Health Consultation

PELICAN BAY – PUBLIC WATER SYSTEM
PELICAN BAY, TARRANT COUNTY, TEXAS

EPA FACILITY ID: TXN000605649

JUNE 28, 2005

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.

You May Contact ATSDR TOLL FREE at
1-888-42ATSDR
or
Visit our Home Page at: http://www.atsdr.cdc.gov

HEALTH CONSULTATION

PELICAN BAY – PUBLIC WATER SYSTEM
PELICAN BAY, TARRANT COUNTY, TEXAS

EPA FACILITY ID: TXN000605649

Prepared by:

The Texas Department of State Health Services
Under Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry

Table of Contents

Purpose

The US Environmental Protection Agency (EPA) requested that the Texas Department of State Health Services (DSHS) investigate potential health risks associated with chemicals found in drinking water wells serving residents of Pelican Bay, Tarrant County, Texas. The DSHS Exposure Assessment and Surveillance Group, under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR), reviewed analyses of samples collected from public water supply, and privately owned residential, groundwater wells in the city of Pelican Bay to assess exposure to these chemicals. (Note: Appendix A provides a listing of abbreviations and acronyms used in this report).

Background

Site Description and History

Pelican Bay is located in Tarrant County. It lies northwest of Fort Worth, Texas and along the western side of Eagle Mountain Lake. The 9,200 acre lake is a drinking water source for other north Texas communities and is popular for recreational fishing [1]. The 2004 census estimate reports that 1,750 residents live within the 0.6 square mile city [2].

On July 30, 2004, the public drinking water section of the Texas Commission on Environmental Quality (TCEQ) notified the US EPA Region 6 of a contaminated aquifer affecting drinking water in the city of Pelican Bay. Water samples from 3 Pelican Bay Public Water System (PWS) wells and 4 private residential wells contained trichloroethene (TCE) at levels which exceeded health protective risk standards. The TCEQ and EPA determined there was a human health threat from drinking the water from wells contaminated with high levels of TCE. On August 9, 2004, the TCEQ met with the area residents to provide sampling data results and to discuss potential health risks. As a temporary protective measure, the EPA began supplying bottled water to affected residents from August 10, 2004 through February 25, 2005. The TCEQ installed filtration systems on affected wells to remove contaminants from the groundwater. Additional samples are being collected by the TCEQ to identify the contamination source and determine where the plume is migrating [3]. The treated well water is routinely tested to ensure that the well filtration systems are operating properly [4].

Sources of Area Drinking Water

The Pelican Bay PWS, ID #2200164, has 13 groundwater wells that are used as drinking water sources for 1,470 people. Nearby Camp Timberlake, a Girl Scouts of America camp (PWS ID #2202205), has 3 groundwater water wells and serves a transient/non-community population of 200 people [5].

EPA Region 6 requested that TCEQ conduct a Preliminary Assessment/Site Screening Inspection (PA/SSI) of the Pelican Bay Public Water System. The purpose of the PA/SSI was to gather information to determine if the site might be eligible for possible cleanup through the National Priorities List (NPL) Superfund Program. The PA/SSI found that from 0 to ¼ mile of the site are 2 private water wells and 13 public water supply wells (Pelican Bay). From ¼ to ½ mile of the site are 5 private water wells and 1 public water supply (Camp Timberlake). From ½ to 1 mile there are no public water supply wells and an unknown number of private wells [6].

The Pelican Bay site has 3 contaminated groundwater plumes originating from unknown sources. The first plume is near Jason Court. Public water supply wells 12 and 13, drilled in February 1994, are considered to be in the central part of the plume. In May 1995, the Texas Natural Resource Conservation Commission (TNRCC), now TCEQ, directed the Pelican Bay Utility Company to plug wells 12 and 13, as the wells were not developed according to public drinking water standards. These wells have since been approved for use (January 2000) and have been designated as center of the site until further data is collected. According to the TCEQ Water Utility Database, wells 12 and 13 are inactive [5]. A second plume is suspected in the area of Marina Drive. Wells 6 and 10, drilled in June 1989, supply water at this location. A third plume is suspected in the vicinity of 1713 Pelican Oval (wells 5, 7, 8, and 9). Local businesses include a gasoline station, a convenience store/gasoline station, and a wrecker service/auto repair shop. These businesses are within a ¼ to ½ mile from wells 12 and 13 [6].

Community Health Concerns

A resident expressed a concern that the contaminants in the groundwater contributed to the development of pulmonary fibrosis. Pulmonary fibrosis is the gradual scarring and thickening of the lung tissue between the alveoli (air sacs). The scarring impairs the lungs' ability to transfer oxygen into the blood. The symptoms, dyspnea (shortness of breath) and dry cough, develop slowly over many months or years. Some of the conditions which cause pulmonary fibrosis include: inhaling asbestos fibers (asbestosis), inhaling silica dust (silicosis), sarcoidosis (an inflammatory disease frequently found in the lungs), scleroderma (hardening and scarring of the skin and connective tissues), rheumatoid arthritis (affecting the lungs), and smoking [7]. No information was found in literature associating the site contaminants with pulmonary fibrosis.

Discussion

Introduction

To assess the potential health risks associated with the contaminants found in the groundwater, each contaminant was compared with its specific health-based assessment comparison (HAC) value. The HAC values are guidelines for levels of chemicals in specific environmental media (soil, water, and air) that are considered safe for human contact. Because many of the assumptions used to calculate HAC values are conservative with respect to protecting public health, exceeding a HAC value does not necessarily mean that adverse health effects will occur, but it does mean that the contaminant warrants further consideration.

