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TECHNICAL ASSISTANCE SERVICES FOR COMMUNITIES

Bandera Road Ground Water Plume Superfund Site: Site History and Status (November 2008)

Document Overview

At the request of the Bandera Road Community Advisory Group (CAG), this document provides a summary of the history and current status of the Bandera Road Ground Water Plume Superfund site (Bandera Road site). This document is provided by the Technical Assistance Services for Communities (TASC) program under Contract No.: EP-W-07-059 with E² Inc. The work is performed under TASC Work Assignment Number R6-TASC-002 and Technical Directive Number R6-Bandera Road-01.

Site History

The City of Leon Valley is located ten miles northwest of downtown San Antonio in Bexar County, Texas. Incorporated in 1952, the City of Leon Valley has a population of approximately 9,500. Leon Valley is surrounded by the City of San Antonio and covers an area of approximately 3.5 miles. According to the City, "the heart of Leon Valley lies along State Highway 16, also known as Bandera Road." This highway is also a major thoroughfare to prominent attractions in the San Antonio area.

In 2004, contaminated ground water was discovered in Leon Valley during an environmental investigation conducted by the Texas Commission on Environmental Quality (TCEQ). The contaminated ground water, or plume, is located in a business area between Grissom Road and Poss Road, approximately 590 feet from of Bandera Road. Some residential homes are also located nearby. The site area is estimated to be approximately one mile long by one-half mile wide. The estimated size of the plume may be modified, however, depending upon ongoing sampling and investigation. Land uses in the larger site area include mainly residential and light commercial/industrial land uses. Parks, playgrounds, schools, and day care facilities are also located in the vicinity of the site.

The area containing the site consists of a very complex sub-surface geology and hydrogeology. The movement of contaminated ground water at the site is directly influenced by the interaction between three aquifers: the

Bandera Road Ground Water Plume Superfund Site: *In Brief*

The Bandera Road Ground Water Plume Superfund site is located in the City of Leon Valley, Texas. The center of the site's contaminated ground water plume is located in a mostly commercial area, near Bandera Road between Poss Road and Grissom Road. Some homes are also located nearby. Major ground water contaminants include toluene and chlorinated solvents, such as tetrachloroethene (PCE), trichloroethene (TCE), and cis-1,2-dichloroethene (DCE).

In 2004, the plume was discovered during an environmental investigation conducted by the Texas Commission on Environmental Quality (TCEQ). In response, TCEQ placed water filtration systems on private wells with contamination above federal standards.

In early 2007, the site was placed on the final National Priorities List. In May 2007, EPA began connecting residents on private wells with contaminant levels above federal standards to a public water supply. This action was completed in February 2008.

As of October, 2008, the site area is estimated to be approximately one mile long by one-half mile wide. The estimated size of the plume may be modified, however, depending upon ongoing sampling and investigation.

Two City of Leon Valley public water supply wells located within one mile of the plume's center are being sampled every month to ensure that these wells have not been affected by contamination. EPA is preparing for an in-depth environmental investigation of the site. EPA is also continuing efforts to identify the source(s) of contamination.

Quaternary Alluvium aquifer, the Austin Chalk aquifer, and the Edwards Aquifer, which is the primary drinking water source for south-central Texas. Contamination may be entering the Edwards Aquifer through minor geologic faults and fractures or through improperly constructed water wells.

Several dozen private water wells are located in or near the area containing the plume. Six of these wells are known to be contaminated at levels above federal standards. Two City of Leon Valley public water supply wells are within one mile of the center of the plume. Neither of these wells, however, has been impacted by the contamination. Residences whose wells were found to be contaminated above federal standards were recently connected to a public water supply. EPA is continuing with water well sampling, including sampling of the two nearby public water supply wells on a monthly basis, to ensure that additional wells are not being impacted.

