Tucson International Airport Area Superfund Site

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What's Inside?

The Tucson International Airport Area (TIAA) **Superfund*** Site is comprised of several contaminated groundwater **plumes** and individual cleanup project areas.

The source of contamination is from multiple industrial activities that occurred from the WWII era (1940s) until the 1990s.

Several legal settlements have resulted in the construction of a number of cleanup systems, which will be discussed in this fact sheet.

This fact sheet is designed to be a general reference document as well as a site update. Inside you will find maps of current groundwater contamination, a discussion of efforts to address an emerging contaminant, and specific information about various project area cleanups.

Updates

Federal Facility Agreement with Air Force

In September 2011 the Air Force signed a Federal Facility Agreement with the Environmental Protection Agency (EPA) and the Arizona Department of Environmental Quality (ADEQ) to clean up Air Force-owned property at Air Force Plant 44. Under the terms of the agreement, the Air Force will work with the EPA and ADEQ to clean up areas impacted by Air Force Plant 44 south of Los Reales Road.

The agreement provides for regulatory oversight of the Air Force's Superfund work at Air Force Plant 44 and allows for assessment of penalties if the work is not completed or is inadequate. For the past several years, the Air Force has been conducting work at the site without a formal enforcement agreement for EPA and state oversight. This agreement will ensure EPA and ADEQ have an active role in the investigation and cleanup performed by the Air Force. It also provides a framework for the work to be done and a schedule for all the work required at the site.

The document is available at the El Pueblo Tucson library as well as online (see "For more information" at the end of this fact sheet).

Staff Change

Richard Muza, the EPA Remedial Project Manager for the Air Force Plant 44 Operable Unit, will no longer be working on this site. Martin Zeleznik, previously the EPA Remedial Project Manager for all of the other Operable Units, will now be overseeing the entire site.

Susan Hess, the previous ADEQ Project Manager for the site, is no longer working at ADEQ. Marc Herman is now the ADEQ Project Manager for the TIAA Superfund Site.

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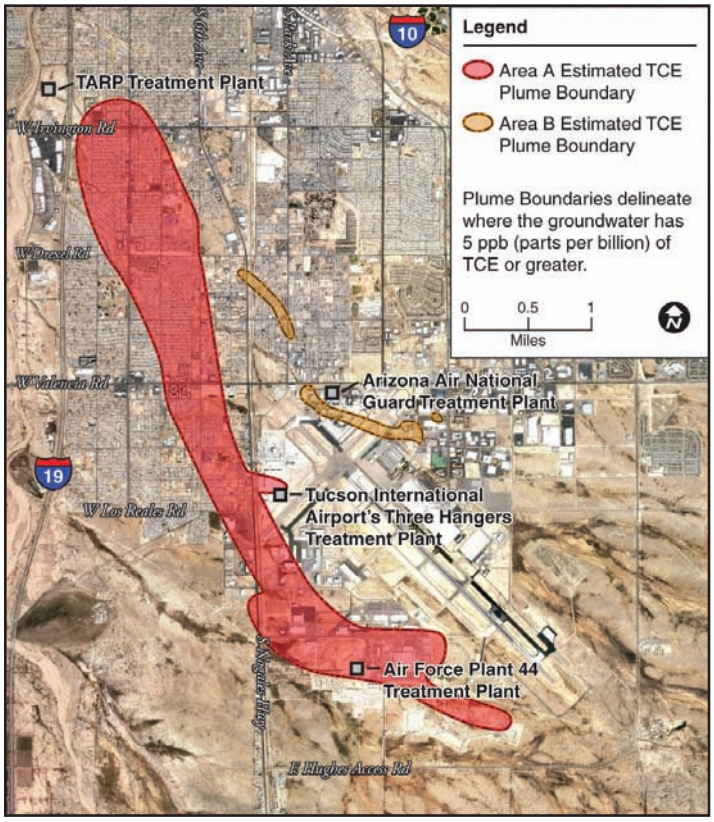


Figure 1: 2011 mapped data for concentrations of TCE in groundwater.