DSHS compared the concentrations of chemicals in the groundwater with the EPA's maximum contaminant levels (MCLs). In 1974, the U.S Congress passed the Safe Drinking Water Act. This law required the EPA to determine safe levels of chemicals in drinking water. The EPA has set the MCL of 5 parts per billion (ppb) for TCE and 70 ppb for DCE. The MCLs are partially based on the ability of public water systems to detect and remove contaminants, given present technology and resources. The EPA believes the MCL is the lowest level to which water systems can reasonably be required to remove the contaminant if present in drinking water. MCLs are the maximum allowable concentration for specific chemicals in public drinking water. We often use

them as a guide in assessing the potential health implications because they are considered protective of public health over a lifetime exposure of 70 years.

This health consultation specifically evaluated groundwater sampling data collected from the city of Pelican Bay public water supply wells (August 1994 – July 2004) and private residential wells (June – September 2004). These samples were analyzed for volatile organic compounds (VOCs). The purpose of the sampling was to document the presence and extent of chemical contamination. The DSHS and ATSDR relied on the information provided in the referenced documents and assumed that adequate quality assurance/quality control (QA/QC) procedures were followed with regard to data collection, chain-of-custody, laboratory procedures, and data reporting.

DSHS reviewed results for 11 groundwater samples collected from six Pelican Bay Public Water System (PWS) wells during August 1994 – August 2004. These six wells and respective locations are: wells 7, 8 and 9 at 1713 Pelican Oval; well 10 at 92 Acres; and wells 12 and 13 at 1653 Jason Court [5].

Of the 11 samples collected from the PWS wells during this 10-year period, three samples from well 12, and two samples from well 13, exceeded the MCL (5 ppb) for TCE. The levels of TCE reported for these two PWS wells ranged from 4.2 to 46 ppb. Wells 12 and 13 are no longer active [5]. In the other PWS wells, TCE was not detected. None of the 11 samples from the six PWS wells exceeded the MCL for DCE (70 ppb). DCE concentrations ranged from not detected to 5 ppb [Table 1].

DSHS also reviewed results for 39 groundwater samples collected from residential wells at 24 addresses. EPA/TCEQ collected these samples during June - September 2004. TCE and DCE concentrations in these well samples ranged from not detected to 644 ppb and from 2.53 to 531 ppb, respectively. Residential groundwater wells exceeding the MCL for TCE or DCE were offered installation of filtration units. Ten such filter units have been installed to date. One filtration unit was declined by the homeowner because the well (TCE - 6 ppb) is only used to fill a swimming pool. Nine residences have been provided with bottled water by EPA. The one residence which was provided a filtration system but not bottled water, uses their well for irrigation purposes only.

Additional sampling was conducted to verify the effectiveness of the filtration system installed on the private wells. Laboratory analysis of samples collected after the water goes through the first filtration unit verified that the unit was removing TCE (not detected to 1.81 ppb) and DCE (not detected to 4.57 ppb). TCE and DCE results for all samples collected after passing through the first filtration unit were below the respective MCLs. Analysis of samples after the second filtration unit did not detect any chemical contamination [Table 2].

Toxicologic Evaluation

Trichloroethene (TCE)

TCE is used mainly to remove grease from metal parts. It is also an ingredient in adhesives, paint removers, typewriter correction fluids, and spot removers. It may get into the air through the use

of these products or by showering with TCE-contaminated water. TCE does not readily dissolve in water and yet it can remain in groundwater for a long time. It quickly evaporates from surface water. In soil, TCE does not evaporate as readily as from surface water, and it adheres to soil particles for a long time. Plants and animals do not have a significant buildup of TCE [8].

Exposure to TCE can result by breathing contaminated air, showering with contaminated water, or by using household products containing TCE (spot removers and metal degreasers). Breathing small amounts of TCE can cause headaches, lung irritation, dizziness and poor coordination. Inhaling large amounts of TCE may impair the heart, cause unconsciousness, nerve, kidney, and liver damage. Ingestion of contaminated water and dermal contact from contaminated soil also can result in exposure. Drinking large amounts of TCE may impair heart function, cause nausea, result in unconsciousness, damage the liver or cause death. Dermal (skin) contact may cause rashes. Recent TCE exposures can be detected in breath, blood, or urine [8].

Evidence of increased cancer was found in people exposed to high levels of TCE over a long period of time. The National Toxicology Program (NTP) determined that TCE is "reasonably anticipated to be a human carcinogen." The International Agency for Research on Cancer (IARC) determined that TCE is "probably carcinogenic to humans"[8].

In 1997, ATSDR documented human exposures to TCE, PCE and 1,2-DCE in drinking water systems at Camp Lejeune over a period of 34 months, but which likely occurred for up to 30 years (9). In 1998, ATSDR completed a study at Camp Lejeune which found a link between babies exposed in the womb to drinking water contaminated with multiple volatile organic compounds and cases of infants born weighing less than the 10^{th} percentile (10). Whether multiple VOCs in drinking water trigger this, or other problems, remains unclear. ATSDR initiated a study in 2005 to further study whether children exposed *in utero* had increased risk for certain health effects including: spina bifida, anencephaly (absence of all or a major part of the brain), cleft lip, cleft palate, childhood leukemia or childhood non-Hodgkin's lymphoma (11).

cis-1,2-Dichloroethene (DCE)

DCE is used to produce solvents. It breaks down slowly in groundwater and evaporates quickly from soil and surface water. Once in the air, DCE takes about 5-12 days to break down [12].

