Health Consultation

NORTH INDIAN BEND WASH
CENTRAL GROUND TREATMENT FACILITY

SCOTTSDALE, MARICOPA COUNTY, ARIZONA

EPA FACILITY ID: AZD980695969

SEPTEMBER 30, 2006

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation
Atlanta, Georgia 30333

Health Consultation: A Note of Explanation

An ATSDR health consultation is a verbal or written response from ATSDR to a specific request for information about health risks related to a specific site, a chemical release, or the presence of hazardous material. In order to prevent or mitigate exposures, a consultation may lead to specific actions, such as restricting use of or replacing water supplies; intensifying environmental sampling; restricting site access; or removing the contaminated material.

In addition, consultations may recommend additional public health actions, such as conducting health surveillance activities to evaluate exposure or trends in adverse health outcomes; conducting biological indicators of exposure studies to assess exposure; and providing health education for health care providers and community members. This concludes the health consultation process for this site, unless additional information is obtained by ATSDR which, in the Agency's opinion, indicates a need to revise or append the conclusions previously issued.

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HEALTH CONSULTATION

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SCOTTSDATE, MARICOPA COUNTY, ARIZONA

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Prepared By:

Arizona Department of Health Services
Office of Environmental Health
Environmental Health Consultation Services
Under Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry

Introduction

The North Indian Bend Wash (NIBW) Superfund site was added to the National Priorities List in 1983. As part of the remediation, the Central Groundwater Treatment Facility (CGTF) was built by several key entities. These entities include, the United States Environmental Protection Agency (US EPA), the State of Arizona (Arizona Department of Environmental Quality –ADEQ and Arizona Department of Water Resources –ADWR), Participating Companies –PC's (Motorola, Inc., GlaxoSmithKline, and SMI Holding LLC), and the City of Scottsdale. The CGTF uses a process called Air Stripping to remove Volatile Organic Compounds (VOC's) from water. The NIBW Community Involvement group has expressed concern regarding the release of VOC's such as trichloroethylene (TCE), perchloroethylene (PCE), and chloroform into the ambient air by this treatment facility. In response, the Arizona Department of Health Services reviewed existing data and prepared a health consultation to evaluate the potentially adverse health effects due to VOC's potentially released by air emissions from the Central Groundwater Treatment Facility.

Background

The Indian Bend Wash Superfund site is located in Scottsdale and Tempe, Arizona in Maricopa County. The site is approximately 13 square miles and has been divided into the North Indian Bend Wash and the South Indian Bend Wash. The NIBW site is bounded by Chaparral Road on the north, the Salt River to the south, the Price Freeway (Loop 101) on the east, and Scottsdale Road on the west. The Central Groundwater Treatment Facility is located at the intersection of Pima Road and Thomas Road at 8650 E Thomas Road in the city of Scottsdale in Maricopa County, Arizona. (See the map in Appendix A). In the area, there are residences, manufacturing facilities, retail outlets, parks, open spaces, golf courses, and waterways. In the same zip code as the CGTF, the population is 37,890. There are 11 schools, 1 hospital, 27 places of worship, 14 commercial day care facilities, and 1 nursing home known to be located the same zip code; however, there are none known to be located within 600 feet of the water treatment facility.

Prior to the existence of our current environmental regulations, local industries disposed of organic solvents directly onto the ground or into dry wells. Various industrial companies took advantage of this practice within the NIBW site up until the 1970's, a practice which subsequently contaminated all three levels of the aquifer. When the solvents traveled through the soil matrix into the underlying aquifers, they contaminated the upper, middle, and lower aquifers with VOC's.

The current levels of VOC's in the groundwater exceed the current water quality standard established by the US Environmental Protection Agency (EPA). MCLs or Maximum Contaminant Levels are enforceable values established by the EPA which are designed for use as a screening tool to look for potential health risks. Currently, four extraction wells supply water to the Central Groundwater Treatment Facility. The raw water quality from these extraction wells is reported quarterly. The sampling monitors the presence of five VOC's: 1,1,1-trichloroethane, 1,1-dichloroethene, chloroform (also called trichloromethane or TCM), tetrachloroethene (also called perchloroethylene or PCE), and Trichloroethylene (TCE).

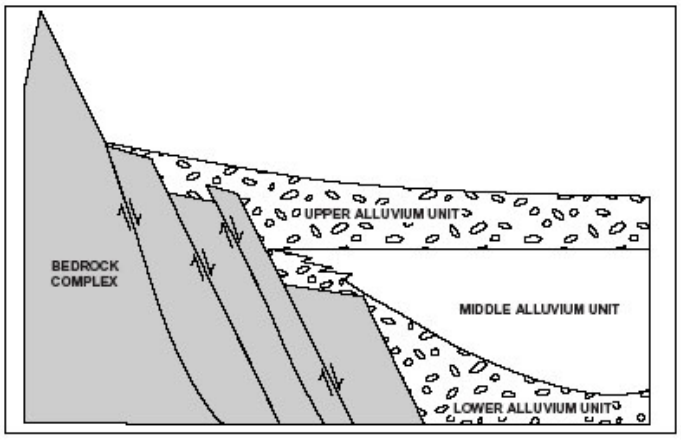

Figure 1. Components of Groundwater Aquifers

Image from EPA's Region 9 April 2001, North Indian Bend Wash North Area Proposed Plan