Overview of Agency Response Actions to Address the Site

TCEQ and EPA have undertaken a range of activities at the site since ground water contamination was discovered in 2004. These activities include ground water sampling to determine the extent and severity of the contamination area and research to identify the source, or sources, contributing to the ground water contamination. In addition, both agencies have taken actions to limit ingestion and exposure to contaminated ground water. Finally, to address questions about the health of Leon Valley residents who may be affected by the contamination, the Agency for Toxic Substances and Disease Registry and the Texas Department of State Health Services completed a public health assessment for the site in 2006-2007.

TCEQ Response Actions to Address the Site: 2004-2007

In 2004, TCEQ identified a nearby contaminated drinking water well while conducting an investigation at the Savings Square Shopping Center in Leon Valley. This ultimately led to the discovery of the site's contaminated ground water plume. TCEQ then undertook intensive sampling activities in the area to identify the extent of the plume as well as the sources of contamination. TCEQ's first environmental assessment included a dry cleaning facility located near the intersection of Grissom Road and Bandera Road. From May 2004 through December 2005, TCEQ sampled numerous private wells within a two-mile radius of the center of the site (more details of TCEQ's sampling efforts are discussed below). In August 2004, TCEQ also installed granulated activated charcoal (GAC) water filtration systems on five private wells that had levels of contamination that exceeded federal standards. The owner of the sixth private well declined to have the GAC system installed because this well was being used for irrigation purposes only. TCEQ continued to conduct ground water sampling through April 2007. Although these actions helped define the ground water plume, sampling efforts did not reveal the area of contaminated soil assumed to be contributing to the ground water contamination.

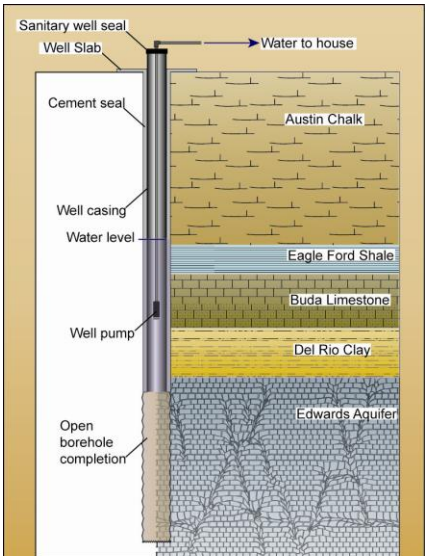

Figure 1. Diagram illustrating the components of a ground water well. Source: Edwards Aquifer Authority. The typical well construction near the Bandera Road site is "open hole" (uncased) in the water bearing zone. The well pump may be set either within the uncased section of the borehole or within the well casing.

EPA Response Actions to Address the Site: 2007-Present

TCEQ, with support from EPA, also completed a Hazard Ranking System scoring process for the site in 2006. Based upon scoring results showing serious contamination, the Bandera Road site was proposed to EPA's National Priorities List (NPL) in September 2006. The site was added to the NPL in March 2007. The site's listing allowed EPA to conduct additional investigations and begin to identify various strategies to ensure the long-term protection of human health and the environment. Between May 2007 and February 2008, EPA also connected residences using private wells with contaminant levels above federal standards to a public water supply. Six locations were ultimately connected. In November 2007, EPA

also began intensive ground water sampling (more details of EPA's sampling efforts are discussed below).

EPA is currently preparing for an in-depth environmental investigation of the site. Planned future activities include:

- Further analysis of subsurface soil contamination;
- Sampling of subsurface soil to identify the presence of harmful vapors resulting from contaminated soil;
- Constructing protective barriers around existing wells to prevent well casings from damage;
- Plugging and abandoning existing damaged wells to prevent them from being a pathway for contamination;
- Further research into potential contaminant ground water migration;
- Further sampling of existing wells; and
- Installation of new Austin Chalk and Edwards Aquifer monitoring wells

EPA will use the information collected from these activities to consider the placement of new monitoring wells and guide the second phase of field investigation activities. EPA is also continuing efforts to identify the source(s) of contamination.

