



Tucson International Airport Area Superfund Site

U.S. Environmental Protection Agency \$ Region 9 \$ San Francisco, CA \$ September 2008

Background on Tucson Airport Superfund Site

In 1981, the US Environmental Protection Agency (U.S. EPA) and the City of Tucson conducted groundwater sampling and analyzed data from city municipal water wells within the Tucson International Airport Area (TIAA), which covers approximately a ten square mile area. The investigation, which began in 1982, revealed elevated levels of **volatile organic compounds (VOCs)***, including **trichloroethylene (TCE)** and **perchloroethylene (PCE)**, in several south-side City water wells. As a result, these wells were closed for use as public drinking water wells. The TIAA was listed as a Federal Superfund site in 1983.

Subsequent sampling identified a main **plume** of groundwater contamination approximately one-half mile wide and five miles in length (see maps 2 and 3). U.S. EPA and the Arizona Department of Environmental Quality (ADEQ) have been involved in investigations and cleanup activities at TIAA since the initial discovery of VOCs in the groundwater. The Tucson International Airport Area Site (referred to as ‘the Site’) is divided into seven areas (see map 1 for areas). Eleven city drinking water wells and several private household wells have been shut down (the last one was shut down in 1983) as a result of contamination. More information about the Site can be found at the Tucson Public Library, El Pueblo Branch, 101 W. Irvington Road, Tucson, AZ 85714.

Air Force Plant 44: Safe Drinking Water Act Order

Air Force Plant 44 is a government-owned, contractor-operated facility that is operated 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 processes, including TCE (until 1971), as a metal degreaser and chromium in electroplating. Hazardous substances generated by plant activities included the following: TCE, **dichloroethylene (1, 1-DCE)**, **trichloroethane (TCA)** (until 1994), and **1,4-dioxane**, which was a stabilizing additive for TCA. Additional hazardous wastes produced were alcohols, **methyl ethyl ketone (MEK)**, and other **solvents**; used oil and lubricants; waste paint and sludges; and industrial wastewater treatment residue containing metals such as **chromium, cadmium** and **cyanide**.

Please Join Us:

The Unified Community Advisory Board (UCAB) will be hosting a public meeting to discuss new information about the chemical 1,4-dioxane and its impacts on the Tucson public water supply.

Presentations will be given by Ecology and Economics Inc., the City of Tucson’s Department of Water, U.S. EPA, and members of the UCAB.

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Tuesday, October 14, 2008
6:00pm - 7:45pm
Santa Rosa Neighborhood Center
1080 S. 10th Ave
Tucson, AZ 85701



Photo 1: Installation of the advanced oxidation process system at Air Force Plant 44

*Words in **bold** are defined in the Glossary on page 8

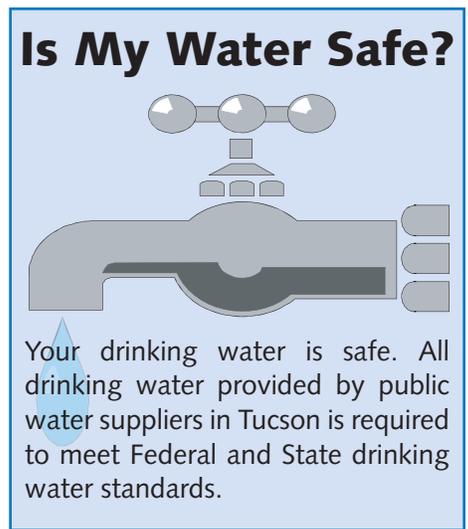
Improvements in technology have allowed for the detection of 1,4-dioxane down to 1 **part per billion (ppb)**. After further investigations, the chemical was discovered at the Tucson Airport Remediation Project's (TARP) plant and later at Air Force Plant 44 and the Airport Property. In July 2007, the U.S. EPA ordered the Raytheon Company and the U.S. Air Force to clean up a migrating plume of groundwater contaminated with 1,4-dioxane at Air Force Plant 44.