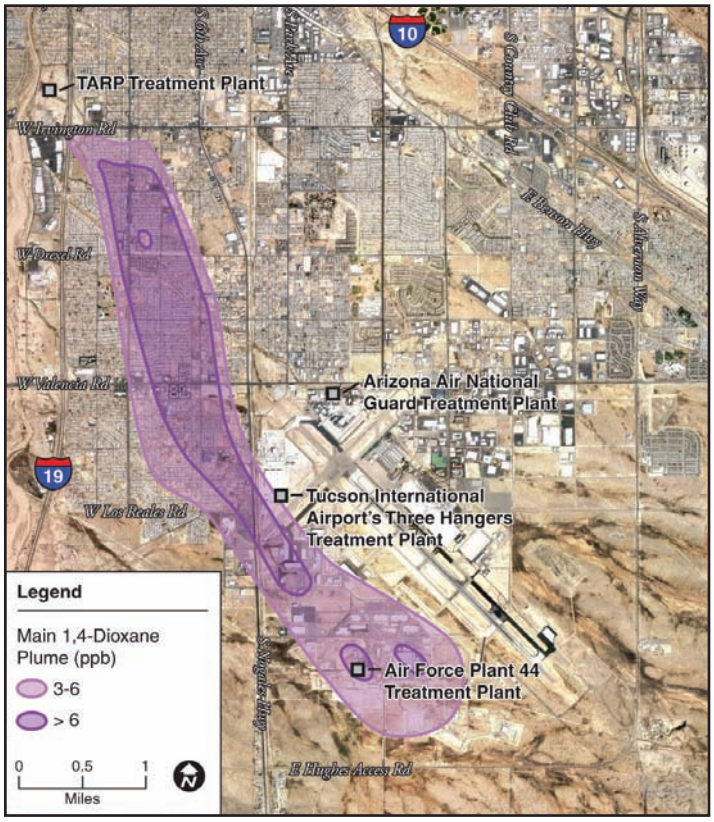


Figure 2: 2008 mapped data for concentrations of 1,4 Dioxane in groundwater. New data is currently being obtained.

Overall Site History and Overview

In 1981, the EPA and City of Tucson sampled and analyzed the **groundwater** from city wells and found high levels of **volatile organic compounds** (VOCs), including **trichloroethylene** (TCE). The wells were immediately closed and are no longer used for drinking water. The site became a federal **Superfund** Site in 1983, and EPA and ADEQ have been investigating and cleaning up the site ever since.

Air Force Plant 44 is the largest source of groundwater and soil contamination at this site. The main underground contaminant **plume** from Air Force Plant 44 and the airport has mingled and extended northward.

The entire Tucson International Airport Area (TIAA) Superfund Site encompasses about 10 square miles in the southeast part of Tucson. It includes seven different project areas, the largest being Air Force Plant 44, Tucson International Airport, and Tucson Airport Remediation Project (TARP), known as "Area A". The smaller areas are Texas Instruments, West-Cap, Arizona Air National Guard Base, and West Plume B, which are grouped together and called "Area B".

There are treatment plants at Air Force Plant 44, Tucson International Airport, Tucson Airport Remediation Project, and the Arizona Air National Guard that address VOCs such as TCE. A new treatment plant at Air Force Plant 44 has been added to treat **1,4-dioxane**. Air Force Plant 44 and Tucson International Airport's treatment plants contain the plume and decrease the contaminants, making the water manageable for TARP to clean to drinking water standards and release to the city of Tucson's drinking water supply. Cleanup activities are at different stages at each of the sites.

1, 4-Dioxane

1,4-Dioxane is a secondary contaminant at the TIAA site. Because it is a solvent itself and a stabilizer for other solvents, 1,4-dioxane is a groundwater contaminant at the TIAA site and many other Superfund sites where solvents such as TCE and 1,1,1-**trichloroethane** (TCA) are the primary contaminants of concern.

1,4-Dioxane does not stick to soil particles, so once released to the ground, it moves quickly into groundwater. Because it does not degrade under natural conditions, it remains in groundwater and migrates with it, sometimes moving faster than other contaminants.