Exposure pathways for DCE are inhalation, ingestion, and dermal contact. These exposures occur during cooking, bathing, washing dishes, or showering with the contaminated water. Breathing high levels of DCE may cause drowsiness, nausea or death. The potential long term human health effects from breathing air with low concentrations of DCE are not known. Animals exposed to high levels of this chemical had liver, heart, and lung damage. Animals that have ingested large amounts of DCE died. Animals ingesting low amounts of DCE experienced decreased numbers of red blood cells and effects on the liver. An animal study indicated that an exposed fetus may not grow as rapidly as a non-exposed one. DCE exposures can be detected in breath, blood, or urine. These tests are not routinely used since the resultant breakdown products in the body are the same as those from exposure to other chemicals. The EPA has determined that DCE (cis-1,2-dichloroethene) is not classifiable as to human carcinogenicity [12].

Interaction of TCE and DCE

TCE is often found along with other VOCs in water samples from, or near, hazardous waste sites. ATSDR (13) has evaluated data on the toxicology of mixtures of 1,1,1-trichloroethane, 1,1-dichloroethane, TCE and tetrachloroethylene to help address concerns about joint toxic actions of these chemicals. Although not included in the ATSDR interaction profile, DCE can produce similar neurological effects as other VOCs (12). While additive joint action of TCE and DCE on the liver and kidney is plausible, the potential for this interaction to occur at Pelican Bay is not known. ATSDR is evaluating adverse health effects from exposures to multiple VOCs at Camp Lejeune (11) and Texas DSHS will review those findings as they become available.

Public Health Implications

Sampling Results Interpretation

It is difficult to determine with any degree of certainty the concentrations of TCE and DCE to which any individual may have regularly been exposed in the past. Standard exposure factors (a 15 kilogram child drinking 1 liter of water per day or a 70 kg adult drinking 2 liters of water per day) and exposure to the maximum concentrations of TCE (644 ppb) and DCE (531 ppb) were used to assess whether children and adults may have been exposed to the contaminants above levels considered to be “safe”.

Sampling results indicate that concentrations of TCE were exceeded on three occasions (August 1994, June 2000, and June 2004) for well 12 and on two occasions (June 2000 and July 2004) for well 13 of the Pelican Bay Public Water System. Using current ATSDR and EPA guidance, under some theoretical scenarios, people may, in the past, have been exposed to potentially unsafe levels of TCE in the public drinking water. Due to the lack of information, we cannot adequately assess past exposure. Because these wells are currently inactive, people using water from this PWS are not being exposed to the contaminant [5].

As there are no standards available for private water supplies, the levels of TCE and DCE were assessed by comparing them to MCLs (standards applied to public drinking water systems). Prior to installation of the filtration systems, the maximum levels of TCE and DCE measured in some residential wells exceeded their respective MCLs. Analyses of water samples collected after the 1st and 2nd filters installed on residential wells indicated that the filtration systems are effectively removing TCE and DCE. Existing evidence indicates with properly installed, operating, and maintained filters, there are no human exposures to the contaminated groundwater.

With no completed exposure pathways, the groundwater at the Pelican Bay site poses no apparent public health hazard.

Children’s Health Considerations

DSHS and ATSDR recognize that the unique vulnerabilities of infants and children demand special consideration. Children may be at greater risk than adults for certain kinds of exposures to hazardous substances emitted from waste sites and emergency events. Children may be more likely to be exposed because they play outdoors and they often bring food into contaminated areas. They are shorter than adults, which mean they breathe dust, soil, and heavy vapors close to the

ground. Children are also smaller, resulting in higher doses of chemical exposure per body weight. Children's developing bodies may sustain permanent damage if toxic exposures occur during critical growth stages. Children depend completely on adults for risk identification and management decisions, housing decisions, and access to medical care.

DSHS and ATSDR evaluated the likelihood for children living in the area of the Pelican Bay Water System site, to be exposed to TCE and DCE at levels of health concern. With properly installed, operated, and maintained water filtration systems on the wells, or on the water lines entering the residence, children will not be exposed to the contaminants from their drinking water or from showering or bathing with the water.

Conclusions

1. The Texas Department of State Health Services (DSHS) reviewed limited water sampling data from the Pelican Bay Public Water System and found that wells 12 and 13 exceeded the MCL (5 ppb) for TCE.

2. Using current health guidelines, people may in the past have been exposed to potentially unsafe levels of TCE in the public drinking water. Current information indicates that wells 12 and 13 are not in use.

3. A review of laboratory analyses showed contaminants are effectively removed by the filtration systems installed on the private wells. Properly installed, operating, and maintained filtration systems prevent exposure to TCE and DCE contaminants above their respective MCLs.

4. With no currently completed pathways, contaminants in the groundwater pose no present public health hazard.

Recommendations

1. Continue to monitor and maintain well filtration systems to ensure proper operation until a safe alternative drinking water source can be found.

2. Continue attempting to identify and sample water wells (residential and public) in the Pelican Bay area that are being used for drinking and other household uses.

3. Collect groundwater samples from the nearby Camp Timberlake Public Water Supply System and analyze for contaminants.

4. DSHS and the Agency for Toxic Substances and Disease Registry (ATSDR) should review any additional environmental sampling results as they become available.

Public Health Action Plan

Actions Completed

1. On August 10, 2004, the US Environmental Protection Agency (EPA) began supplying bottled water to residents whose groundwater wells exceeded the MCLs of 5 parts per billion of TCE and/or 70 ppb of DCE.

2. The Texas Commission on Environmental Quality (TCEQ) installed filtration systems on 10 residential wells that exceeded the MCLs for TCE and/or DCE.

3. In February 2005, the TCEQ conducted groundwater sampling to verify the effectiveness of the water filtration system in removing TCE and DCE. TCEQ also performed routine maintenance on the water filtration units on residential wells that had previously exceeded the MCLs for TCE and/or DCE.