The CGTF was built to reduce the concentrations of contaminants in the groundwater to below the MCL's. The project began operation in 1994 and was expected to continue for the next 40 years. The air stripper column was designed to remove the NIBW Contaminants of Concern (COCs), as defined by the EPA, to below the MCL's. A tower influent manifold allows water from specific wells to be routed to the air stripper columns. As the water trickles down a medium in the air stripper column, air is forced up from the bottom. The VOC's are transferred from the water to the air in this process. The air, which now contains the contaminants, is passed through Granulated Activated Carbon (GAC) absorption system. The treated air is released into the atmosphere and most of the VOC's are trapped in the carbon filter. Treated water is directed to a clearwell and then either to the Salt River Project irrigation network, or flows by gravity to City of Scottsdale (COS) Reservoir 80. If the water is destined for the COS Reservoir 80, it is disinfected, blended with clean groundwater and/or water purchased from another provider and then pumped into the municipal potable supply network. The following figure is a drawing of an air stripping unit.

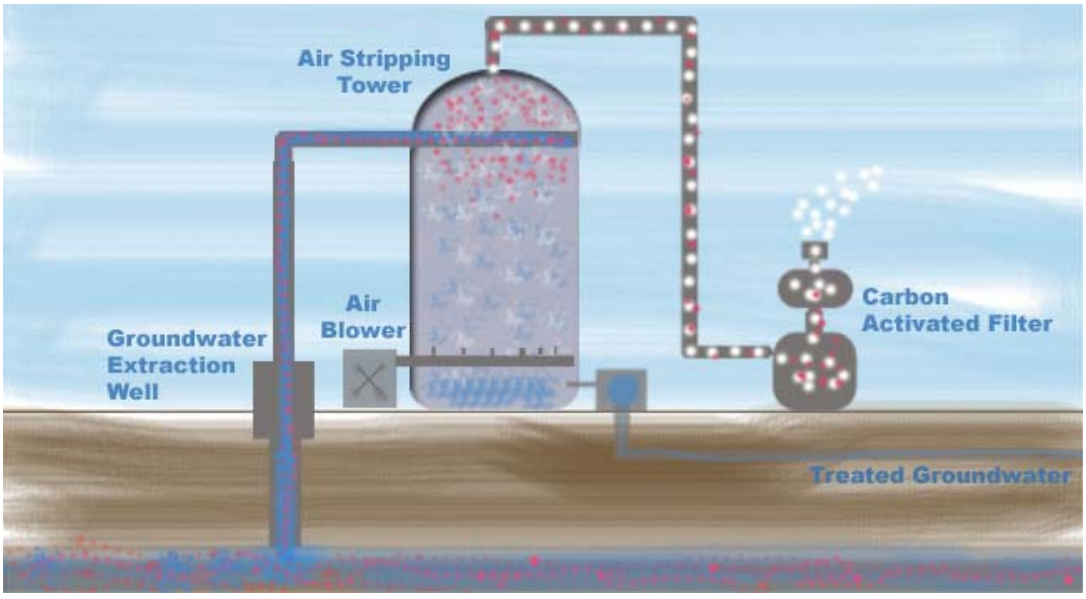

Figure 2. Air Stripping Unit with Granulated Activated Carbon Absorption System

Discussion

Data Collection:

VOC monitoring of the groundwater at the extraction wells, as influent, and as effluent

Groundwater at the CGTF is monitored monthly for VOC's at each extraction well. The only contaminants in the extraction wells that were above the corresponding MCL's were TCE and PCE. In all four quarters of 2004, all four wells of the wells (COS-31, COS-71, COS-72, and COS-75A) had TCE concentrations above the MCL for drinking water. All but one well (COS-31) had PCE concentrations above the MCL for PCE in drinking water. The MCL for both TCE and PCE is 5 ppb in drinking water. The concentration of TCE in the extraction wells ranged from 23 to 210 ppb (5 to 42 times the MCL). The concentration of PCE in the extraction wells ranged from 0.8 to 0.9 in COS-31 and from 4.7 to 16 ppb in wells COS-71, COS-72, and COS-75A. The influent to each of the three air strippers is monitored monthly as well as the effluent. The average VOC concentrations in the influent fluctuate depending on which wells are being pumped to the air strippers. The concentrations of all VOC's are reduced to non-detectable levels in the treated effluent (See Table 1).