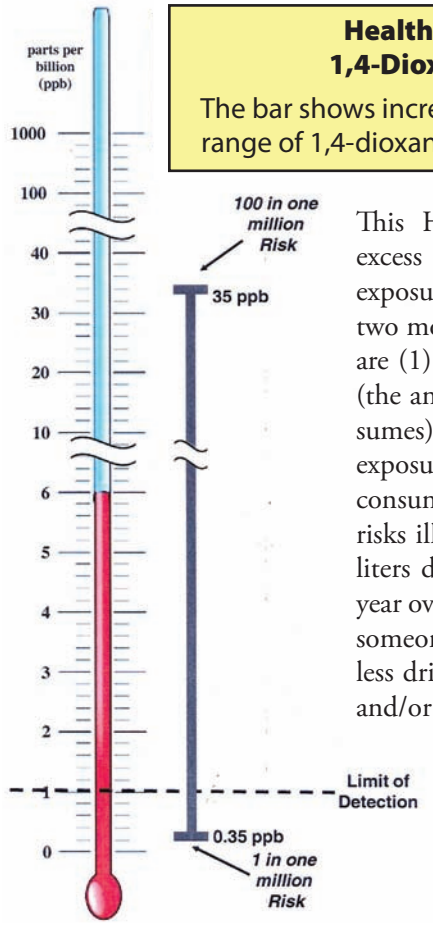
When present at Superfund sites, 1,4-dioxane is a contaminant of concern because it has been shown to cause cancer in laboratory animals and is reasonably anticipated to be a human carcinogen.

EPA Revisions to Toxicity Levels for 1,4-Dioxane

In August 2010, EPA revised its toxicity assessment of 1,4-dioxane and determined that it is a more potent carcinogen than previously believed. As a result, the protective risk range for 1,4-dioxane levels in drinking water was lowered to between 0.35 ppb (parts per billion) and 35 ppb for a lifetime of exposure. Current laboratory procedures limit the ability to detect and measure 1,4-dioxane in drinking to levels of 0.5 to 1 ppb. Since the revised assessment, the Tucson Airport Remediation Project (TARP) has maintained 1,4-dioxane levels in drinking water to about 1 ppb, well within the risk range. Previously levels were held to below 3 ppb (also within the revised risk range).

Health Effects Thermometer
1,4-Dioxane in Drinking Water

The bar shows increased cancer risks associated with a range of 1,4-dioxane concentrations in drinking water.



This Health Effects Thermometer illustrates excess cancer risks associated with a lifetime exposure to 1,4-dioxane in drinking water. The two most important factors that determine risk are (1) the 1,4-dioxane level in drinking water (the amount of 1,4-dioxane that a person consumes) and (2) the frequency and duration of exposure (how often and for how long a person consumes water containing 1,4-dioxane). The risks illustrated here assume consumption of 2 liters drinking water per day for 350 days per year over a 70 year period; risks will be lower for someone consuming lower 1,4-dioxane levels, less drinking water per day or for less frequent and/or shorter exposures.

How can 1,4-dioxane in ground water be treated?

The technology currently being used to treat ground water for TCE at Tucson Airport Remediation Project (TARP), operated by Tucson Water, is not effective in removing 1,4-dioxane. At the present time, Tucson Water is using a blending strategy to lower the 1,4-dioxane concentrations to meet the revised protective risk levels.

EPA and the TIAA Responsible Parties are currently evaluating the extent of the 1,4-dioxane contamination to determine which treatment methods are appropriate for the TIAA Superfund Site. In September 2009, an advanced oxidation process treatment system applying a combination of hydrogen peroxide and liquid ozone was put into operation at Air Force Plant 44. This type of system has been used in several sites around the country with 1,4-dioxane contamination. However, there is a concern that the use of hydrogen peroxide may result in the formation of bromate, which is also a regulated drinking water contaminant.

At the TARP facility, 1,4-dioxane is not being treated, but different options for treatment are currently being examined.