4. On February 25, 2005, the EPA stopped providing bottled water to the residents, as analysis of the well filtration systems indicated proper operation.

Actions Planned

1. The TCEQ is conducting a Hazard Ranking System (HRS) report to further determine the nature and extent of the groundwater contamination.

2. This health consultation report will be provided to federal/state health and environmental agencies.

Authors, Technical Advisors, and Organizations

Report Prepared by

Tom Ellerbee
Environmental Specialist
DSHS Exposure Assessment & Surveillance Group

Susan Prosperie, MS, RS
Manager
DSHS Exposure Assessment & Surveillance Group

John F. Villanacci, PhD, NREMT-1
Director
DSHS Environmental & Injury Epidemiology and Toxicology Branch

Jennifer Lyke
Regional Representative
ATSDR Region 6

George Pettigrew, PE
Senior Regional Representative
ATSDR Region 6

W. Allen Robison, PhD
Toxicologist
Division of Health Assessment and Consultation
Superfund and Program Assessment Branch

References

1. Texas Parks and Wildlife Department website. Eagle Mountain Lake. Available from URL: http://www.tpwd.state.tx.us/infish/regions. February 2005.

2. DFWinfo.com. North Central Texas Council of Governments. Available from URL: http://www.nctcog.org. August 2004.

3. U.S. Environmental Protection Agency. On-Scene Coordinator. Pollution Report (POLREP) No. 1. Available from URL: http://www.epaosc.net. August 31, 2004.

4. U.S. Environmental Protection Agency. On-Scene Coordinator. Pollution Report (POLREP) No. 2. Available from URL: http://www.epaosc.net. February 28, 2005.

5. Texas Commission on Environmental Quality website. Water Utility Database. Available from URL: http://www3.tnrcc.state.tx.us/iwud/pws. November 2004.

6. Texas Commission on Environmental Quality. Preliminary Assessment/ Screening Site Inspection Work Plan. Pelican Bay Public Water System. June 2004.

7. Mayo Clinic website. Pulmonary Fibrosis. Available from URL: http://www.mayoclinic.com. January 21, 2004.

8. Agency for Toxic Substances and Disease Registry website. ToxFAQs™ for Trichloroethylene (TCE). Available from URL: http://www.atsdr.cdc.gov/tfacts19.html. November 22, 2004.

9. Agency for Toxic Substances and Disease Registry. Public Health Assessment for U.S. Marine Corps Base, Camp Lejeune, Onslow County, North Carolina. August 1997. Available from http://www.atsdr.cdc.gov/HAC/PHA/usmclejeune/clej_toc.html.

10. Agency for Toxic Substances and Disease Registry. Volatile Organic Compounds in Drinking Water and Adverse Pregnancy Outcomes: United States Marine Corps Base, Camp Lejeune, North Carolina. August 1998. Available from http://www.atsdr.cdc.gov/HS/lejeune/.

11. Agency for Toxic Substances and Disease Registry. Exposure to Volatile Organic Compounds in Drinking Water and Specific Birth Defects and Childhood Cancers, United States Marine Corps Base, Camp Lejeune, North Carolina. Study in progress. (http://www.atsdr.cdc.gov/sites/lejeune/update.html)

12. Agency for Toxic Substances and Disease Registry website. ToxFAQs™ for 1,2-Dichloroethene. Available from URL: http://www.atsdr.cdc.gov/tfacts87.html. November 22, 2004.

13. Agency for Toxic Substances and Disease Registry website. Interaction Profile for 1,2-Dichloroethene. Available from URL: http://www.atsdr.cdc.gov/tfacts87.html. November 22, 2004.

Certification

This Pelican Bay Public Water System public health consultation was prepared by the Texas Department of State Health Services (DSHS) under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with approved methodology and procedures existing at the time the public health consultation was initiated. Editorial review was completed by the Cooperative Agreement partner.

Technical Project Officer, CAT, SPAB, DHAC, ATSDR

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

Team Lead, CAT, SPAB, DHAC, ATSDR

Appendix A - Acronyms and Abbreviations

ATSDR	Agency for Toxic Substances and Disease Registry
DCE	cis-1,2-Dichloroethene, Dichloroethene
DSHS	Department of State Health Services
EPA	Environmental Protection Agency
HAC	Health Assessment Comparison
HRS	Hazard Ranking System
IARC	International Agency for Research on Cancer
MCL	Maximum Contaminant Level
NPL	National Priorities List
NTP	National Toxicology Program
PA/SSI	Preliminary Assessment/Site Screening Inspection
ppb	parts per billion
PWS	Public Water System
QA/QC	Quality Assurance/Quality Control
TCE	Trichloroethene, Trichloroethylene
TCEQ	Texas Commission on Environmental Quality
TNRCC	Texas Natural Resource Conservation Commission
VOCs	Volatile Organic Compounds

Appendix B - Tables

Table – 1

Pelican Bay Public Water System
Groundwater Sample Results
August 1994 – July 2004

Contaminant	Sample Range (ppb)	Maximum Contaminant Level (MCL)	samples exceeding MCL per total samples
Trichloroethene (TCE)	nd – 46	5	5/11
cis-1,2-Dichloroethene (DCE)	nd - 5	70	0/11

nd = not detected

Table – 2

Residential
Groundwater Sample Results
June 2004 – September 2004

Contaminant	Maximum Contaminant Level (ppb)	sample range (ppb)	samples exceeding MCL per total samples	sample results after 1st filter (ppb)	sample results after 2nd filter (ppb)
Trichloroethene (TCE)	5	nd - 644	14/25	nd – 1.81	all nd
cis-1,2-Dichloroethene (DCE)	70	2.53 - 531	4/10	nd – 4.57	all nd

nd = not detected

HEALTH CONSULTATION

PELICAN BAY – PUBLIC WATER SYSTEM
PELICAN BAY, TARRANT COUNTY, TEXAS

EPA FACILITY ID: TXN000605649

Prepared by:

