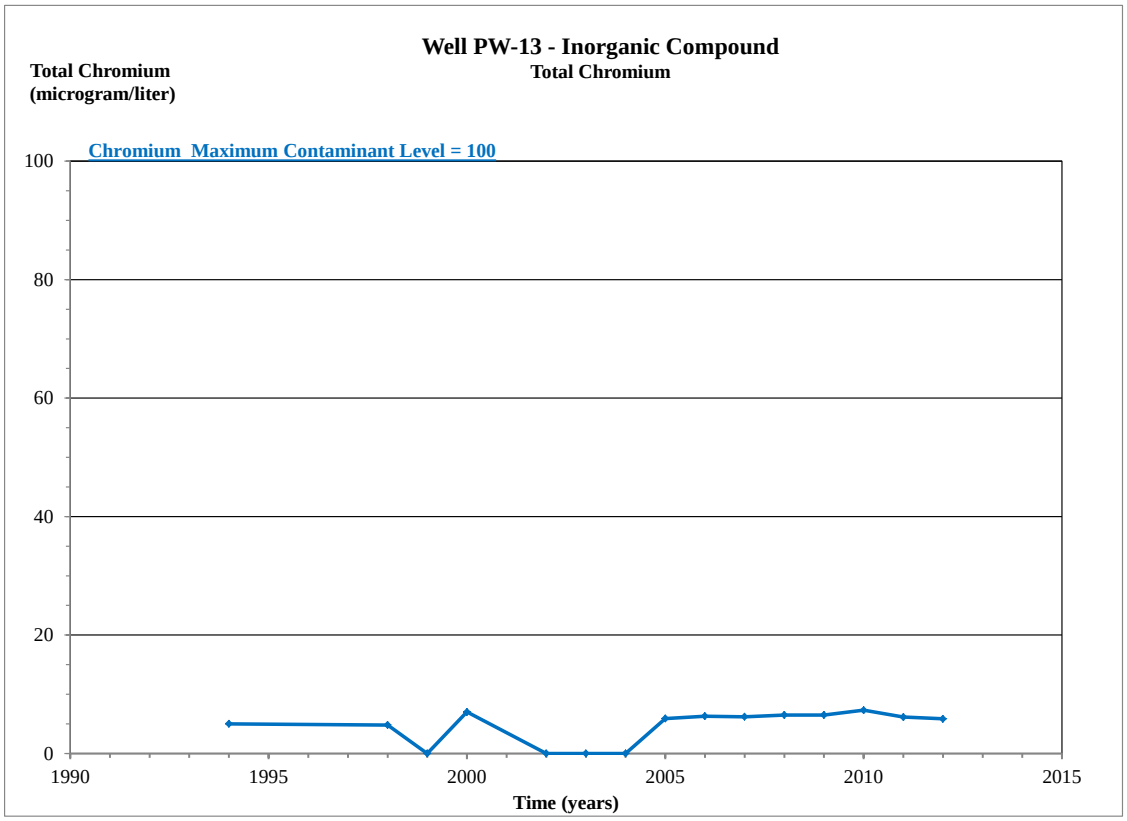

Figure 7b. Well PW-13 - Inorganic Compounds Total Chromium

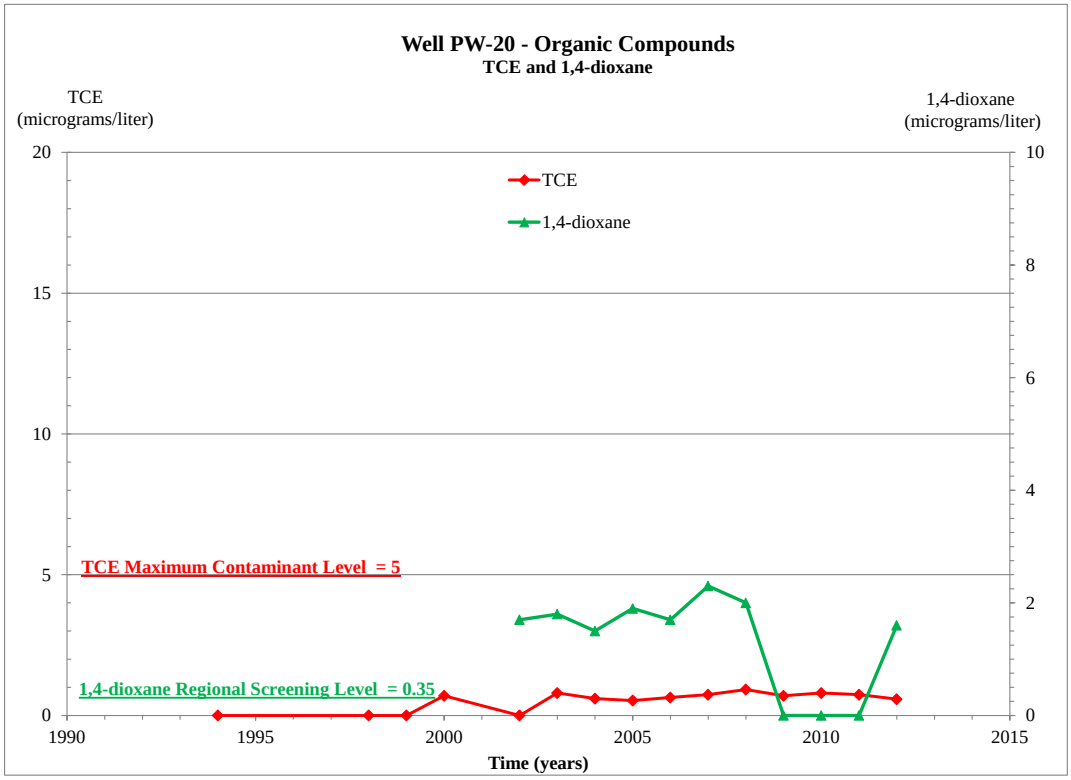

Figure 8a. Well PW-20- Organic Compounds TCE and 1,4-Dioxane

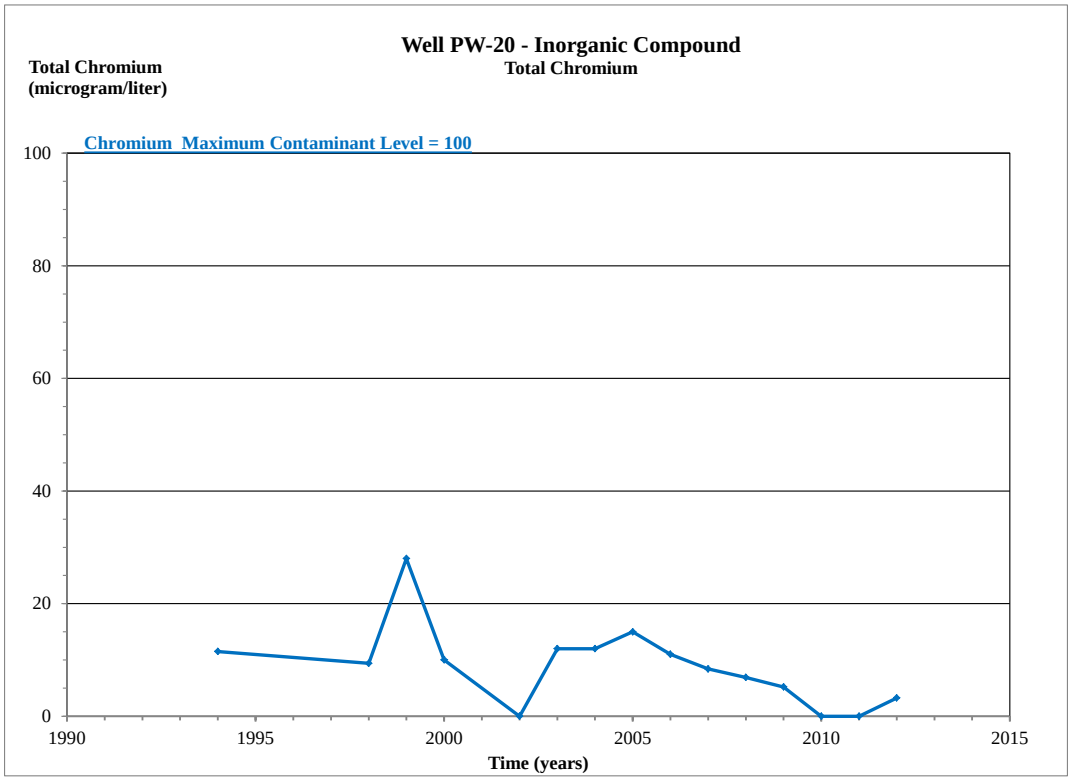

Figure 8b. Well PW-20 - Inorganic Compounds Total Chromium

6.0 REPORTING OF SAMPLING RESULTS

6.1 Communications with Well Owners

PDEQ sent a letter to each owner summarizing the findings of this year's sample results (Table 8, Appendix G). The information provided to the well owners was based on validated data.

Table 8. Owner Notification of Well Contamination

Well #	Contaminant Value Exceeds MCL or Regional Screening Level		Sampling Date	Laboratory Results Received by PDEQ	Level IV Laboratory Data Received by PDEQ	Telephone Notification	Letter Notification
	TCE	1,4-dioxane					
PW-07	no	no	02.29.12	03.19.12	06.27.12	No	06.28.12
PW-12	no	no	02.29.12	03.19.12	06.27.12	No	06.28.12
PW-13	no	yes	02.29.12	03.19.12	06.27.12	No	06.28.12
PW-20	no	yes	02.29.12	03.19.12	06.27.12	No	06.28.12

MCL = maximum contaminant level
TCE MCL = 5µg/L
Chromium MCL = 100µg/L