VOC monitoring at the stacks

After passing through the carbon filters, air samples from the three air stripping units are collected and evaluated via an EPA certified method called TO-15. In this method, air is pumped into a specially prepared evacuated stainless steel canister. Components of the canister regulate the rate and duration of sampling. The canister valve is then closed and an identification tag is attached, at which point the canister is transported to the laboratory for analysis. The canister is designed to be able to effectively store the sample for up to 30 days. On analysis, a known volume of the sample is concentrated and excess moisture is removed from the air sample. The components of the air sample are separated out via a method called gas chromatography. Each purified separation is then analyzed by mass spectrometry. In mass spectrometry, the sample is scanned, and a computer generates the result in the form of a graph. Every compound has its own characteristic peak, and therefore, the compound can be identified. The intensity of the peak is able to determine the concentration of the compound. The removal efficiencies, shown in Table 1, are based on the concentration of the VOC in the influent and the measurement of the VOC's released to the air from the stacks. VOC's have a removal efficiency of roughly 90%. TCE on average has a slightly higher removal efficiency

Table 1: Concentrations of VOC's in the influent and effluent (ND = non-detect, ppb = parts per billion)

Source	Average TCE concentration (ppb)	Average PCE concentration (ppb)	Average DCE concentration (ppb)	Average TCA concentration (ppb)	Average TCM concentration (ppb)	Average VOC Removal Efficiencies
Contactor 1	378	24	6.68	3.7	9.62	90 %
Contactor 2	383	23.7	6.7	3.7	9.8	92%
Contactor 3	303	21.2	6	3.7	8.0	90%
Effluent	ND	ND	ND	ND	ND	--

VOC monitoring at the perimeter of the site

In February 2005, Ambient Air sampling was collected in the NIBW area. CGTF was sampled from February 14 to February 15, 2005. Four samples were collected on the CGTF property, and four background samples were collected at the intersection of Miller Road and Thomas Road. Samples were collected in approximately 24-hour integrated samples. The sample was collected in a 6-liter evacuated Summa® canister outfitted with an intake flow regulator and vacuum gauge to control for a constant airflow. The samples were collected and analyzed in a similar way as the method mentioned above. The canisters were intended to be at breathing level, and were placed on tables that were about 4 feet high. Local meteorological data (wind speed, wind direction, barometric pressure, temperature, and relative humidity) was collected at each facility. The sampling map and windrose can be found in Appendix B and Appendix C.

The four samples at CGTF were collected one in each cardinal direction (North, South, East, and West). All samples were evaluated for the presence and concentration of the following VOC's: Vinyl chloride, 1,3-Butadiene, 1,1-Dichloroethene, 1,1,2-Trichloro-1,2,2-trifluoroethane, Dichloromethane, 1,1-Dichloroethane, cis-1,2-Dichloroethene, Chloroform, 1,1,1-Trichloroethane, Carbon tetrachloride, Benzene, Trichloroethene, 1,2-Dichloropropane, Tetrachloroethene, and 1,2-Dichlorobenzene. These results can be seen in Table 2.

A Novalynx WS 16 portable weather station was assembled at each facility to collect the meteorological data. These data were recorded on a datalogger at each facility at 15-minute intervals during the 24-hour collection period.

The highest concentrations of TCE in the air were found at the northern and western parts of the facility with concentrations of 0.046 parts per billion (ppb) and 0.065 ppb, respectively. Data from the portable weather station indicates that the wind direction was blowing from the southeast with a maximum speed of 4.0 miles per hour (mph) and an average wind speed of 0.86 mph during the 24-hour collection period (Appendix C).

Exposure Pathways:

Identifying exposure pathways is important in a health consultation, because presence of a contaminant in the environment does not necessarily mean that people are actually coming into contact with that contaminant, thereby allowing the contaminant to be a threat to public health. Exposure pathways have been divided into three categories: Completed, Potential, and Eliminated. There are five elements to be considered when identifying exposure pathways: Source of Contamination, Environmental Medium through which chemicals travel, Point of Exposure, Route of Exposure, and Receptor Population. A completed pathway is observed when all five elements are present. In a Potential Pathway, one or more elements of the pathway cannot be identified, but it is possible that the element might be present or might have been present. In an Eliminated Pathway, at least one element of the pathway is not present and either will never be present or is extremely unlikely to ever be present. Identifying a pathway does not admit the presence or concentration of potential contaminants; it is simply a way of determining the possibility of exposure as if the contaminant were present in the medium.

In the case of the North Indian Bend Wash Central Groundwater Treatment Facility's possible emission of VOC's into the ambient air, the exposure pathway is considered to be a Completed Pathway. The Source of Contamination is the CGTF. The Environmental Medium is the air.

The Point of Exposure is the outdoor ambient air surrounding the CGTF. The Route of Exposure is inhalation. The Receptor Population is the community surrounding the CGTF.

Results:

Table 2 shows the results of the ambient air sampling that was done by CH2M Hill for the EPA, along with the background concentrations for Metropolitan Phoenix. Note: ppb = parts per billion; N/A = Not Available; ND = Non-Detect.

Table 2: Air Sampling Results for CGTF.