The Texas Department of State Health Services
Under Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry

Table of Contents

Purpose

The US Environmental Protection Agency (EPA) requested that the Texas Department of State Health Services (DSHS) investigate potential health risks associated with chemicals found in drinking water wells serving residents of Pelican Bay, Tarrant County, Texas. The DSHS Exposure Assessment and Surveillance Group, under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR), reviewed analyses of samples collected from public water supply, and privately owned residential, groundwater wells in the city of Pelican Bay to assess exposure to these chemicals. (Note: Appendix A provides a listing of abbreviations and acronyms used in this report).

Background

Site Description and History

Pelican Bay is located in Tarrant County. It lies northwest of Fort Worth, Texas and along the western side of Eagle Mountain Lake. The 9,200 acre lake is a drinking water source for other north Texas communities and is popular for recreational fishing [1]. The 2004 census estimate reports that 1,750 residents live within the 0.6 square mile city [2].

On July 30, 2004, the public drinking water section of the Texas Commission on Environmental Quality (TCEQ) notified the US EPA Region 6 of a contaminated aquifer affecting drinking water in the city of Pelican Bay. Water samples from 3 Pelican Bay Public Water System (PWS) wells and 4 private residential wells contained trichloroethene (TCE) at levels which exceeded health protective risk standards. The TCEQ and EPA determined there was a human health threat from drinking the water from wells contaminated with high levels of TCE. On August 9, 2004, the TCEQ met with the area residents to provide sampling data results and to discuss potential health risks. As a temporary protective measure, the EPA began supplying bottled water to affected residents from August 10, 2004 through February 25, 2005. The TCEQ installed filtration systems on affected wells to remove contaminants from the groundwater. Additional samples are being collected by the TCEQ to identify the contamination source and determine where the plume is migrating [3]. The treated well water is routinely tested to ensure that the well filtration systems are operating properly [4].

Sources of Area Drinking Water

The Pelican Bay PWS, ID #2200164, has 13 groundwater wells that are used as drinking water sources for 1,470 people. Nearby Camp Timberlake, a Girl Scouts of America camp (PWS ID #2202205), has 3 groundwater water wells and serves a transient/non-community population of 200 people [5].

EPA Region 6 requested that TCEQ conduct a Preliminary Assessment/Site Screening Inspection (PA/SSI) of the Pelican Bay Public Water System. The purpose of the PA/SSI was to gather information to determine if the site might be eligible for possible cleanup through the National Priorities List (NPL) Superfund Program. The PA/SSI found that from 0 to ¼ mile of the site are 2 private water wells and 13 public water supply wells (Pelican Bay). From ¼ to ½ mile of the site are 5 private water wells and 1 public water supply (Camp Timberlake). From ½ to 1 mile there are no public water supply wells and an unknown number of private wells [6].

The Pelican Bay site has 3 contaminated groundwater plumes originating from unknown sources. The first plume is near Jason Court. Public water supply wells 12 and 13, drilled in February 1994, are considered to be in the central part of the plume. In May 1995, the Texas Natural Resource Conservation Commission (TNRCC), now TCEQ, directed the Pelican Bay Utility Company to plug wells 12 and 13, as the wells were not developed according to public drinking water standards. These wells have since been approved for use (January 2000) and have been designated as center of the site until further data is collected. According to the TCEQ Water Utility Database, wells 12 and 13 are inactive [5]. A second plume is suspected in the area of Marina Drive. Wells 6 and 10, drilled in June 1989, supply water at this location. A third plume is suspected in the vicinity of 1713 Pelican Oval (wells 5, 7, 8, and 9). Local businesses include a gasoline station, a convenience store/gasoline station, and a wrecker service/auto repair shop. These businesses are within a ¼ to ½ mile from wells 12 and 13 [6].

Community Health Concerns

A resident expressed a concern that the contaminants in the groundwater contributed to the development of pulmonary fibrosis. Pulmonary fibrosis is the gradual scarring and thickening of the lung tissue between the alveoli (air sacs). The scarring impairs the lungs' ability to transfer oxygen into the blood. The symptoms, dyspnea (shortness of breath) and dry cough, develop slowly over many months or years. Some of the conditions which cause pulmonary fibrosis include: inhaling asbestos fibers (asbestosis), inhaling silica dust (silicosis), sarcoidosis (an inflammatory disease frequently found in the lungs), scleroderma (hardening and scarring of the skin and connective tissues), rheumatoid arthritis (affecting the lungs), and smoking [7]. No information was found in literature associating the site contaminants with pulmonary fibrosis.

Discussion

Introduction

To assess the potential health risks associated with the contaminants found in the groundwater, each contaminant was compared with its specific health-based assessment comparison (HAC) value. The HAC values are guidelines for levels of chemicals in specific environmental media (soil, water, and air) that are considered safe for human contact. Because many of the assumptions used to calculate HAC values are conservative with respect to protecting public health, exceeding a HAC value does not necessarily mean that adverse health effects will occur, but it does mean that the contaminant warrants further consideration.