Under the order, Raytheon and the U.S. Air Force were required to update its treatment facility for TCE and install and operate an advanced oxidation process (AOP) system to treat 1,4-dioxane (See photo 1). The 1,4-dioxane contamination is entering the groundwater coming from its 1,365-acre Air Force Plant 44 facility, which is part of and located on the southern end of the Site.

In July 2008, the Air Force installed a new system for treating 1,4-dioxane using AOP. The AOP system injects

hydrogen peroxide (H_2O_2) and ozone (O_3) at multiple points into the mixing chamber with the contaminated water. The water and chemicals pass through a mixer to ensure that it is completely combined. The reaction of the water and chemicals together rids the contaminated water of 1,4-dioxane and TCE and converts it to carbon dioxide and water (See Figure 1). The system will begin operating later this year.

The current extraction and treatment system is not effectively containing the contaminated groundwater plume from the Air Force Plant 44 facility, allowing TCE and 1,4-dioxane to migrate north and combine with a separate plume originating at the Tucson International Airport. Without the work directed in the Order, the migrating contaminants could affect TARP's ability to successfully continue treating TCE and managing 1,4-dioxane. TARP treats water that serves approximately 50,000 residents in north Tucson.



Raytheon and the Air Force expect to have the modifications to their treatment facility up and running by late-2008. The technology in the advanced oxidation system has been used at other Superfund sites to treat 1,4-dioxane contamination. The addition of this system will ensure TARP continues to meet its goal of no more than 3 **ppb** of 1,4-dioxane in drinking water and reduces electricity use at the facility. By containing the source area at Air Force Plant 44, EPA anticipates that TARP will continue to maintain 1,4-dioxane below 3 ppb and TCE below 1.5 ppb.