Contaminant	**Background Level in Metropolitan Phoenix in 2004** (ppb)	**Average Level at the Intersection** (ppb)	**Average Concentration On-Site** (ppb)	**Non-Cancer Comparison Value (CV)** (ppb)	**Cancer Comparison Value (CV)** (ppb) **& Cancer Class****		**Chemical of Concern?**
Benzene	1.01	0.480	0.303	3[a]	0.03	A	Yes
1,3- Butadiene	0.21	0.076	0.038	0.9[b]	0.01	B2	Yes
Carbon tetrachloride	0.09	0.085	0.084	32[c]	0.01	B2	Yes
Chloroform (TCM)	0.05	0.049	0.060	21[c]	0.008	B2	Yes
Dichloromethane (DCM)	0.31	0.160	0.120	249[c]	0.9	B2	No
Tetrachloroethylene (PCE)	0.18	0.150	0.221	40[c]	N/A	UR	Yes
Trichloroethylene (TCE)	0.025	0.033	0.040	100[a]	UR*	B2	Yes
1,1,2- Trichloro- 1,2,2-trifluoroethane	N/A	0.071	0.072	4000[d]	N/A	UR	Yes
1,1,1-Trichloroethane	0.05	ND	ND	700[a]	N/A	D	No
1,1-Dichloroethene	0.39	ND	0.040	20[a]	N/A	C	No
Vinyl Chloride	0.02	ND	ND	30[a]	0.04	A	No
1,1-Dichloroethane	0.025	ND	ND	126[d]	N/A	C	No
Cis-1,2-Dichloroethene	N/A	ND	ND	N/A	N/A	D	No
1,2-Dichloropropane	0.037	ND	ND	7[a]	N/A	UR	No
1,2-Dichlorobenzene	N/A	ND	ND	26[d]	N/A	D	No

** Cancer Classes

A Human Carcinogen (EPA – 1986 cancer assessment guidelines)
B1 Probable Human Carcinogen – limited human, sufficient animal studies (EPA – 1986 cancer assessment guidelines)
B2 Probable Human Carcinogen – inadequate human, sufficient animal studies (EPA – 1986 cancer assessment guidelines)
C Possible human carcinogen (no human, limited animal studies)
D Not classifiable as to human carcinogenicity
UR Under Review
UR* Under Review-Proposed change: Cancer Slope Factor range from 0.02-0.4 (mg/kg/day)-1

[a] ATSDR's Intermediate Environmental Media Evaluation Guide (EMEG)
[b] EPA's Reference Concentration (RfC): (0.2 ug/m3)
[c] ATSDR's Chronic EMEG
[d] EPA Region 3's Risk Based Concentration (RBC)

Non Cancer Health Effects Evaluation:

A completed exposure pathway has been identified; however, people can be harmed only if they contact a chemical over time and at levels high enough to cause adverse health effects. To determine weather residents in the vicinity of the CGTF were being exposed to contaminants over time and at levels high enough to cause adverse health effects, existing data was reviewed.

The first step after identifying exposure pathways is to determine if the contaminants are present at concentrations that are concerning (above the comparison value). If a contaminant is above the comparison value, it is selected for further analysis. However, if a contaminant is above the comparison value, it does not mean that the contaminant *will* cause adverse health effects. Comparison values are simply used as a screening tool to identify contaminants that should be looked at more closely to determine if there *may* be any adverse health effect risks.

In none of the data available for the Central Groundwater Treatment Facility, were any of the concentrations of VOCs in the air higher than the non-cancer comparison values. Therefore, no contaminant was selected for further evaluation of non-cancer health affects.

For all air samples (On-Site, at the intersection, and in Metropolitan Phoenix), **all contaminants** were below the Non-Cancer Comparison Value. The following comparisons can be made:

- Contaminant that tested higher on-site than both the intersection and background:
  - TCE
  - PCE
  - TCM
  - 1,1-Dichloroethene
- Contaminant that tested lower on-site than the intersection samples, but higher than the background:
  - 1,3-Butadiene
- Contaminants that tested lower on-site than both at the intersection and the background:
  - Benzene
  - Carbon tetrachloride
  - Chloroform
  - Tetrachloroethylene
  - Vinyl Chloride
  - Cis-1,2-Dichloroethene
  - 1,1,1-Trichloroethane
  - 1,2-Dichloropropane
  - 1,2-Dichlorobenzene
- Contaminant that tested higher on-site than at the intersection, but for which background samples were not tested:
  - 1,1,2-Trichloro-1,2,2-trifluoroethane

Cancer Health Effects Evaluation:

Nine VOC's were detected onsite, and seven were selected as chemicals of interest. The Environmental Protection Agency (EPA) assigns a cancer class to various chemicals. If the chemical is a known, probable, or possible human carcinogen, the concentration detected is compared to the Cancer Comparison Value. If the concentration is higher than the Cancer Comparison Value, or if a Comparison Value is not available, than the chemical is selected as a

chemical of interest and is evaluated further. The following chemicals were selected for further evaluation:

1) **Benzene**

The excess lifetime cancer risk due to benzene from inhalation was estimated based on the EPA's inhalation Unit Risk Value. The excess lifetime cancer risk was 7.55 X 10^{-6}. This means that there is a potential increase in excess lifetime cancer of 7.55 cases per 1,000,000 persons. The estimated excess lifetime cancer risks are within the range of the acceptable risk of one excess case in 10,000 to one in 1,000,000, defined by the U.S. EPA.