To avoid the formation of bromate, a treatability study is being conducted to evaluate the use of ultraviolet light in place of hydrogen peroxide at TARP. As of October 2011, no final decision has been made on the treatment of 1,4 dioxane for this facility, but it is expected that a final decision will be made in less than a year.

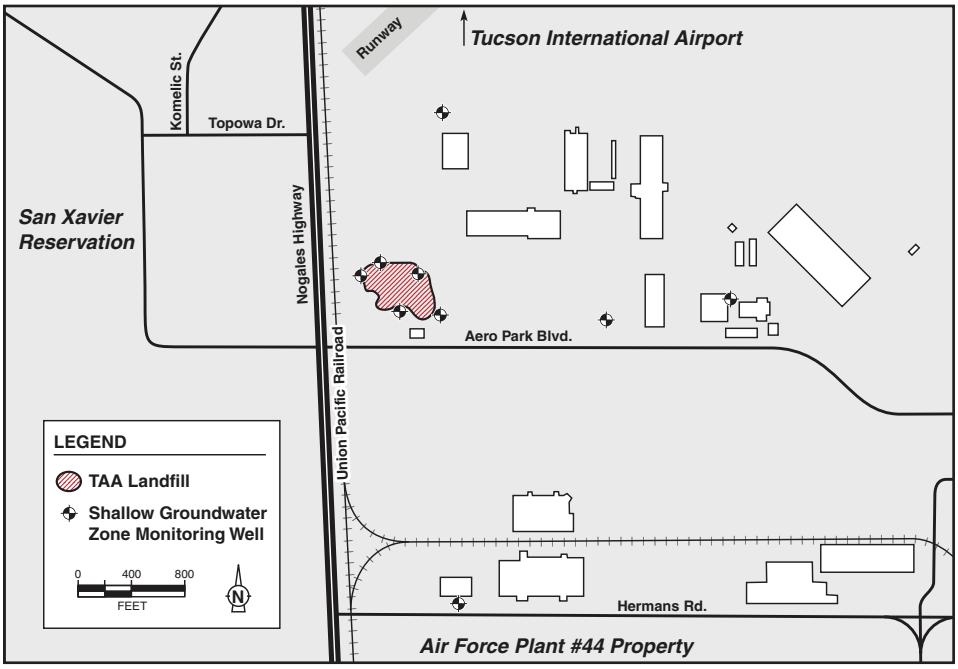


Figure 3: Location of landfill

Landfill Closure at the Tucson Airport Property

In 2011, the Settling Defendants for the Tucson Airport Property completed its construction work associated with the closure of the landfill. The map (above) shows the location of the abandoned landfill. The photos below show the original landfill, the removal of the contents of the landfill, and the final stages of **hydroseeding** on the new soil cap that will allow for natural vegetation to grow at the site. All of this construction work was completed by September 2011 with the final reports associated with the landfill closure expected to be completed by December, 2011.

Tucson International Airport "Area B" Proposed Plan

Area B includes West-Cap, Arizona Air National Guard, and Texas Instruments. Pump and treat systems were used for many years in Area B, and although contamination was reduced, the systems were ineffective in eliminating the shallow groundwater contamination.

Pilot studies were conducted that demonstrate other treatment technologies, such as in-situ chemical oxidation, can be effective in treating the contamination. Therefore, EPA has proposed changing the remedy in Area B in order to achieve the cleanup goal sooner and more effectively.

Using the information from the pilot studies, EPA worked with the Arizona Air National Guard and Texas Instruments to complete a Focused Feasibility Study in 2011. The Focused Feasibility Study compared various alternative treatment technologies to remediate the TCE and perchloroethylene (PCE) in Area B. The document summarizes the projected time to clean up the site and the costs associated with different treatment technologies, such as pump and treat and in-situ chemical oxidation with potassium permanganate.

A Proposed Plan was released and mailed out in late October, 2011, which explains the history of the site and rationale for proposing the change in remedy and sought community input. It is available on the EPA website listed on the last page of this fact sheet. The deadline for public comment was November 30, 2011. A public meeting to solicit comments on the Proposed Plan was held on November 16, 2011.

What's next?