Agency for Toxic Substances and Disease Registry (ATSDR) Public Health Assessment: 2006-2007

According to ATSDR, the purpose of the public health assessment was to find out if people are being exposed to hazardous substances and, if so, whether that exposure is harmful and should be stopped or reduced. To conduct its analysis, ATSDR and the Texas Department of State Health Services (TDSHS) reviewed the environmental information available for the site and evaluated the ways through which the public could come into contact with contaminants from the site. Depending upon the results of a public health assessment, ATSDR may reach conclusions about a site that fall into one of five categories.

- urgent public health hazard
- public health hazard
- indeterminate public health hazard
- non-apparent public health hazard
- no public health hazard

ATSDR's public health assessment report concluded that past exposures to contaminants in private water wells pose an indeterminate public health hazard because data were not available on how long residents using private wells had been exposed to contaminants in their drinking water or at what levels these exposures occurred. ATSDR also concluded that, even if residents had been exposed to contaminants in drinking water with contaminant concentrations similar to the highest level of contaminant concentration detected in ground water samples, negative health effects would not be expected. ATSDR also found that incidences of cancer were not elevated in the Leon Valley area in comparison to state cancer incidence rates. The prevalence of certain types of birth defects was elevated in comparison to state rates. ATSDR noted that, after accounting for maternal age and race/ethnicity, these elevations were not statistically significant, suggesting that these results could be due to chance alone. ATSDR added that because – after accounting for these factors – the prevalence of birth defects did not substantially decrease, this finding should be interpreted carefully.

Other community concerns were also addressed by ATSDR in the public health assessment. One concern centered on human consumption of meat and eggs from local poultry in contact with contaminated ground water. ATSDR responded that health effects from this were unlikely. ATSDR also noted that problems associated with using private wells containing contamination to water lawns and gardens were unlikely, because the chemicals of concern evaporate quickly when they are released into the air and plants do not accumulate these compounds.

Current Site Status

Federal and state agencies regularly develop what is called a Conceptual Site Model (CSM) to more fully understand what is known and not known about a particular site. The CSM helps agencies make better decisions about how to further research, address, and remediate contaminated sites. In September 2008, an updated CSM was completed for the Bandera Road site. Specifically, the updated CSM attempted to answer several questions:

- Have the source(s) of contamination been identified?
- Have the nature and extent of soil and ground water impacts been defined?
- What are the likely pathways for contaminant migration?
- Are there potentially complete ecological and human health exposure pathways?

The following report sections summarize recent sampling activities and the updated CSM's responses to these questions. In addition, related portions of the updated CSM that could be of potential interest to the Bandera Road site CAG are also highlighted. Finally, the sections summarize the information still needed to more fully understand the site and the recommended next steps presented in the updated CSM.

Recent Sampling Information

Current understanding of the contaminant plume and potential risks to human health and the environment primarily rely on sampling events undertaken by TCEQ and EPA between late 2005 and summer 2008. The most recent EPA sampling event for which data was available for the updated CSM took place in July 2008. In total, approximately 70 different wells have been sampled, many repeatedly, between late 2005 and mid-2008. Most wells sampled have been private wells used for domestic purposes. One private well was used for commercial purposes, while a few private wells were not in use. Two public water supply, or municipal, wells have been routinely sampled. One of these wells (USGS-50) is located near the intersection of Bandera Road and Grass Hill Drive.[1] The second public water supply well (USGS-18) is located in the vicinity of the intersection of Huebner Road and Evers Road. See Figure 2. Depending upon the sampling event, TCEQ and EPA collected ground water from the tap nearest the well pump or used Passive Diffusion bags (PDBs).[2] EPA also employed video/geophysical logging as part of its sampling effort, which can help identify whether breaches to well casings have occurred. A summary of recent TCEQ and EPA sampling events is presented in Table 1.