After review of available exposure and health effect data, the Arizona Department of Health Services determined that detected Benzene levels in the air samples on site do not pose a public health hazard for cancer effects.

2) **1,3 – Butadiene**

The excess lifetime cancer risk due to 1,3 – butadiene from inhalation was estimated based on the EPA's inhalation Unit Risk Value. The excess lifetime cancer risk was 2.52 X 10^{-6}. This means that there is a potential increase in excess lifetime cancer of 2.52 cases per 1,000,000 persons. The estimated excess lifetime cancer risks are within the range of the acceptable risk of one excess case in 10,000 to one in 1,000,000, defined by the U.S. EPA.

After a review of available exposure and health effect data, the Arizona Department of Health Services determined that detected 1,3 – Butadiene levels in the air samples on site do not pose a public health hazard for cancer effects.

3) **Carbon Tetrachloride**

The excess lifetime cancer risk due to carbon tetrachloride from inhalation was estimated based on the EPA's inhalation Unit Risk Value. The excess lifetime cancer risk was 7.93 X 10^{-6}. This means that there is a potential increase in excess lifetime cancer of 7.93 cases per 1,000,000 persons. The estimated excess lifetime cancer risks are within the range of the acceptable risk of one excess case in 10,000 to one in 1,000,000, defined by the U.S. EPA.

After review of available exposure and health effect data, the Arizona Department of Health Services determined that detected carbon tetrachloride levels in the air samples on site do not pose a public health hazard for cancer effects.

4) **Chloroform (TCM)**

The excess lifetime cancer risk due to Chloroform from inhalation was estimated based on the EPA's inhalation Unit Risk Value. The excess lifetime cancer risk was 6.74 X 10^{-6}. This means that there is a potential increase in excess lifetime cancer of 6.74 cases per 1,000,000 persons. The estimated excess lifetime cancer risks are within range of the acceptable risk of one excess case in 10,000 to one in 1,000,000, defined by the U.S. EPA.

After review of available exposure and health effect data, the Arizona Department of Health Services determined that detected TCM levels in the air samples on site do not pose a public health hazard for cancer effects.

5) **Tetrachloroethylene (PCE)**

The level of PCE measured at the site is typical for metropolitan Phoenix, so there is no additional risk attributable to this site. The EPA's inhalation Unit Risk Value for PCE is currently under review, so no quantitative risk can be assigned from the concentration

detected at the site. Therefore, the Arizona Department of Health Services classifies PCE as an indeterminate public health hazard for cancer health effects.

6) **Trichloroethylene (TCE)**

The level of PCE measured at the site is typical for metropolitan Phoenix, so there is no additional risk attributable to this site. The EPA's inhalation Unit Risk Value for TCE is currently under review, so no quantitative risk can be assigned from the concentration detected at the site. Therefore, the Arizona Department of Health Services classifies TCE as an indeterminate public health hazard for cancer health effects.

7) **1,1,2 – Trichloro 1,2,2 – trifluoroethane**

Background levels for 1,1,2-Trichloro 1,2,2 – trifluoroethane are not available for metropolitan Phoenix, and are not available in EPA's AirData database. The EPA's inhalation Unit Risk Value for 1,1,2 – Trichloro 1,2,2 – trifluoroethane is currently under review, so no quantitative risk can be assigned from the concentration detected at the site. Therefore, the Arizona Department of Health Services classifies 1,1,2 – Trichloro 1,2,2 – trifluoroethane as an indeterminate public health hazard for cancer health effects.

Conclusions

Regarding the following VOC's: Vinyl chloride, 1,3-Butadiene, 1,1-Dichloroethene, Dichloromethane, 1,1-Dichloroethane, cis-1,2-Dichloroethene, Chloroform, 1,1,1-Trichloroethane, Carbon tetrachloride, Benzene, 1,2-Dichloropropane, and 1,2-Dichlorobenzene and based on the data presented in this report, and the current functionality of the Central Groundwater Treatment Facility, the facility poses **no apparent public health hazard for cancer or non cancer health effects** at this time.

Regarding the following VOC's: 1,1,2-Trichloro-1,2,2-trifluoroethane, Trichloroethene, Tetrachloroethene, and based on the data presented in this report, and the current functionality of the Central Groundwater Treatment Facility, the facility poses **no apparent public health hazard** for non cancer health affects, but **an indeterminant public health hazard** for cancer health effects at this time.

Recommendations

The Arizona Department of Health Services has the following recommendation:

- Continued monitoring of the ambient air to determine if future actions are required to avoid exposures to the VOCs.

Public Health Action Plan

- The Arizona Department of Health Services will continue to review and evaluate data provided for this site
- The Arizona Department of Health Services will notify the property owners in the area of the findings of this health consultation.

References

CH2M Hill 2005. Technical Memorandum. Prepared for the U.S. Environmental Protection Agency. NIBW Ambient Air Sampling Results from the February 14 to February 19, 2005 Air Sampling Event, April 12, 2005.