The treatment plant at the Tucson International Airport continues to remove VOC contamination from the groundwater. It has become necessary for Tucson Water to incorporate 1,4-dioxane treatment technology into the TARP facility. Tucson Water is in the process of designing the new 1,4-dioxane treatment system.

Photos of the landfill area before, during and after completion of the landfill, from left to right.

In October 2011, EPA proposed changes to the remedy approach for Area B. EPA recommended that the existing pump & treat technology be replaced by in-situ chemical oxidation for the Arizona Air National Guard (AANG), Texas Instruments facility, and West-Cap facility. EPA believes that cleanup goals could be achieved sooner with the proposed technology. This change in remedial technology would require an amendment to the existing Record of Decision (ROD) for Area B. EPA's decision on whether or not to issue a ROD amendment is expected in March 2012.

Background Information for the TIAA Superfund Site

Air Force Plant 44

Air Force Plant 44 is a U.S. government-owned, contractor operated facility that is currently run by Raytheon Missile Systems Company (formerly known as Hughes Missile Systems Company). In the past the facility used a variety of different chemicals in its industrial process, including TCE as a metals degreaser and chromium in electroplating processes. Hazardous substances generated by plant activities included the following: TCE, **1,1 dichloroethylene** (1,1-DCE), **trichloroethane** (TCA), and **1,4-dioxane**.

A number of actions, including **capping**, excavations and off-site disposal, and **soil vapor extraction**, were performed in the 1990s to address soil contamination. A regional groundwater extraction system and treatment plant addressing the known contaminants of concern began operation in 1987. In addition, the results of on-going studies of **in-situ chemical oxidation** and **biodegradation** of residual soil contamination are being evaluated.

1,4-Dioxane Discovery

The treatment plant, however, does not address **1,4-dioxane**, which was not a known contaminant of concern until 2001. In the early 2000s, improvements in laboratory technology allowed for the detection of 1,4-dioxane down to 1 **part per billion** (ppb). In 2007, after finding 1,4-dioxane in the main groundwater plume, the EPA ordered the Raytheon Company and the Air Force to clean up the 1,4-dioxane contaminating the groundwater at Air Force Plant 44.

The Air Force was required to update its groundwater treatment facility by installing and operating an advanced **oxidation** process (AOP) system to treat 1,4-dioxane and the other contaminants of concern. The 1,4-dioxane contamination entered the groundwater from various sources at the Air Force Plant 44 facility.

The AOP system began fulltime operations in September 2009. The AOP system addresses treatment of all contaminants of concern and also reduces energy usage at the treatment facility. This system replaced the historic **air stripping** towers, once the primary mode of groundwater treatment.

Cleaning up the Shallow Groundwater Zone

The Shallow Groundwater Zone is an area of groundwater on the western side of Air Force Plant 44 that is characterized by higher groundwater levels and contaminant concentrations. The Air Force operated a **dual-phase extraction** system in this area from 1997 to 2008 in an attempt to remove contaminant vapors and contaminated groundwater. This system was effective in removing contaminants in vapor in the **vadose** (or shallow, unsaturated) **zone** but was not a cost-effective cleanup option for groundwater, as contaminant concentrations remained elevated well above cleanup goals after eleven years of operation. Studies to assess the impacts of contamination in the Shallow Groundwater Zone on regional groundwater quality and to evaluate the potential for **in-situ treatment** of contaminants are currently being performed.

Tucson Airport Remediation Project (TARP)

TARP is a treatment facility that manages a 4-mile long, 1-mile wide plume of comingled groundwater contamination from Air Force Plant 44 and the Tucson International Airport Property.

The treatment plant has been in operation since 1994 and utilizes **air stripping** technology and carbon filtration to remove TCE and all other VOCs from groundwater. As of August 2009, 32.75 billion gallons of water have been cleaned and about 4,000 pounds of TCE have been removed. This system provides clean drinking water to approximately 50,000 residents of Tucson (or about 9% of the municipal water supply).