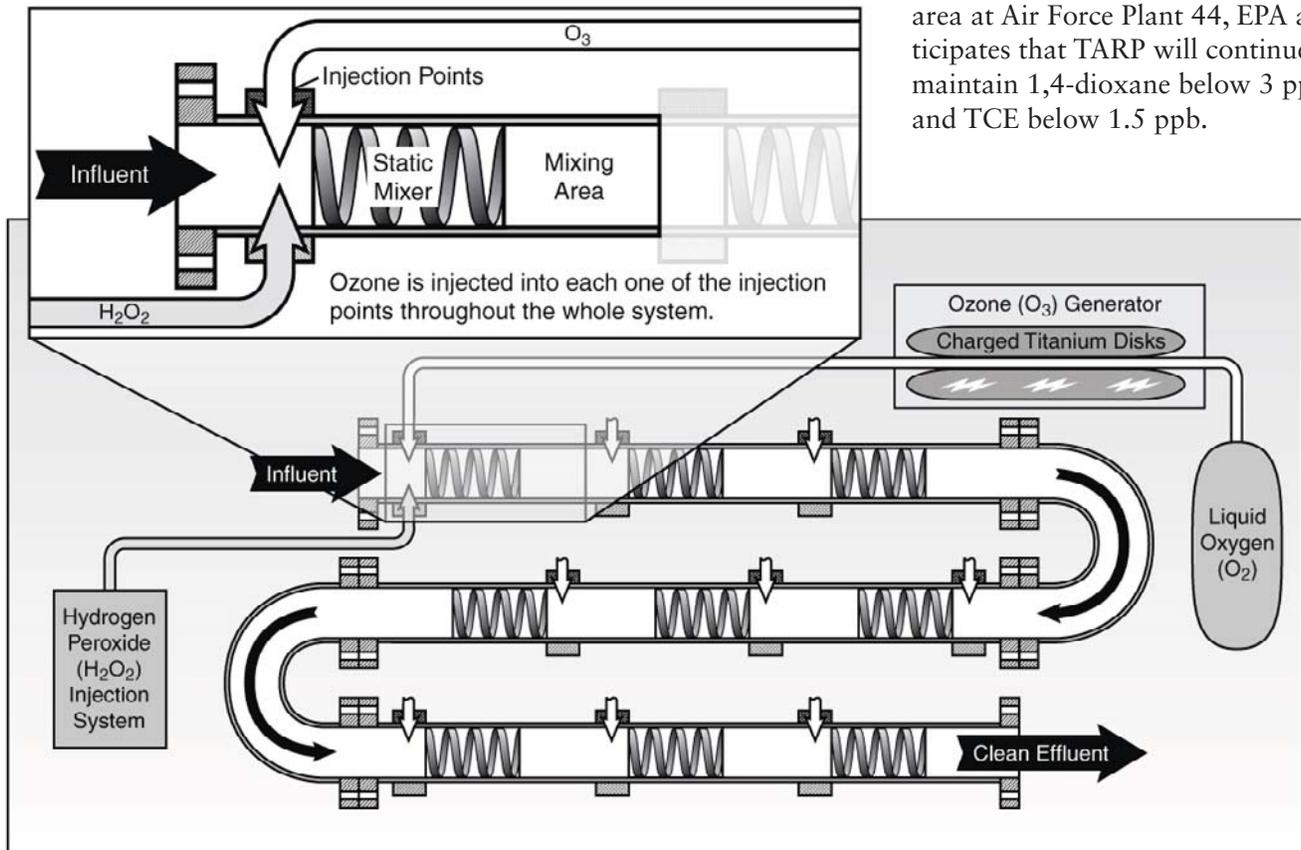


Figure 1: Advanced Oxidation Process System

Tucson Area Remediation Project (TARP)

TARP is a treatment facility responsible for a 4-mile long, 1-mile wide project area where the majority of the Site's contamination is concentrated. The contamination comes from Air Force Plant 44 and the Tucson International Airport property. TARP does not treat any type of soil contamination associated with the Site.

The treatment plant has been in operation since 1994 and utilizes **air stripping** technology and carbon filtration to remove TCE from the groundwater (See photo 2). As of March 2008, 29.5 billion gallons of water have been cleaned and 3,557 pounds of TCE have been removed. This system provides clean drinking water to 50,000 residents of Tucson (about 9% of the municipal water supply).



Photo 2: TARP Treatment Facility

Tucson International Airport

At the Tucson International Airport property (specifically the Airport Three Hangars Area off South Susana St.), chemicals were used for airplane modification and engine part degreasing from 1942 to 1958. During this period, VOCs were used and disposed of on airport property. While TCE was the primary VOC used, other VOCs included **methylene chloride, chloroform, carbon tetrachlorine and benzene**. **Persistent organic chemicals**, such as **polychlorinated biphenyls (PCB's)**, were also used at the site.

University of Arizona's Superfund Basic Research Program (UA SBRP) and US-Mexico Binational Center for Environmental Studies and Toxicology (Binational Center)

Since October 2006, the U.S. EPA has been collaborating with members of the UA SBRP and Binational Center to provide information and answer community questions regarding the TIAA Superfund Site's remediation strategies and the health effects of TCE and 1,4-dioxane. They also serve to support the Unified Community Advisory Board's (UCAB) outreach activities in the community.

The UA SBRP have developed informational materials on TCE and 1,4-dioxane, as well as other materials on contaminants currently confronting the Southwestern region of the United States. Materials are available in both English and Spanish and prepared for people with a technical background (SciTransfer Bulletins) and without a technical background (Informational Materials).

For more information on the UA SBRP, visit: http://superfund.pharmacy.arizona.edu/prof_comm_info.php or contact Monica Ramirez at (520) 260-6620 or ramirez@pharmacy.arizona.edu

For more information on the UA Binational Center, visit <http://binational.pharmacy.arizona.edu/outreach.php> or contact Denise Moreno at (520) 429-1428 or dmoreno@pharmacy.arizona.edu.



Photo 3: SVE System at the Tucson International Airport

Tucson International Airport Continued...

In November 2007, the Tucson International Airport Authority completed the fifth and final major treatment component for the Tucson Airport Superfund Site. The \$5.5 million soil and groundwater treatment facility is located on the southern end of the Three Hangars site (See Picture 3 and 4).

