

Health Consultation

**BRYAN BOULEVARD SUBDIVISION WELLS
MANCHESTER, COFFEE COUNTY, TENNESSEE**

SEPTEMBER 30, 2003

**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 consultations previously issued.

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HEALTH CONSULTATION

BRYAN BOULEVARD SUBDIVISION WELLS
MANCHESTER, COFFEE COUNTY, TENNESSEE

Prepared by:
Tennessee Department of Health
Under a Cooperative Agreement with
Agency for Toxic Substances and Disease Registry

Background and Statement of Issues

On July 7, 2003, the Tennessee Department of Health (TDH) received a call from the Tennessee Division of Superfund (TDSF) concerning water sample results from private wells in Bryan Boulevard Subdivision, Manchester, Coffee County, Tennessee. This small subdivision was developed in the 1970's and comprises approximately 68 single family dwellings, located south of Interstate 40 and adjacent to Arnold Air Force Base and the former Coffee County Landfill (Figure 1). TDSF had recently been contacted by an environmentalist with Arnold Engineering Development Center (AEDC) regarding positive tests for trichloroethylene (TCE) and tetrachloroethylene (PCE) in the well water samples taken by the United States Geologic Survey (USGS) in December 2001 in the subdivision. TDSF continued to monitor these wells, obtaining well water samples in February 2002, October 2002, and June 2003. During the course of collecting water samples, several of the residents complained of ambiguous health symptoms and concerns possibly relating to the contaminated water. TDSF requested the assistance of TDH concerning health effects concerns of the residents in the subdivision, particularly the concerns of those residents whose well water had PCE concentrations above the Environmental Protective Agency (EPA) Maximum Contaminant Level (MCL) of 5 parts per billion (ppb).

A site visit was made on July 16, 2003, by staff of TDH and TDSF. Twenty well water samples were taken to complete the third round of testing (Figure 2). During this visit, available residents were interviewed concerning their health problems.

Discussion

In January 2002, USGS reported preliminary results from the December 2001 sampling for chlorinated volatile organic compounds (VOCs) in private well water from Bryan Boulevard Subdivision and in groundwater from the Crumpton Creek Basin. The private wells and groundwater samples collected between the Coffee County Landfill and Bryan Boulevard, and between Arnold AFB and Bryan Boulevard had no detectable VOC's; the PCE/TCE concentration ratios of Arnold AFB sampling sites did not match Bryan Boulevard ratios. The report concluded the groundwater flow and concentration data show that Arnold AFB is not the source of the PCE plume at Bryan Boulevard Subdivision, and all data indicated that the PCE source is in the immediate vicinity of Bryan Boulevard Subdivision (USGS 2002).

After receiving the USGS report, AEDC contacted TDSF for investigation of the plume source and the continued monitoring of the private wells in the Bryan Boulevard Subdivision. The following table summarizes the water sample testing results conducted by TDSF.

Table 1. Summary results of water sample testing performed by USGS and TSDf, December 2001 to July 2003, in Bryan Boulevard Subdivision, Coffee County, Tennessee.

Sample Number	USGS Dec 01 (ppb)		TDSF Feb 02 (ppb)		TSDf Oct 02 (ppb)		TSDf June 03 (ppb)		TSDf July 03 (ppb)	
	TCE	PCE	TCE	PCE	TCE	PCE	TCE	PCE	TCE	PCE
1	U	U					U	U	U	U
2	U	U					U	U		
4	U	U							U	U
5	U	0.79J	U	1.40	U	1.40	U	U		
6	U	1.80	U	U					U	U
7	U	3.00							U	U
8	U	3.60	U	11.00	U	19.00	U	17.00		
9	U	U							U	U
16	U	U							U	U
23	U	U	U	4.20	U	U	U	U		
27	U	U							U	U
29	U	0.58J					U	U		
30	U	1.20							U	U
32	U	U								
34	U	0.46J	U	U					U	U
41	U	0.8J							U	U
42	U	3.00							U	U
44	U	U							U	U
53	U	1.20							U	U
55	U	U			U	U	U	U		
59	U	1.40			U	U	U	5.00		
60	U	1.00							U	U
64	0.85J	12.00	1.20	16.00	1.20	14.00	3.00	33.00		
67	U	2.60								
68			U	U	U	1.70			U	U
69					U	1.40	U	4.00		
70									U	U
71									U	U
72									U	U
73									U	U

J represents laboratory estimated value below the report limit.
 U represents laboratory values not detected at the report limit.
 ppb denotes parts per billion.