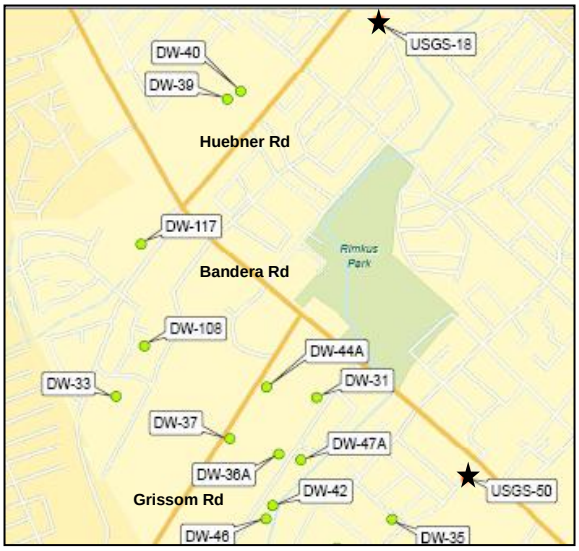

Figure 2. Location of Water Well Sampling Locations (November 2007). From EPA's updated Conceptual Site Model (Attachment E - Figure E-1). Municipal wells are marked with stars. Private wells are shown in green. Not all private well sampling locations are shown in Figure 2.

[1] The 'USGS' well designation comes from a well inventory conducted by the United States Geological Survey (USGS) for the EPA.
[2] A PDB sampler is a low-density polyethylene bag filled with deionized water. The PDB acts as a semi-permeable membrane and is suspended in a well to passively collect ground water samples at specific depths within the well.

Table 1. Recent TCEQ and EPA Ground Water Sampling Events for the Bandera Road Ground Water Plume Site

	TCEQ Sampling Events (1-4)	EPA Sampling Event 1	EPA Sampling Event 2	EPA Sampling Event 3	EPA Sampling Event 4
Dates of Sampling Event	1) Nov 2005 2) May 2006 3) Nov 2006 4) April 2007	Nov 2007	Jan 2008	April 2008	July 2008
Number of private wells sampled	37	27	10	30	8
Number of municipal water wells sampled	2	2	2	2	2

Following each ground water sampling event, samples with the highest concentrations of various chemicals were then compared to pre-set numerical values (i.e., screening levels) for particular chemicals. If the numerical value of a particular sample exceeded the screening level for a particular chemical, this chemical was identified as a potential chemical of concern. The screening levels used in the updated CSM included National Primary Drinking Water Regulation Maximum Contaminant Levels (MCLs), EPA Region 6 Tap Water Medium-Specific Screening Levels (MSSLs), and the TCEQ residential Protective Concentration Levels (PCLs) for ground water ingestion. These findings are presented in Table 2.

Table 2. Chemicals Exceeding One or More Risk Screening Levels during Recent Sampling Events

	November – April 2007	November 2007	January 2008	April 2008	July 2008
Bromodichloromethane	b	b	b,c	---	---
Bromoform	---	---	b	---	
Chloroform	b	b	b	b	b
Chloromethane	---	b	---	---	---
Dibromochloromethane	a,b	b,c	b,c	---	
cis-1,2-Dichloroethene (DCE)	---	---	---	a,b,c	a,b,c
Methyl tert-butyl ether (MTBE)	---	---	---	b	b
Tetrachloroethene (PCE)	a,b,c	a,b,c	a,b,c	a,b,c	a,b,c
Toluene			a,c		
Trichloroethene (TCE)	a,b,c	b	a,b,c	a,b,c	a,b,c
Vinyl chloride (VC)	b	---	---	b	b

- Table based upon summary data for private and municipal well sampling events in Tables 4-8 in EPA's updated Conceptual Site Model.
a - Indicates that at least one sample for this chemical exceeded TCEQ residential PCLs.
b - Indicates that at least one sample for this chemical exceeded Region 6 Tap Water MSSLs.
c - Indicates that at least one sample for this chemical exceeded National Primary Drinking Water Regulation MCLs.

In summary, samples exceeded at least one or more of the screening levels for 11 different chemicals or chemical compounds across all sampling events that took place between November 2005 and July 2008.