The facility will use 11 extraction wells to treat approximately 34 million gallons of groundwater a year for TCE. This treatment system will bring TCE levels down from over 1600 ppb to approximately 0.5 ppb. A reinjection well will pump up to 100 gallons-per-minute of treated water back into the aquifer. In addition, seven soil vapor extraction wells were installed that will pass the extracted air through three continuous carbon filters. It is expected that over 30,000 pounds of contaminants will be removed in the first year.

The University of Arizona recently was awarded a \$900,000 grant from the Department of Defense environmental research program to perform a four-year research project in the two-acre, **Technical Impractability (TI)** zone of the Airport property. In 1997, the TI zone was considered too complicated to remediate, allowing the Airport Authority to contain the contaminants to the zone. The University of Arizona will investigate this TI Zone to determine how and where the contaminants flow in this area. It is hoped that this research will lead to better ways to contain and remediate in the TI zone.

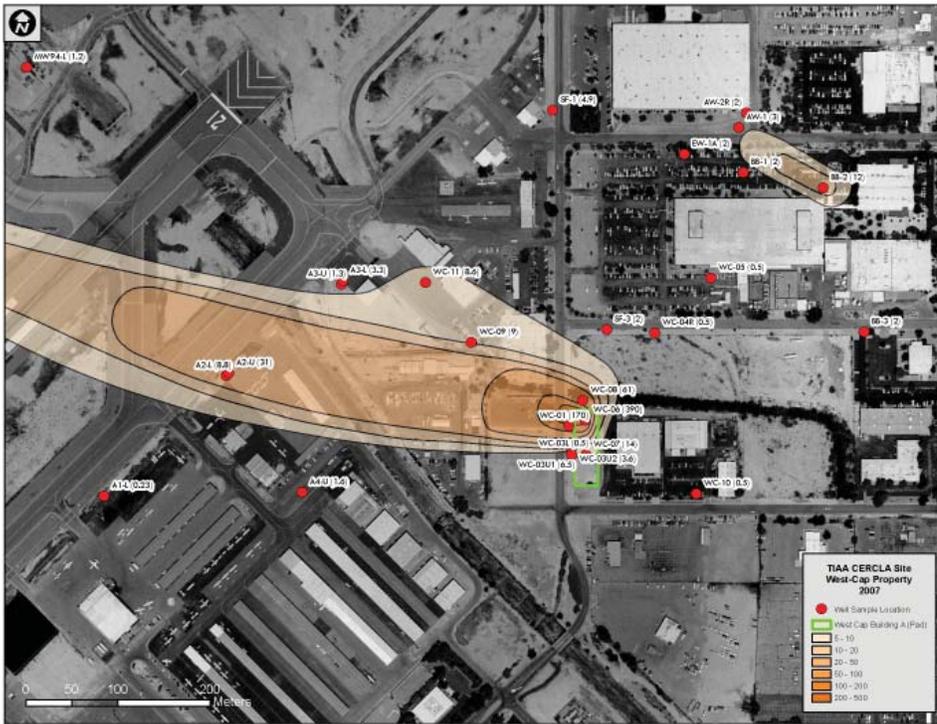
West Cap

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 improper floor drains and leaking drainpipes. These disposal practices resulted in the current groundwater contamination at the West Cap **Operable Unit (OU)**. The size of the plume is approximately 400 feet wide and half a mile long extending under the airport runway with concentrations of the plume ranging from 530 ppb to 49 ppb.

Based on extensive well sampling, U.S. EPA has determined that the groundwater in the West Cap site is contaminated in the Upper Zone of the regional aquifer. Land use around the West Cap OU includes residential, military, aviation, industrial/commercial, undeveloped open space and washes (See map 1). None of the contaminated groundwater is being served as drinking water or pumped for industrial use.



Photo 4: Pump and Treat System at the Tucson International Airport



Map 1: West Cap Sample locations

West Cap Continued...