DSHS compared the concentrations of chemicals in the groundwater with the EPA's maximum contaminant levels (MCLs). In 1974, the U.S Congress passed the Safe Drinking Water Act. This law required the EPA to determine safe levels of chemicals in drinking water. The EPA has set the MCL of 5 parts per billion (ppb) for TCE and 70 ppb for DCE. The MCLs are partially based on the ability of public water systems to detect and remove contaminants, given present technology and resources. The EPA believes the MCL is the lowest level to which water systems can reasonably be required to remove the contaminant if present in drinking water. MCLs are the maximum allowable concentration for specific chemicals in public drinking water. We often use

them as a guide in assessing the potential health implications because they are considered protective of public health over a lifetime exposure of 70 years.

This health consultation specifically evaluated groundwater sampling data collected from the city of Pelican Bay public water supply wells (August 1994 – July 2004) and private residential wells (June – September 2004). These samples were analyzed for volatile organic compounds (VOCs). The purpose of the sampling was to document the presence and extent of chemical contamination. The DSHS and ATSDR relied on the information provided in the referenced documents and assumed that adequate quality assurance/quality control (QA/QC) procedures were followed with regard to data collection, chain-of-custody, laboratory procedures, and data reporting.

DSHS reviewed results for 11 groundwater samples collected from six Pelican Bay Public Water System (PWS) wells during August 1994 – August 2004. These six wells and respective locations are: wells 7, 8 and 9 at 1713 Pelican Oval; well 10 at 92 Acres; and wells 12 and 13 at 1653 Jason Court [5].

Of the 11 samples collected from the PWS wells during this 10-year period, three samples from well 12, and two samples from well 13, exceeded the MCL (5 ppb) for TCE. The levels of TCE reported for these two PWS wells ranged from 4.2 to 46 ppb. Wells 12 and 13 are no longer active [5]. In the other PWS wells, TCE was not detected. None of the 11 samples from the six PWS wells exceeded the MCL for DCE (70 ppb). DCE concentrations ranged from not detected to 5 ppb [Table 1].

DSHS also reviewed results for 39 groundwater samples collected from residential wells at 24 addresses. EPA/TCEQ collected these samples during June - September 2004. TCE and DCE concentrations in these well samples ranged from not detected to 644 ppb and from 2.53 to 531 ppb, respectively. Residential groundwater wells exceeding the MCL for TCE or DCE were offered installation of filtration units. Ten such filter units have been installed to date. One filtration unit was declined by the homeowner because the well (TCE - 6 ppb) is only used to fill a swimming pool. Nine residences have been provided with bottled water by EPA. The one residence which was provided a filtration system but not bottled water, uses their well for irrigation purposes only.

Additional sampling was conducted to verify the effectiveness of the filtration system installed on the private wells. Laboratory analysis of samples collected after the water goes through the first filtration unit verified that the unit was removing TCE (not detected to 1.81 ppb) and DCE (not detected to 4.57 ppb). TCE and DCE results for all samples collected after passing through the first filtration unit were below the respective MCLs. Analysis of samples after the second filtration unit did not detect any chemical contamination [Table 2].

Toxicologic Evaluation

Trichloroethene (TCE)

TCE is used mainly to remove grease from metal parts. It is also an ingredient in adhesives, paint removers, typewriter correction fluids, and spot removers. It may get into the air through the use

of these products or by showering with TCE-contaminated water. TCE does not readily dissolve in water and yet it can remain in groundwater for a long time. It quickly evaporates from surface water. In soil, TCE does not evaporate as readily as from surface water, and it adheres to soil particles for a long time. Plants and animals do not have a significant buildup of TCE [8].

Exposure to TCE can result by breathing contaminated air, showering with contaminated water, or by using household products containing TCE (spot removers and metal degreasers). Breathing small amounts of TCE can cause headaches, lung irritation, dizziness and poor coordination. Inhaling large amounts of TCE may impair the heart, cause unconsciousness, nerve, kidney, and liver damage. Ingestion of contaminated water and dermal contact from contaminated soil also can result in exposure. Drinking large amounts of TCE may impair heart function, cause nausea, result in unconsciousness, damage the liver or cause death. Dermal (skin) contact may cause rashes. Recent TCE exposures can be detected in breath, blood, or urine [8].

Evidence of increased cancer was found in people exposed to high levels of TCE over a long period of time. The National Toxicology Program (NTP) determined that TCE is "reasonably anticipated to be a human carcinogen." The International Agency for Research on Cancer (IARC) determined that TCE is "probably carcinogenic to humans"[8].

In 1997, ATSDR documented human exposures to TCE, PCE and 1,2-DCE in drinking water systems at Camp Lejeune over a period of 34 months, but which likely occurred for up to 30 years (9). In 1998, ATSDR completed a study at Camp Lejeune which found a link between babies exposed in the womb to drinking water contaminated with multiple volatile organic compounds and cases of infants born weighing less than the 10^{th} percentile (10). Whether multiple VOCs in drinking water trigger this, or other problems, remains unclear. ATSDR initiated a study in 2005 to further study whether children exposed *in utero* had increased risk for certain health effects including: spina bifida, anencephaly (absence of all or a major part of the brain), cleft lip, cleft palate, childhood leukemia or childhood non-Hodgkin's lymphoma (11).

cis-1,2-Dichloroethene (DCE)

DCE is used to produce solvents. It breaks down slowly in groundwater and evaporates quickly from soil and surface water. Once in the air, DCE takes about 5-12 days to break down [12].