Identification of Contamination Sources

Based upon the recent sampling and screening efforts, two major sources of contamination have been identified and may require additional investigation. These sources were considered significant because they exceeded federal MCLs in one or more of the last four ground water sampling events. Two additional sources of contamination were also identified. These sources were not considered significant, however, because concentrations of these chemicals did not exceed federal MCLs.

The two additional contamination sources include gasoline constituents MTBE and benzene, which are located in the vicinity of USGS-42 and USGS-58 (near Bandera Road between Grissom Road and Poss Road) and TCE in

the vicinity of DW-39 (near the Bandera Road-Huebner Road intersection in between Linklea Street and Huebner Road).

Toluene and chlorinated solvents – the group of chemicals considered to be the primary chemicals of concern (COCs) at the site – are discussed below.[3]

Significant Contamination Source #1: Toluene Likely Upgradient of Monitoring Well DW-31

One significant source of contamination is toluene, which is likely located upgradient (northwest) of monitoring well DW-31 (near the intersection of El Verde Road and Jeff Loop toward Bandera Road). This assumption is based upon the directional flow of local ground water, which moves from northwest to southeast. It is assumed that toluene is likely entering the ground water through a breach (i.e., a hole or gap) in the DW-31 well casing. The boundary, or extent, of the toluene ground water contamination is well-defined to the north, west, and southwest. The boundary, or extent, of toluene contamination is not known to the southeast. Figure 3 shows the most current understanding of the toluene plume based upon recent sampling events.

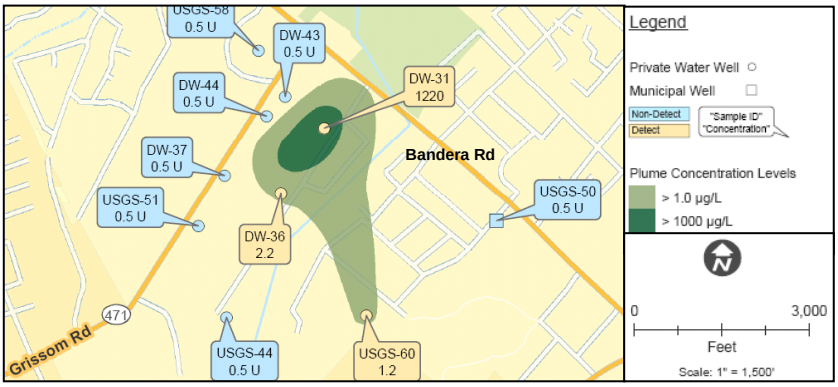

Figure 3. Toluene Ground Water Sampling Results (January 2008). From EPA's updated Conceptual Site Model (Attachment F - Figure F-5). The maximum concentrations from samples are shown above. These samples were collected in January 2008 through passive diffusion bags in private water wells. Sample results and chemical concentration amounts are presented in micrograms per liter (µg/L). EPA's MCL for Toluene is 1,000 µg/L. A "non-detect" sample indicates that no concentration of toluene was detected above the lowest-level that could be detected by laboratory analytical equipment. A "detect" sample indicates that some level of toluene was present in the sample collected detectable by laboratory analytical equipment.

Significant Contamination Source #2: Chlorinated Solvents near USGS-42

The second major source of ground water contamination is the group of chemicals referred to as chlorinated solvents located around monitoring well USGS-42 (near the Grissom Road-Bandera Road intersection). This source is likely associated with a PCE release at a former dry cleaning facility that once operated in the area. It is likely that the chlorinated solvents are moving from sub-surface soil into the ground water via infiltration of contaminants through the sub-surface soil area or directly to ground water via a manmade conduit (e.g., a borehole or well). The chlorinated solvents in the ground water are likely continuing to spread because of:

- extensive ground water use from private wells along the edge of the chlorinated solvent plume;
- the presence of the two minor faults to the northwest and southeast of the plume; and
- possible Austin Aquifer ground water flow from USGS-42 outward toward DW-43.