EPA 2005. AirData: Access to Air Pollution Data. EPA'S database on air pollution. Available at: www.epa.gov/air/data/. Last accessed on January 18, 2006.

EPA 1999. Compendium of Methods for Toxic Organic Air Pollutants. Pp. 15-1 to 15-4.

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Office of Regional Operations, Region IX
Office of the Assistant Administrator

Certification

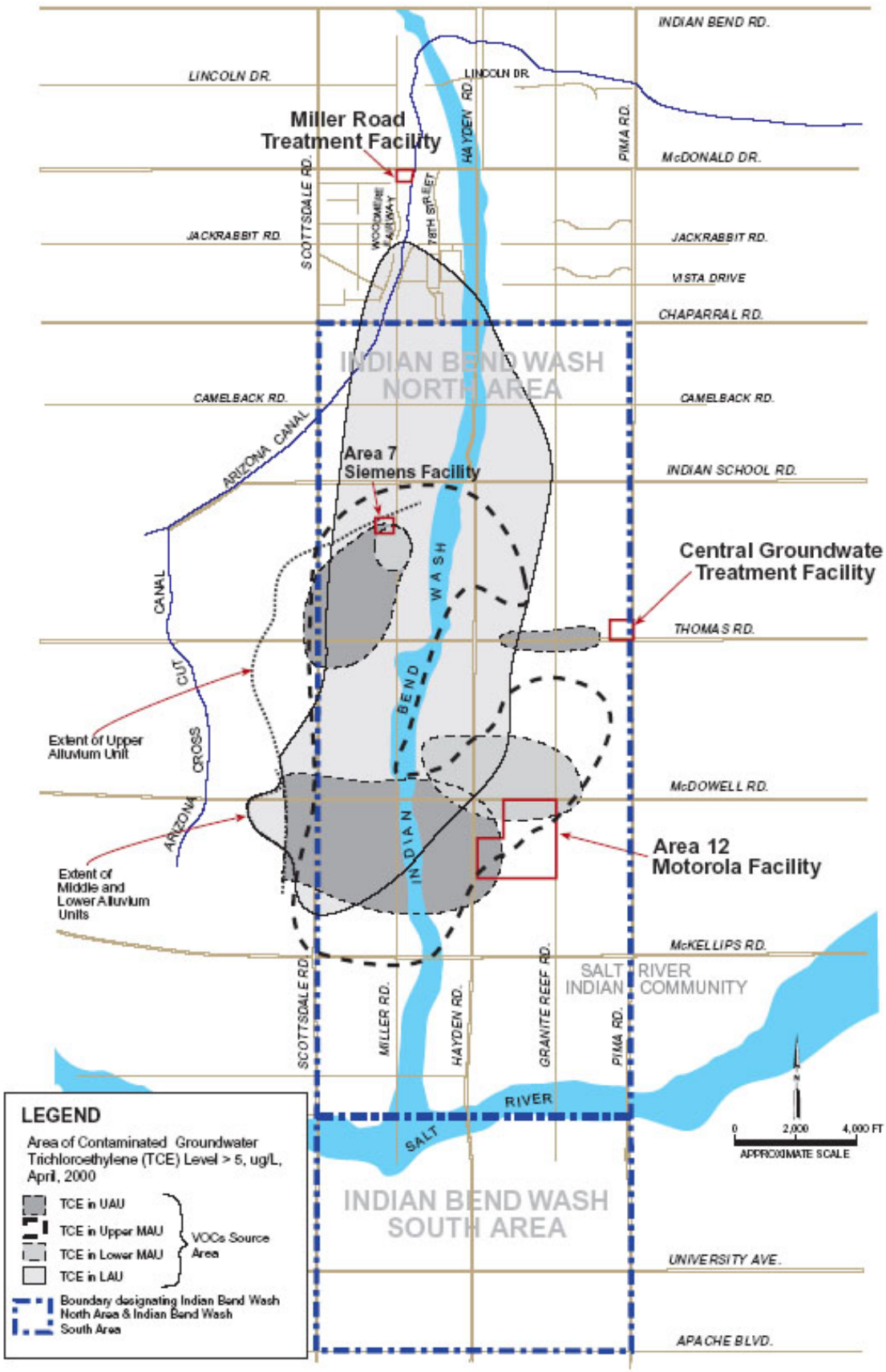
This North Indian Bend Wash Central Groundwater Treatment Facility Public Health Consultation was prepared by the Arizona Department of Health Services under a cooperative agreement with the federal Agency for Toxic Substances and Disease Registry (ATSDR). It was completed in accordance with approved methodologies and procedures existing at the time the health consultation was initiated. Editorial review was completed by the Cooperative Agreement partner.