The U.S. EPA is continuing its work on developing a clean up strategy for treating the contaminated groundwater at the West Cap OU. A six-month treatability study is being designed with a proposed start date in November 2008. This study will evaluate the potential of **in-situ chemical oxidation** using **potassium permanganate** to remediate the TCE and PCE. Currently, the contamination plume is mixing with the AZ National Air Guard's groundwater plume and being captured by its treatment facility just northwest of the site. Using in-situ chemical oxidation will shorten the estimated time for the cleanup and will lessen the overall **carbon footprint** created by the remediation process by saving the energy that would have been required to pump the extraction wells, power the treatment plant, and operate the reinjection well. The chemical oxidation process will complete the remediation process in the subsurface with almost no power requirements.

Arizona Air National Guard

Since 1956, the Arizona Air National Guard (AANG) 162nd Fighter Tactical Group has been used to train fighter pilots from the U.S. and foreign countries. Operations include fueling and aircraft maintenance activities. These activities resulted in the release of hazardous waste contaminating the soil and ground water. The soil extraction system was shut down in 1997 after performance goals were met. The pump and treat system is still operating with eleven extraction wells pumping 116 gallons per minute with the highest concentration of TCE at 8.2 ppb. The contaminated water is treat using **granulated activated carbon** (see photo 5) to non-detect and re-injected in the regional aquifer.

Photo 5: AANG Overview

Since 2006, the AANG has installed eight new monitoring wells that will be used to monitor and assure that all of the contamination is being captured by the existing pump and treat system. In 2007, a Remedial Process Optimization study was conducted at the AANG site, which recommended that an in-situ chemical oxidation treatability study be implemented at the site. In July 2008, U.S. EPA and AANG met and agreed to cooperate in the design and implementation of the two concurrent in-situ chemical oxidation studies expected to start in late 2008.

Texas Instruments

Currently, TCE contamination levels at the Texas Instruments site, (formerly known as Burr Brown), range from not detectable to 15 ppb with the clean up goal of 5 ppb. They are utilizing air stripping technology and carbon filtration to remove TCE from the small groundwater plume underneath their facility. Texas Instruments drilled two new exploratory wells in May 2008 to help them characterize the site better and allow them to consider alternative remediation.

Texas Instruments informed the U.S. EPA in December 2007 that they will be ending their production activities in the Tucson area sometime in 2009. The Agency is working with them to develop a plan for continued treatment of the remaining contaminated groundwater at the site.