[3] According to the updated CSM, the group of chlorinated solvents considered to be primary chemicals of concern for the site include: 1,1- dichloroethene, chloroform, chloromethane, PCE, TCE, DCE, trichloromethane, and vinyl chloride. Of these, PCE, TCE, and DCE are considered to be indicator compounds for all the chlorinated solvents.

Figure 4 shows the most current understanding of the PCE plume based upon recent sampling events.

Identifying the Location of Contamination Sources in Soil or Subsurface Soil

Although the likely general locations of sources of toluene and chlorinated solvents contributing to the ground water contamination are known, specific soil locations have not been found. It is suspected that the major toluene contamination source is located near the soil surface or in sub-surface soil upgradient (northwest) of DW-31. It is suspected that the major contamination source of chlorinated solvents is located near the soil surface or in sub-surface soil near USGS-42. EPA has identified numerous current or former potential sources within a two-mile radius of the site. These include 21 dry cleaners, 26 automobile-related service facilities, and four light industrial sites. Further identification of the soil source will be part of upcoming EPA site investigations.

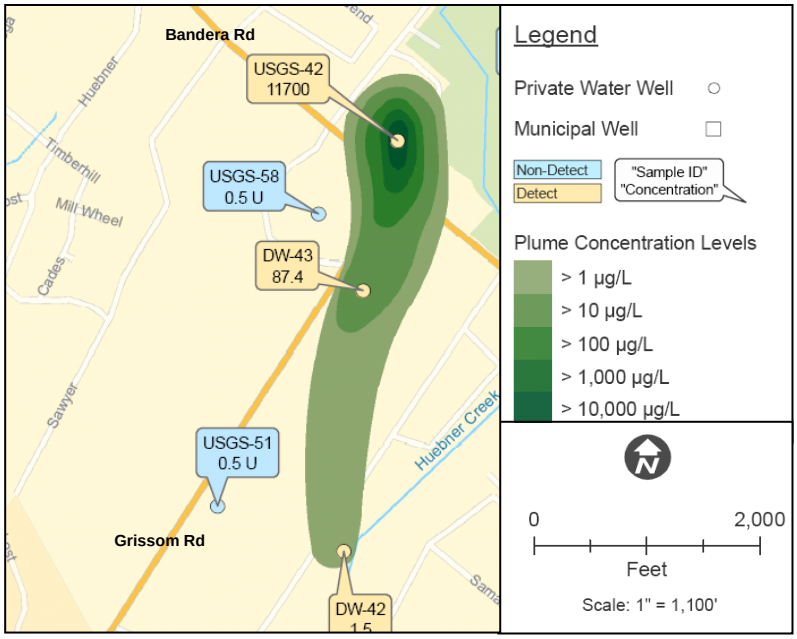

Figure 4. Tetrachloroethene (PCE) Ground Water Sampling Results (July 2008). From EPA's updated Conceptual Site Model (Attachment I - Figure I-4). Maximum concentrations from samples are shown. These samples were collected in January 2008 through passive diffusion bags in private water wells. Sample results and chemical concentration amounts are presented in micrograms per liter (µg/L). EPA's MCL for PCE is 5 µg/L.

Pathways for Human Exposure to Site Chemicals

People located at or near the Bandera Road site may potentially be exposed to chemicals through several pathways, most notably through contact with contaminated ground water or contaminated soil. People can potentially be exposed to site contaminants through breathing contaminated air, skin contact, or eating or accidently ingesting contaminated soil. While the chances for contact with contaminated ground water are greatly reduced now that residents using private wells for drinking water purposes have been connected to a public water supply, residents, workers, and other groups may still be potentially exposed to site contaminants by coming into contact with contaminated soil or contaminated ground water. Table 3 lists the ways that different populations may potentially come into contact with contamination at the site.

About Chlorinated Solvents

Chlorinated solvents include a range of chemical compounds, including PCE and TCE.

PCE and TCE started being used in the 1920s.

TCE was commonly used for degreasing operations and in metal cleaning.

PCE was commonly used for textile production and dry cleaning, among other activities.