Technical Project Officer, CAT, SPAB, DHAC

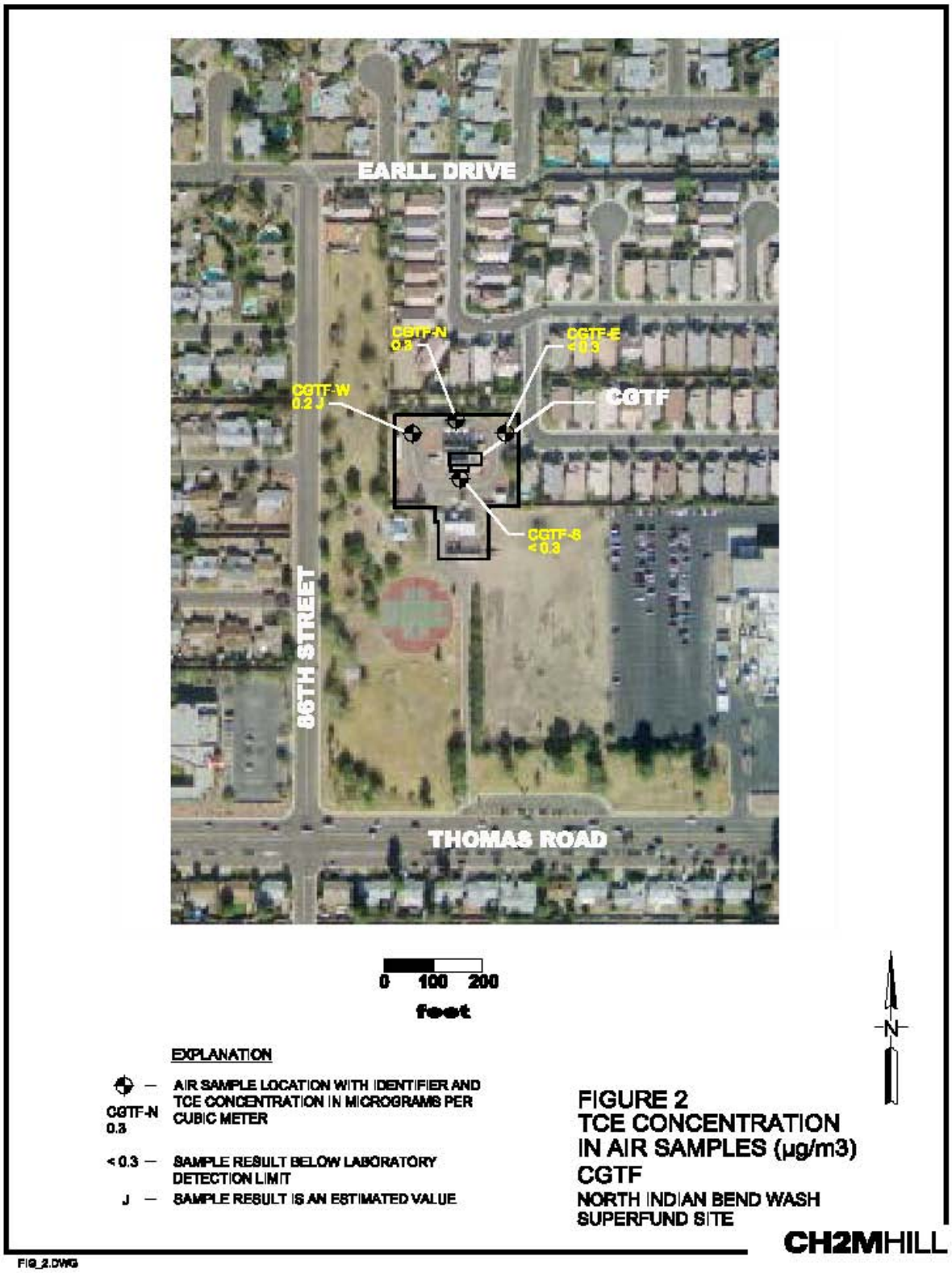
The Division of Health Assessment and Consultation (DHAC), ATSDR, has reviewed this health consultation and concurs with its findings.