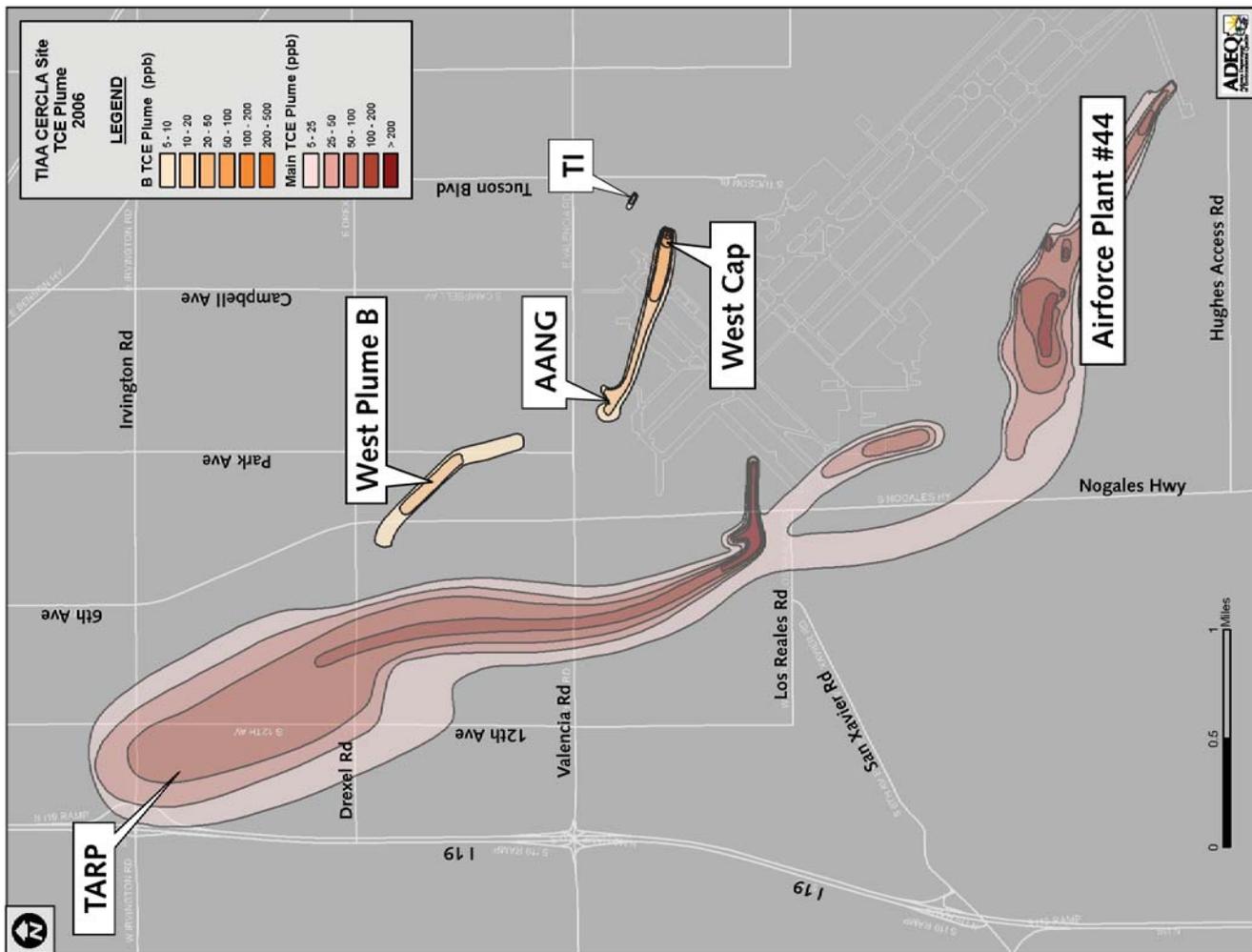


Table 1:
Tucson Airport
Superfund Site
Progress Chart

		Preliminary Assessment/ Site Inspection (PA/SI)	Remedial Investigation (RI)	Feasibility Study (FS)	Record of Decision (ROD)	Remedial Design (RD)	Remedial Action (RA)	Operation and Maintenance (O&M)
AFP # 44 / Raytheon	TCE	12/01/82	11/19/85	11/19/85	11/19/85	3/1987	3/1987	Underway
	1, 4-dioxane	_____	7/13/07	7/13/07	7/13/07	8/11/08	Underway	_____
TARP	TCE	12/01/82	8/22/88	8/22/88	8/22/88	6/05/91	11/07/95	Underway
	1, 4-dioxane	Underway	_____	_____	_____	_____	_____	_____
Tucson International Airport (3 Hangars)		12/01/82	9/30/97	9/30/97	9/30/97	4/28/05	Underway	_____
West Cap		12/01/82	9/30/97	9/30/97	9/08/04	10/17/03	Underway	_____
Arizona Air National Guard (AANG)		12/01/82	_____	_____	_____	5/12/97	9/30/97	Underway
Tucson International Airport/ Burr-Brown (Texas Instruments)		12/01/82	8/22/88	8/22/88	3/16/90	9/12/91	11/09/92	Underway
West Plume B		12/01/82	9/08/04	9/08/04	9/08/04	Underway	_____	_____



Map 3: 2006 Dioxane Plume

Opportunities for Community Involvement!

We encourage community members who are interested in being active participants in the Unified Community Advisory Board (UCAB) to attend their meetings. UCAB is a unique outreach program which involves and empowers the local community as major stakeholders in environmental decisions. These stakeholders (the general public, community activists, University of Arizona, Tucson International Airport, the Air Force, Raytheon, ADEQ, and U.S. EPA) work together to resolve issues, and participate in the cleanup process at the Tucson International Airport Area Superfund Site. They also serve as a hub for the exchange of information among local community members.