When 1,4-dioxane was identified at the TIAA Site in 2002, it was detected in groundwater at three of the project areas: the Tucson Airport Remediation Project; Air Force Plant 44; and the Airport Property. Since these discoveries, a groundwater plume of 1,4-dioxane contaminated groundwater has been characterized.

Tucson International Airport

At the Tucson International Airport Property (specifically the Three Hangars building off South Susana St.), VOCs were used for airplane modification and engine part degreasing from 1942 to 1958 and disposed of on Airport Property. **Persistent organic chemicals**, such as **polychlorinated biphenyls (PCB's)**, were also used at the site. The Tucson Airport Authority, the City of Tucson, General Dynamics Corporation, and McDonnell Douglas Corporation are responsible for the cleanup of this area, and are referred to as the "Settling Defendants".

In November 2007, the Settling Defendants completed a $5.5 million treatment facility located immediately south of the Three Hangars site. This treatment system brought TCE levels down from over 1600 ppb to approximately 0.5 ppb. This plant treats both soil vapor (through an SVE system) and groundwater (through a pump and treat system). A reinjection well pumps treated water back into the aquifer. As of November 2009, 10,000 pounds of contaminants have been removed by this treatment plant.

West-Cap

The West-Cap site was a former manufacturer of magnets and film capacitors that operated from the early 1960s until the early 1980s. It is believed that industrial solvents containing VOCs and other contaminants were released through floor drains and leaking drainpipes. These disposal practices resulted in the current groundwater contamination at the West-Cap **Operable Unit**. The size of the contamination plume is currently under evaluation. None of the contaminated groundwater is being served as drinking water.

From about 2000 to 2009, a groundwater pump and treat system was operated by EPA. In 2009, EPA began a pilot test for in-situ chemical oxidation treatment. Test results were presented in the Focused Feasibility Study and a Proposed Plan was issued in October 2011. EPA will soon be issuing a Record of Decision for a new remedy at West-Cap.

Texas Instruments

TCE contamination levels at the Texas Instruments facility, (formerly known as Burr Brown), range from non-detectible to 15 ppb with the cleanup goal of 5 ppb. From 1992 to 2009, the contaminated water was extracted, treated, and used in the manufacturing process. In 2009, Texas Instruments closed manufacturing operations in Tucson. With the shutdown of the plant, there was no more need for treated water for the manufacturing operations. This closure leaves 4 active treatment facilities for the TIAA Superfund site. With EPA approval, in October 2009 Texas Instruments initiated an in-situ chemical oxidation treatability study similar to the one at West-Cap. The Texas Instruments information is also included in the EPA Focused Feasibility Study.

A Proposed Plan describing possible new remedies was issued in October 2011. EPA will soon be issuing a Record of Decision for a new remedy at Texas Instruments.

Arizona Air National Guard

Past operations at the Arizona Air National Guard (AANG) such as fueling and aircraft maintenance activities resulted in the release of hazardous waste contaminating the soil and ground water. A soil vapor extraction system operated from 1997 until 1998, when it was shut down after performance goals were met. A groundwater pump and treat system comprised of eleven extraction wells has been operating since 1997.

Since 2006, the AANG has installed eight additional monitoring wells that are used to evaluate the effectiveness of the existing pump and treat system. In 2009, an in-situ chemical oxidation treatability study was implemented and a decrease in TCE concentrations was observed.

Glossary

1,4-dioxane: An organic chemical used as a stabilizer in solvents and for other purposes including cosmetics, detergents, and shampoos; a probable human carcinogen.

Air Stripping: A treatment system that removes volatile organic compounds (VOCs) from contaminated ground water or surface water by forcing a stream of air through the water, causing the compounds to evaporate.

Aquifer: An underground geologic formation containing groundwater.

Biodegradation: The process of microbes naturally breaking down chemicals into non-toxic byproducts.

Capping: Placing an impermeable layer, such as concrete, over waste as a means of containing and minimizing exposure to contaminants.

Carbon Footprint: A way of calculating carbon dioxide emissions from different activities including emissions from the burning of fossil fuels for energy and from the extraction of raw materials to the final manufacturing of a product.