Team Lead, CAT, SPAB, DHAC, ATSDR

APPENDIX A

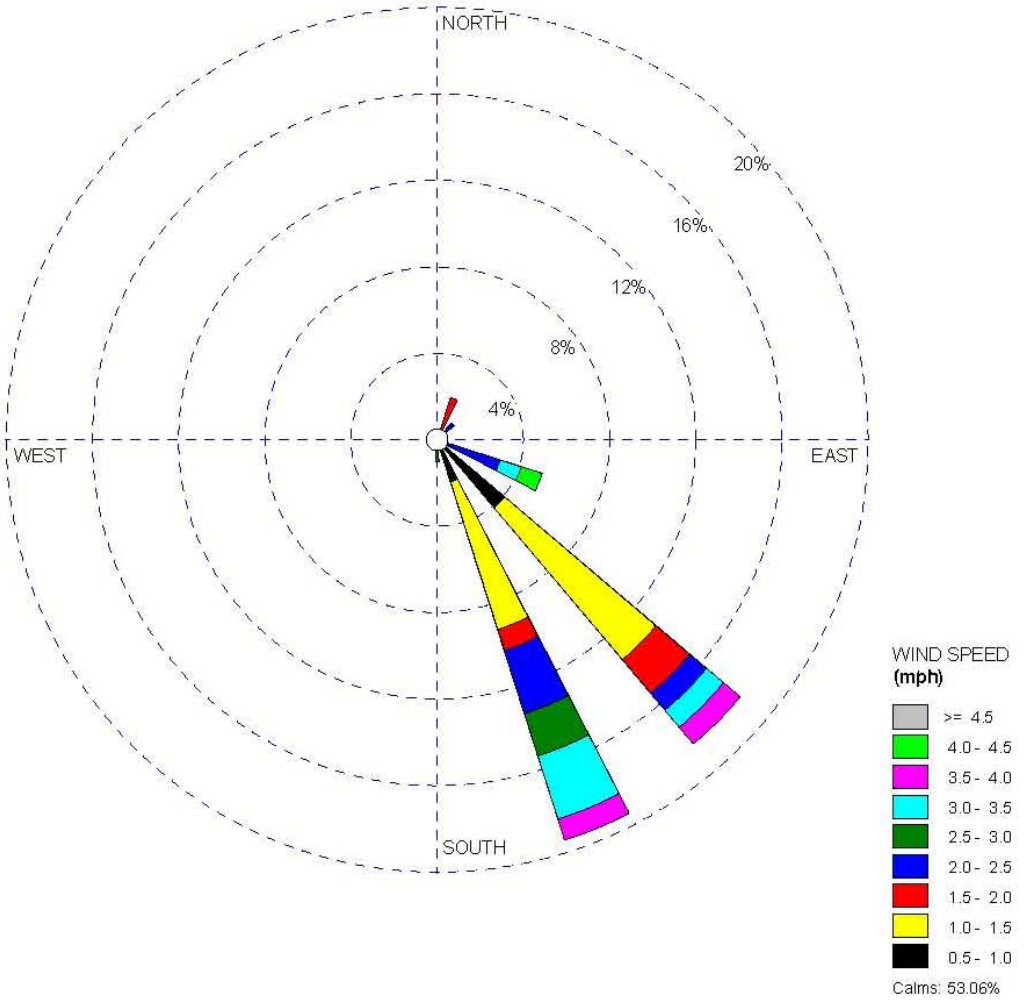

INDIAN BEND RD.
LINCOLN DR.
LINCOLN DR.
Miller Road
Treatment Facility
HAYDEN RD.
PIMA RD.
McDONALD DR.
SCOTTSDALE RD.
JACKRABBIT RD.
JACKRABBIT RD.
VISTA DRIVE
CHAPARRAL RD.
INDIAN BEND WASH
NORTH AREA
CAMELBACK RD.
CAMELBACK RD.
ARIZONA CANAL
Area 7
Siemens Facility
INDIAN SCHOOL RD.
Central Groundwate
Treatment Facility
THOMAS RD.
CUT
CROSS
Extent of Upper
Alluvium Unit
McDOWELL RD.
Extent of
Middle and
Lower Alluvium
Units
Area 12
Motorola Facility
McKELLIPS RD.
SALT RIVER
INDIAN COMMUNITY
SCOTTSDALE RD.
MILLER RD.
HAYDEN RD.
GRANITE REEF RD.
PIMA RD.
RIVER
SALT
0
2,000
4,000 FT
APPROXIMATE SCALE
INDIAN BEND WASH
SOUTH AREA
UNIVERSITY AVE.
APACHE BLVD.
LEGEND
Area of Contaminated Groundwater
Trichloroethylene (TCE) Level > 5, ug/L,
April, 2000
TCE in UAU
TCE in Upper MAU
TCE in Lower MAU
TCE in LAU
VOCs Source
Area
Boundary designating Indian Bend Wash
North Area & Indian Bend Wash
South Area

APPENDIX B


EARLL DRIVE
CGTF-N
0.3
CGTF-E
< 0.3
CGTF-W
0.2 J
CGTF
CGTF-S
< 0.3
86TH STREET
THOMAS ROAD
0 100 200
feet
N
EXPLANATION
AIR SAMPLE LOCATION WITH IDENTIFIER AND TCE CONCENTRATION IN MICROGRAMS PER CUBIC METER
CGTF-N 0.3
< 0.3 — SAMPLE RESULT BELOW LABORATORY DETECTION LIMIT
J — SAMPLE RESULT IS AN ESTIMATED VALUE
FIGURE 2
TCE CONCENTRATION
IN AIR SAMPLES (µg/m3)
CGTF
NORTH INDIAN BEND WASH
SUPERFUND SITE
CH2MHILL
FIG_2.DWG

APPENDIX C

WIND ROSE PLOT:	DISPLAY:
CGTF	**Wind Speed** **Direction (blowing from)**



COMMENTS:		COMPANY NAME:	
		MODELER:	
	CALM WINDS: **53.06%**		
	AVG. WIND SPEED: **0.86 mph**	DATE: **03/31/2005**	PROJECT NO.:

WRPLOT View - Lakes Environmental Software