The UCAB meetings are open to the public and meet from 6:30-8:30 pm the third Wednesday of the month in January, April, July, and October at El Pueblo Center on 101 W. Irvington Rd. in Tucson. There are no special skills needed to participate and membership is free.

U.S. EPA and ADEQ will continue to update residents on the Tucson Airport Superfund site through fact-sheets, public meetings, and regularly scheduled UCAB meetings. Please feel free to call or write the U.S. EPA or ADEQ using the contact information in this factsheet.

For more information on how to participate in the UCAB, contact José García or Matthew Jefferson. (Contact information on the back of this factsheet)



Glossary

1,4-dioxane: An organic chemical used as a stabilizer in solvents and for other purposes; 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.

Benzene: A widely used chemical formed from both natural processes and human activities.

Cadmium: A heavy metal that accumulates in the environment.

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.

Carbon tetrachlorine: A VOC used as a cleaning solvent and for other purposes.

Chloroform: A colorless, volatile liquid used as a solvent, and in the manufacturing of fluorocarbon refrigerants and plastics; a probable human carcinogen.

Chromium: A naturally occurring element found in rocks, animals, plants, soil, and in volcanic dust and gases.

Cyanide: Chemical usually used in electroplating, metallurgy, organic chemicals production, photographic developing, manufacture of plastics, fumigation of ships, and some mining processes.

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

Granular Activated Carbon: A water treatment technology that uses pure carbon to adsorb pollutants.

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

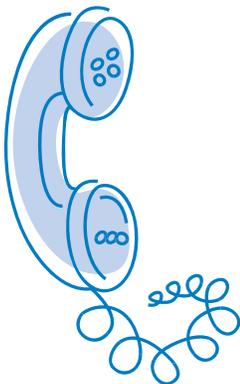
In-situ Chemical Oxidation: The introduction of certain chemicals into the ground in order to make groundwater and/or soil contaminants less harmful.

Methyl Ethyl Ketone (MEK): A substance used in many industrial, commercial, and household products.

Methylene chloride: A chemical that does not occur naturally in the environment and is used as an industrial solvent, paint stripper, and in the manufacture of photographic film and may also be found in some aerosol and pesticide products.

Site Contacts

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



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f (415) 947-3528

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f (415) 947-3528

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**.

Glossary (Continued)

National Priorities List: The U.S. EPA's list of the most serious uncontrolled or abandoned hazardous waste sites identified for possible long-term remedial action under Superfund law. The list is based primarily on the score a site receives from the Hazard Ranking System. U.S. EPA is required to update the NPL at least once a year and a site must be on the NPL to receive money from the Trust Fund for remedial action.

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; e.g., destruction of chemicals such as cyanides, phenols, and organic sulfur compounds in sewage by bacterial and chemical means.

Parts per billion: Units commonly used to express contamination ratios, as in establishing the maximum permissible amount of a contaminant in water, land, or air.

Persistent organic pollutants: Toxic chemicals that adversely affect human health and the environment around the world.

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.

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

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

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

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.

Technical Impracticability (TI) Zone: An area at a Superfund site where the regulators have agreed that restoration to typical clean up standards cannot be achieved using available technology, permitting the owner/operators of the Site to clean up to alternative remedial goals.

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.

Volatile Organic Compounds (VOC): Primarily solvents most commonly used in dry cleaning, machinery degreasing, and metal plating industries.

Site Repositories

El Pueblo Library
101 W. Irvington Rd.
Tucson, AZ 85714
(520) 791-4733

Hours: Mon, Tues: 9 a.m. - 6 p.m.
Wed, Thurs: 10 a.m. - 6 p.m.
Friday: 10 a.m. - 5 p.m.

EPA Superfund Records Center
95 Hawthorne St., 4th Floor
San Francisco, CA 94105
(415) 536-2000

Hours: Mon-Fri : 8 a.m. - 5 p.m.



Visit EPA's web page for the Tucson International Airport Area Site: www.epa.gov/region09/TucsonAirport



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