Regional Screening Level for 1,4-dioxane = 0.35µg/L = drinking water concentration that would increase cancer risk by one in one million over a lifetime of water consumption [excess cancer risk of $1x10^{-6}$]

6.2 Communications with Elected Officials

As part of the private well monitoring program, PDEQ provided progress updates to Pima County Supervisor Ramon Valadez[1] and City Council Ward Members Richard Fimbres and Regina Romero. On July 3, 2012, PDEQ provided summaries of the validated results to Supervisor Valadez and Council Members Fimbres and Romero (Appendix H).

6.3 Conclusions and Recommendations

The 2012 sampling season marked the tenth year the current monitoring program was implemented by PDEQ. This was also the tenth time PDEQ sampled for 1,4-dioxane, as part of the private well monitoring program.

Combined with the 1,4-dioxane analytical results obtained from ADEQ's 2002 sampling efforts, there are now eleven years of 1,4-dioxane data for the private wells. Although several of the wells have shown non-detect levels of 1,4-dioxane, the extent of ground-water contamination is still under investigation. PDEQ recommends all wells be sampled for 1,4-dioxane, as well as for chromium and TCE, during the 2013 sampling season.

[1] In previous years, Supervisor Richard Elias was also given project updates. This is because all of the wells, except well PW-03, were located within Supervisor Elias' District [District #5]. In January 2005, the boundary between District #2 and #5 changed such that all of the private wells are now located in District #2.

7.0 REFERENCES

ARCADIS. *Data Validation Report, South-Side Private Well Monitoring Program*. June 2012.

Arizona Department of Environmental Quality; Southern Regional Office. *Remedial Investigation Report, Phase II, Former West-Cap Property and Vicinity, Area B Tucson International Airport Area CERCLA Site*. ADEQ Open File Report: OFR 98-2. June 1998.

Arizona Department of Environmental Quality; Southern Regional Office. TIAA CERCLA Site Dioxane Results and Plume Map. February 2008.

Arizona Department of Environmental Quality; Southern Regional Office. Tucson Int'l Airport Area (TIAA) EPA NPL Site. January 2011.