The properties of chlorinated solvents can make it difficult to address ground water contaminated with chlorinated solvents.

Chlorinated solvents can easily penetrate small fractures and pore spaces. Similarly, chlorinated solvents do not stick to soil particles, so once they are introduced into the ground, they move quickly into area ground water.

Table 3. Potential Contamination Contact Pathways for Different Populations at the Site

	Industrial Worker	Construction Worker	Trespasser	Individual in Residential Setting
Ingestion of contaminated soil				
Incidental ingestion of surface soil	x		x	x
Incidental ingestion of surface and subsurface soil		x		
Dermal contact with contaminated soil				
Dermal contact with surface soil	x		x	x
Dermal contact with surface and subsurface soil		x		
Inhalation of chemicals originating in contaminated soil				
Inhalation of chemicals bound to windblown surface soils released to outdoor air	x		x	x
Inhalation of chemicals bound to windblown surface and subsurface soils released to outdoor air		x		
Inhalation of chemicals released as a gas from surface soil to outdoor air	x		x	x
Inhalation of chemicals released as a gas from surface and subsurface soil to outdoor air		x		
Inhalation of indoor air vapors from subsurface soil vapor intrusion	x			x
Ingestion of contaminated ground water	x			x
Dermal contact with contaminated ground water	x			x
Inhalation of chemicals originating within contaminated ground water				
Inhalation of chemicals volatilized from ground water during industrial use	x			
Inhalation of chemicals volatilized from ground water during domestic use				x
Inhalation of indoor air vapors from ground water vapor intrusion	x			x

Vapor Intrusion to Indoor Air

Currently, the most likely way that residents and workers could potentially be exposed to site contaminants is through vapor generated from contaminated soil located within 100 horizontal feet of the chlorinated solvent and toluene source areas. Vapor could penetrate into occupied homes, businesses, or other buildings.

Vapor Intrusion of Chlorinated Solvents

Chlorinated solvents in subsurface soil or shallow ground water may migrate to indoor air in the vicinity of USGS-42, located near the intersection of Bandera and Grissom Roads. See Figure 5. The concentration of PCE in ground water near the air water interface where vapors may emanate from ground water at USGS-42 is 6,600 micrograms per liter (µg/L). This level exceeds EPA's vapor intrusion screening level for PCE of 110 µg/L at a one in 10,000 cancer risk level. The zoning for this area permits retail, commercial, or government-exempt land uses. This suggests that it is likely that commercial/industrial workers in the vicinity of USGS-42 are

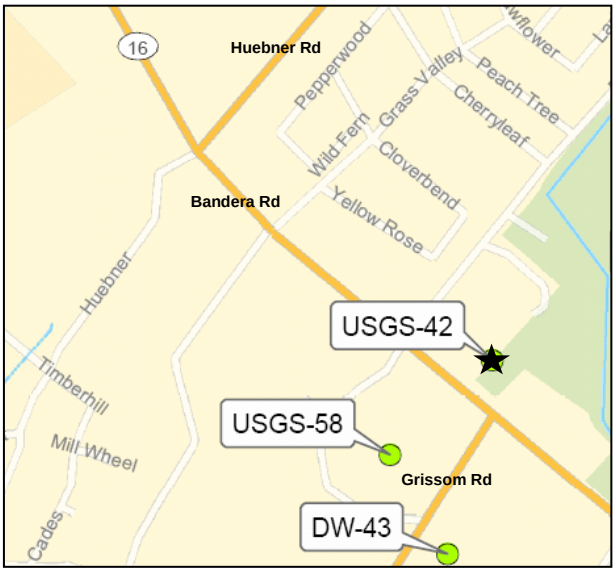

Figure 5. Location of Well USGS-42 (highlighted with star). From EPA's updated Conceptual Site Model (Attachment I - Figure I-1).

exposed to chlorinated solvent vapors from the subsurface soil or ground water that exceed EPA's vapor intrusion screening level for PCE.