Exposure pathways for DCE are inhalation, ingestion, and dermal contact. These exposures occur during cooking, bathing, washing dishes, or showering with the contaminated water. Breathing high levels of DCE may cause drowsiness, nausea or death. The potential long term human health effects from breathing air with low concentrations of DCE are not known. Animals exposed to high levels of this chemical had liver, heart, and lung damage. Animals that have ingested large amounts of DCE died. Animals ingesting low amounts of DCE experienced decreased numbers of red blood cells and effects on the liver. An animal study indicated that an exposed fetus may not grow as rapidly as a non-exposed one. DCE exposures can be detected in breath, blood, or urine. These tests are not routinely used since the resultant breakdown products in the body are the same as those from exposure to other chemicals. The EPA has determined that DCE (cis-1,2-dichloroethene) is not classifiable as to human carcinogenicity [12].

Interaction of TCE and DCE

TCE is often found along with other VOCs in water samples from, or near, hazardous waste sites. ATSDR (13) has evaluated data on the toxicology of mixtures of 1,1,1-trichloroethane, 1,1-dichloroethane, TCE and tetrachloroethylene to help address concerns about joint toxic actions of these chemicals. Although not included in the ATSDR interaction profile, DCE can produce similar neurological effects as other VOCs (12). While additive joint action of TCE and DCE on the liver and kidney is plausible, the potential for this interaction to occur at Pelican Bay is not known. ATSDR is evaluating adverse health effects from exposures to multiple VOCs at Camp Lejeune (11) and Texas DSHS will review those findings as they become available.

Public Health Implications

Sampling Results Interpretation

It is difficult to determine with any degree of certainty the concentrations of TCE and DCE to which any individual may have regularly been exposed in the past. Standard exposure factors (a 15 kilogram child drinking 1 liter of water per day or a 70 kg adult drinking 2 liters of water per day) and exposure to the maximum concentrations of TCE (644 ppb) and DCE (531 ppb) were used to assess whether children and adults may have been exposed to the contaminants above levels considered to be “safe”.

Sampling results indicate that concentrations of TCE were exceeded on three occasions (August 1994, June 2000, and June 2004) for well 12 and on two occasions (June 2000 and July 2004) for well 13 of the Pelican Bay Public Water System. Using current ATSDR and EPA guidance, under some theoretical scenarios, people may, in the past, have been exposed to potentially unsafe levels of TCE in the public drinking water. Due to the lack of information, we cannot adequately assess past exposure. Because these wells are currently inactive, people using water from this PWS are not being exposed to the contaminant [5].

As there are no standards available for private water supplies, the levels of TCE and DCE were assessed by comparing them to MCLs (standards applied to public drinking water systems). Prior to installation of the filtration systems, the maximum levels of TCE and DCE measured in some residential wells exceeded their respective MCLs. Analyses of water samples collected after the 1st and 2nd filters installed on residential wells indicated that the filtration systems are effectively removing TCE and DCE. Existing evidence indicates with properly installed, operating, and maintained filters, there are no human exposures to the contaminated groundwater.

With no completed exposure pathways, the groundwater at the Pelican Bay site poses no apparent public health hazard.

Children’s Health Considerations

DSHS and ATSDR recognize that the unique vulnerabilities of infants and children demand special consideration. Children may be at greater risk than adults for certain kinds of exposures to hazardous substances emitted from waste sites and emergency events. Children may be more likely to be exposed because they play outdoors and they often bring food into contaminated areas. They are shorter than adults, which mean they breathe dust, soil, and heavy vapors close to the

ground. Children are also smaller, resulting in higher doses of chemical exposure per body weight. Children's developing bodies may sustain permanent damage if toxic exposures occur during critical growth stages. Children depend completely on adults for risk identification and management decisions, housing decisions, and access to medical care.

DSHS and ATSDR evaluated the likelihood for children living in the area of the Pelican Bay Water System site, to be exposed to TCE and DCE at levels of health concern. With properly installed, operated, and maintained water filtration systems on the wells, or on the water lines entering the residence, children will not be exposed to the contaminants from their drinking water or from showering or bathing with the water.

Conclusions

1. The Texas Department of State Health Services (DSHS) reviewed limited water sampling data from the Pelican Bay Public Water System and found that wells 12 and 13 exceeded the MCL (5 ppb) for TCE.

2. Using current health guidelines, people may in the past have been exposed to potentially unsafe levels of TCE in the public drinking water. Current information indicates that wells 12 and 13 are not in use.

3. A review of laboratory analyses showed contaminants are effectively removed by the filtration systems installed on the private wells. Properly installed, operating, and maintained filtration systems prevent exposure to TCE and DCE contaminants above their respective MCLs.

4. With no currently completed pathways, contaminants in the groundwater pose no present public health hazard.

Recommendations

1. Continue to monitor and maintain well filtration systems to ensure proper operation until a safe alternative drinking water source can be found.

2. Continue attempting to identify and sample water wells (residential and public) in the Pelican Bay area that are being used for drinking and other household uses.

3. Collect groundwater samples from the nearby Camp Timberlake Public Water Supply System and analyze for contaminants.

4. DSHS and the Agency for Toxic Substances and Disease Registry (ATSDR) should review any additional environmental sampling results as they become available.

Public Health Action Plan

Actions Completed

1. On August 10, 2004, the US Environmental Protection Agency (EPA) began supplying bottled water to residents whose groundwater wells exceeded the MCLs of 5 parts per billion of TCE and/or 70 ppb of DCE.

2. The Texas Commission on Environmental Quality (TCEQ) installed filtration systems on 10 residential wells that exceeded the MCLs for TCE and/or DCE.

3. In February 2005, the TCEQ conducted groundwater sampling to verify the effectiveness of the water filtration system in removing TCE and DCE. TCEQ also performed routine maintenance on the water filtration units on residential wells that had previously exceeded the MCLs for TCE and/or DCE.

4. On February 25, 2005, the EPA stopped providing bottled water to the residents, as analysis of the well filtration systems indicated proper operation.