Connecticut Department of Public Health. Fact Sheet: *What you need to know about 1,4-Dioxane in Well Water*, February, 2012.

Pima County Department of Environmental Quality. *Southside TCE Private Well Investigation, Tucson International Airport Area Superfund Site, Tucson, Arizona*. November 1994.

Pima County Department of Environmental Quality. *Southside TCE Private Well Investigation, Tucson International Airport Area Superfund Site, Tucson, Arizona*. February 1999.

Pima County Department of Environmental Quality. *Southside TCE Private Well Investigation, Tucson International Airport Area Superfund Site, Tucson, Arizona*. January 2000.

Pima County Department of Environmental Quality. *Southside TCE Private Well Investigation, Tucson International Airport Area Superfund Site, Tucson, Arizona*. May 2001.

Pima County Department of Environmental Quality. *PDEQ2 Sampling & Analysis Plan, South-Side Private Well Monitoring Program, Tucson International Airport Area Superfund Site*, June 20, 2002.

Pima County Department of Environmental Quality. *South-Side Private Well Monitoring Program, Tucson International Airport Area Superfund Site, Tucson, Arizona, Annual Report*. September 2003.

Pima County Department of Environmental Quality. *South-Side Private Well Monitoring Program, Tucson International Airport Area Superfund Site, Tucson, Arizona, Annual Report*. May 2004.

Pima County Department of Environmental Quality. *South-Side Private Well Monitoring Program, Tucson International Airport Area Superfund Site, Tucson, Arizona, Annual Report*. May 2005.

Pima County Department of Environmental Quality. *South-Side Private Well Monitoring Program, Tucson International Airport Area Superfund Site, Tucson, Arizona, Annual Report*. March 2006.

Pima County Department of Environmental Quality. *South-Side Private Well Monitoring Program, Tucson International Airport Area Superfund Site, Tucson, Arizona, Annual Report*. May 2007.

Pima County Department of Environmental Quality. *South-Side Private Well Monitoring Program, Tucson International Airport Area Superfund Site, Tucson, Arizona, Annual Report*. May 2008.

Pima County Department of Environmental Quality. *South-Side Private Well Monitoring Program, Tucson International Airport Area Superfund Site, Tucson, Arizona, Annual Report*. April 2009.

Pima County Department of Environmental Quality. *South-Side Private Well Monitoring Program, Tucson International Airport Area Superfund Site, Tucson, Arizona, Annual Report*. April 2010.

Pima County Department of Environmental Quality. *South-Side Private Well Monitoring Program, Tucson International Airport Area Superfund Site, Tucson, Arizona, Annual Report*. April 2011.

United States Department of Health & Human Services, Public Health Service; Agency for Toxic Substances and Disease Registry. *Petitioned Public Health Assessment Addendum, Tucson International Airport Area, Tucson, Pima County, Arizona*. September 6, 1996.

United States Department of Health & Human Services, Public Health Service; Agency for Toxic Substances and Disease Registry. *Groundwater Contamination in West Plume B, North of Valencia Road, Tucson International Airport Area, Tucson, Pima County, Arizona*. July 6, 2000.

United States Environmental Protection Agency, Region 9. *Preparation of a U.S. EPA Region 9 Field Sampling Plan for Private and State-Lead Superfund Projects*. 1993.

United States Environmental Protection Agency. *Contract Laboratory Program National Functional Guidelines for Inorganic Data Review*. EPA-540/R-04/004 (OSWER 9240.1-45). 2004.

United States Environmental Protection Agency. *Contract Laboratory Program National Functional Guidelines for Superfund Organic Data Review*. EPA-540/R-08/01. 2008.

United States Environmental Protection Agency, Region 9. *Tucson International Airport Area Superfund Site*. March, 2010.

United States Geological Survey. *Contamination of Ground Water at the Tucson International Airport Area Superfund Site, Tucson Arizona – Overview of Hydrogeologic Considerations, Conditions as of 1995, and Cleanup Efforts*. Water-Resources Investigations Report 97-4200. 1997.