Vapor Intrusion of Toluene

Toluene may migrate into an indoor area from subsurface soil or shallow ground water in the vicinity of DW-31, located between Grissom and El Verde Roads. See Figure 6. The zoning for this area is single family residential and commercial. This suggests that it is likely that residents and commercial/industrial workers in the vicinity of DW-31 are exposed to toluene vapors from the subsurface soil or ground water. The concentration of toluene in ground water near the air water interface where vapors may emanate from ground water at DW-31 is 1,220 µg/L. This level is close to, but does not exceed, EPA's vapor intrusion screening level for toluene of 1,500 µg/L at a one in 1,000,000 cancer risk level.

Although vapor intrusion to indoor air may not be of concern in the vicinity of DW-31, it is possible that residents or commercial/industrial workers located *upgradient (northwest)* of DW-31 are being potentially exposed to toluene vapors present in ground water at concentrations greater than the screening level.

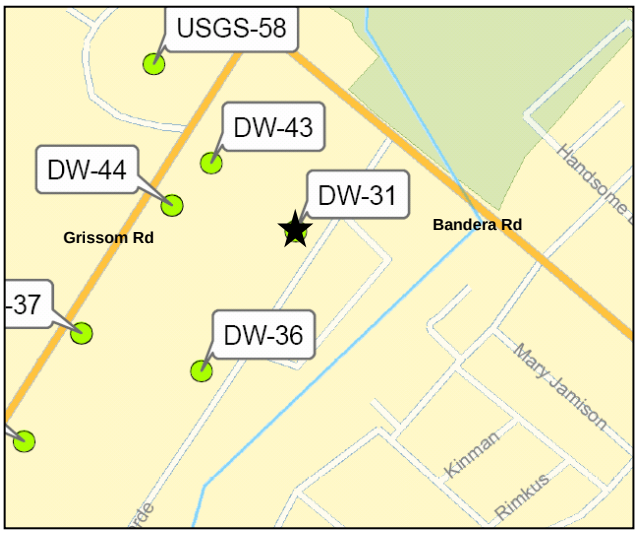

Figure 6. Location of Well DW-31 (highlighted with star). From EPA's updated Conceptual Site Model (Attachment F - Figure F-1).

Potential Data Gaps and Recommendations Identified in the Updated CSM

Three specific additional information need areas were identified in the updated CSM. Specifically, the updated CSM indicated that: 1) the full extent of the site's contaminated ground water is not fully known in some areas; 2) the full extent of chlorinated solvent contamination in the sub-surface soil area near USGS-42 is unknown; and 3) the full extent of toluene contamination in the sub-surface soil area likely upgradient (northwest) from DW-31 is unknown.

To address these data gaps and guide future investigation and remedial efforts, the updated CSM included several recommended next steps, which are summarized below:

- Undertake soil gas samples near USGS-42 and upgradient (northwest) of DW-31 to define the sub-surface areas of contamination. To more fully evaluate how residents and workers may be exposed to indoor vapor originating from soil contaminated with chlorinated solvents and toluene, sub-slab soil gas sampling and/or indoor air sampling may also be needed.
- Following these activities, further analyze the contaminated sub-surface areas to verify the contaminant concentrations and to collect data that could inform cleanup remedies.
- Further investigate private well USGS-42 to better understand movement of the chlorinated solvent plume.
- Consider four specific wells for "plugging and abandonment."
- Consider including six specific wells as part of the group of wells that are used to monitor the contaminated plume.
- Place new wells in four specific locations in order to fill data gaps and increase the number of wells used to monitor the plume.
- Analyze future ground water samples for volatile organic compounds or for factors that provide information on the possibility of monitored natural attenuation only.

- Conduct pump tests on each aquifer utilizing the new monitoring well network to evaluate aquifer flow rates, hydraulic conductivity, and to see if there is water movement between the Austin and Edwards Aquifers.
- Conduct a die tracer study to evaluate contaminant migration direction and time, which may be useful for predicting the performance of a remedy (e.g., enhanced natural attenuation).

Sources

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