Actions Planned

1. The TCEQ is conducting a Hazard Ranking System (HRS) report to further determine the nature and extent of the groundwater contamination.

2. This health consultation report will be provided to federal/state health and environmental agencies.

Authors, Technical Advisors, and Organizations

Report Prepared by

Tom Ellerbee
Environmental Specialist
DSHS Exposure Assessment & Surveillance Group

Susan Prosperie, MS, RS
Manager
DSHS Exposure Assessment & Surveillance Group

John F. Villanacci, PhD, NREMT-1
Director
DSHS Environmental & Injury Epidemiology and Toxicology Branch

Jennifer Lyke
Regional Representative
ATSDR Region 6

George Pettigrew, PE
Senior Regional Representative
ATSDR Region 6

W. Allen Robison, PhD
Toxicologist
Division of Health Assessment and Consultation
Superfund and Program Assessment Branch

References

1. Texas Parks and Wildlife Department website. Eagle Mountain Lake. Available from URL: http://www.tpwd.state.tx.us/infish/regions. February 2005.

2. DFWinfo.com. North Central Texas Council of Governments. Available from URL: http://www.nctcog.org. August 2004.

3. U.S. Environmental Protection Agency. On-Scene Coordinator. Pollution Report (POLREP) No. 1. Available from URL: http://www.epaosc.net. August 31, 2004.

4. U.S. Environmental Protection Agency. On-Scene Coordinator. Pollution Report (POLREP) No. 2. Available from URL: http://www.epaosc.net. February 28, 2005.

5. Texas Commission on Environmental Quality website. Water Utility Database. Available from URL: http://www3.tnrcc.state.tx.us/iwud/pws. November 2004.

6. Texas Commission on Environmental Quality. Preliminary Assessment/ Screening Site Inspection Work Plan. Pelican Bay Public Water System. June 2004.

7. Mayo Clinic website. Pulmonary Fibrosis. Available from URL: http://www.mayoclinic.com. January 21, 2004.

8. Agency for Toxic Substances and Disease Registry website. ToxFAQs™ for Trichloroethylene (TCE). Available from URL: http://www.atsdr.cdc.gov/tfacts19.html. November 22, 2004.

9. Agency for Toxic Substances and Disease Registry. Public Health Assessment for U.S. Marine Corps Base, Camp Lejeune, Onslow County, North Carolina. August 1997. Available from http://www.atsdr.cdc.gov/HAC/PHA/usmclejeune/clej_toc.html.

10. Agency for Toxic Substances and Disease Registry. Volatile Organic Compounds in Drinking Water and Adverse Pregnancy Outcomes: United States Marine Corps Base, Camp Lejeune, North Carolina. August 1998. Available from http://www.atsdr.cdc.gov/HS/lejeune/.

11. Agency for Toxic Substances and Disease Registry. Exposure to Volatile Organic Compounds in Drinking Water and Specific Birth Defects and Childhood Cancers, United States Marine Corps Base, Camp Lejeune, North Carolina. Study in progress. (http://www.atsdr.cdc.gov/sites/lejeune/update.html)

12. Agency for Toxic Substances and Disease Registry website. ToxFAQs™ for 1,2-Dichloroethene. Available from URL: http://www.atsdr.cdc.gov/tfacts87.html. November 22, 2004.

13. Agency for Toxic Substances and Disease Registry website. Interaction Profile for 1,2-Dichloroethene. Available from URL: http://www.atsdr.cdc.gov/tfacts87.html. November 22, 2004.

Certification

This Pelican Bay Public Water System public health consultation was prepared by the Texas Department of State Health Services (DSHS) under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with approved methodology and procedures existing at the time the public health consultation was initiated. Editorial review was completed by the Cooperative Agreement partner.

Technical Project Officer, CAT, SPAB, DHAC, ATSDR

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

Team Lead, CAT, SPAB, DHAC, ATSDR

Appendix A - Acronyms and Abbreviations

ATSDR	Agency for Toxic Substances and Disease Registry
DCE	cis-1,2-Dichloroethene, Dichloroethene
DSHS	Department of State Health Services
EPA	Environmental Protection Agency
HAC	Health Assessment Comparison
HRS	Hazard Ranking System
IARC	International Agency for Research on Cancer
MCL	Maximum Contaminant Level
NPL	National Priorities List
NTP	National Toxicology Program
PA/SSI	Preliminary Assessment/Site Screening Inspection
ppb	parts per billion
PWS	Public Water System
QA/QC	Quality Assurance/Quality Control
TCE	Trichloroethene, Trichloroethylene
TCEQ	Texas Commission on Environmental Quality
TNRCC	Texas Natural Resource Conservation Commission
VOCs	Volatile Organic Compounds

Appendix B - Tables

Table – 1

Pelican Bay Public Water System
Groundwater Sample Results
August 1994 – July 2004

Contaminant	Sample Range (ppb)	Maximum Contaminant Level (MCL)	samples exceeding MCL per total samples
Trichloroethene (TCE)	nd – 46	5	5/11
cis-1,2-Dichloroethene (DCE)	nd - 5	70	0/11

nd = not detected

Table – 2

Residential
Groundwater Sample Results
June 2004 – September 2004

Contaminant	Maximum Contaminant Level (ppb)	sample range (ppb)	samples exceeding MCL per total samples	sample results after 1st filter (ppb)	sample results after 2nd filter (ppb)
Trichloroethene (TCE)	5	nd - 644	14/25	nd – 1.81	all nd
cis-1,2-Dichloroethene (DCE)	70	2.53 - 531	4/10	nd – 4.57	all nd

nd = not detected