Chromium: A naturally-occurring element found in rocks, animals, plants, and soil.

Dichloroethylene (1,1-DCE): A volatile organic chemical used as a cleaning agent in chemical manufacturing.

Glossary *(Continued)*

Dual phase extraction: a technology that uses a high-vacuum system to remove both contaminated groundwater and soil vapor. As the water table around the well is lowered from pumping, newly drained soil is exposed. Contaminants in this exposed soil zone can be removed by vapor extraction. Use of dual-phase extraction can shorten the cleanup time at a site, because the drained soil is often the most contaminated area.

Groundwater: The water found beneath the Earth's surface that supplies wells and springs.

In-situ Chemical Oxidation/Treatment: The introduction of certain chemicals into the ground that break down harmful chemicals.

Operable Unit (OU): A project or project area at an U.S. EPA Superfund site.

Oxidation: The chemical addition of oxygen to break down pollutants or organic waste.

Perchloroethylene (PCE): Also known as tetrachloroethylene, is a VOC used primarily as a solvent and for dry cleaning; probable human carcinogen.

Persistent organic chemicals: Toxic chemicals that adversely affect human health and the environment around the world and do not break down easily.

Plume: A visible or measurable discharge of a contaminant from a given point of origin, such as in groundwater.

Polychlorinated biphenyls (PCB's): A group of toxic, persistent chemicals used in electrical transformers and capacitors for insulating purposes, and in gas pipeline systems as lubricant. The sale and new use of these chemicals, also known as PCBs, were banned by law in 1979.

Potassium Permanganate: Chemical used in in-situ chemical oxidation to clean pollutants from the water.

Soil vapor extraction: Suction system that removes volatile organic compounds (VOCs), such as gasoline, solvents, and other relatively volatile compounds from the soil. The basic system used to accomplish this consists of a vapor extraction well, or a pipe that extends from the surface down to a depth where the soil is contaminated, coupled with blowers or vacuum pumps, which draw air through the contaminated soil up to the surface via the pipe.

Solvent: A liquid or gas substance that is used for industrial, commercial, and household products, such as paint thinners, nail polish, dry cleaning, and detergents.

Superfund site: A contaminated site that has been placed on the National Priorities List, which is EPA's list of the most serious uncontrolled or abandoned hazardous waste sites identified for possible long-term remedial action under Superfund law.

Tetrachloroethylene (PCE): see Perchloroethylene

Trichloroethane (TCA): A chemical that does not occur naturally in the environment; no longer produced in the U.S.A. because it affects the ozone layer; has many industrial and household uses.

Trichloroethylene (TCE): A VOC used primarily as a solvent to remove grease from metal parts; a probable human carcinogen.

Vadose Zone: Also termed the "unsaturated zone", the subsurface between the land surface and the top of the water table. The pores between sediments in the vadose zone contain both air and water.

Volatile Organic Compounds (VOC): Primarily solvents most commonly used in dry cleaning, machinery de-greasing, and metal plating industries. They evaporate easily once exposed to air and tend to be only partially soluble in water.

Tucson International Airport Area Superfund Site

For More Information

If you are interested in having EPA do a presentation for a group, or have any questions regarding the Tucson Airport Superfund Site, please contact Leana Rosetti (contact information below).

Site Contacts

If you have questions or comments regarding the Tucson International Airport Area Superfund Site, please contact:

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You may also call EPA's toll-free Superfund hotline and leave a message that will be forwarded to the appropriate EPA staff. The hotline number is 1-800-231-3075.

The public information repository for the site can be found at:

Tucson Public Library
El Pueblo
Neighborhood Center
101 W. Irvington
Tucson, AZ 85714
520-791-4733

Web Site

Links to some documents and a general site overview can also be found at: **www.epa.gov/region09/tucsonairport**

Unified Community Advisory Board (UCAB)

The UCAB meets quarterly to discuss site cleanup activities and the public is welcome. The next meeting will be April 18, 2012 in the Activities Room of the El Pueblo Center at 101 W. Irvington Rd., Tucson, 5:45-7:45 pm.

Versión en español adentro

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