TSDf collected water samples from private residence wells on four separate occasions— February 2002, October 2002, June 2003, and July 2003. However, the June and July 2003 draws were considered as one total sampling event since the second draw was simply to complete the residences not sampled at the end of June. Of the three total samplings, the data shows only three residence wells located in the Bryan Boulevard subdivision to be above the MCL of 5 ppb for PCE. All well sample results were below the detection limit for TCE. One well sample is equal to the MCL for PCE; one well sample is more than 3 times the MCL for PCE; and one well is six times the MCL for PCE. The two residences with the higher levels of PCE are located side-by-side and the third residence is across the street and approximately 1000 yards northwest of the other two.

The AEDC investigation of the PCE plume has not discovered its source, but it appears to be in the immediate vicinity of the Bryan Boulevard subdivision. The TDSF assessment also has thus far not clearly determined the source of the PCE contamination in the wells.

PCE is the contaminant of concern within the three private residential wells in Bryan Boulevard Subdivision. Because these residents use their wells as their only water source, they clearly have completed pathways of exposure. To determine whether people are or could be exposed to contaminants associated with a property, ATSDR and TDH evaluate the environmental and human components that lead to human exposure. An exposure pathway contains five major elements: 1) a source of contamination, 2) contaminant transport through an environmental medium, 3) a point of exposure, 4) a route of human exposure, and 5) a receptor population. An exposure pathway is considered a complete pathway if there is evidence that all five of these elements are, have been, or will be present at the property. Exposure occurs to both adults and children via ingestion, inhalation, and dermal contact at this site. Ingestion occurs by drinking the water, while inhalation and dermal contact occur while bathing/showering..

Tetrachloroethylene CAS# 127-18-4

Tetrachloroethylene (PCE) is a manufactured chemical that is widely used for dry cleaning of fabrics and for metal degreasing. It also is used to make other chemicals and is used in some consumer products such as adhesives, paint removers, typewriter correction fluids, and spot remover. It is a nonflammable liquid at room temperature. It evaporates easily into the air and has a sharp, sweet odor. Most people can smell tetrachloroethylene when it is present in the air at a level of 1 part per million (ppm) or more, although some can smell it at lower levels (ATSDR 1997).

Much of the PCE that discharges into water or soil evaporates into the air. It dissolves little in water, but it can adhere to particles and remain in ground water for a long time. PCE does not bioaccumulate in plants and animals. PCE enters the environment mostly by evaporating into the air during use. It can stay in the air for several months before it is broken down into other chemicals, or is brought back down to the soil and water by rain. Under certain conditions, PCE may biodegrade into other chemicals which may be also be harmful (ATSDR 1997).

People can be exposed to PCE by inhalation, ingestion of food or water, and through the skin if prolonged contact persists. Minimal PCE in the air can pass through the skin into the body.

For all exposure pathways, most PCE leaves the body through the lungs while breathing. A small amount is changed by the liver into other chemicals and is removed from the body in urine. Most of the altered PCE leaves the body in a few days. However, PCE can be found in blood and other tissues, especially body fat. PCE stored in body fat can remain in the body for several days to weeks (ATSDR 1997).

PCE has been used safely as a general anesthetic. This involves a concentration of PCE that is much higher than the levels found at this site. At high concentrations it is known to produce loss of consciousness. When air concentrations are high, particularly in closed, poorly ventilated areas, single exposures can cause dizziness, headache, sleepiness, confusion, nausea, difficulty in speaking and walking, unconsciousness, and death. Irritation may result from repeated or extended skin contact. The health effects of breathing in air or drinking water with low levels of PCE are not definitely known. However, at levels found in ambient air or drinking water at this site, the risk of adverse health effects is minimal. The effects of exposing babies to PCE through breast milk are unknown. Results from some studies suggest that women who work in dry cleaning industries where exposures to PCE can be quite high may have more menstrual problems and spontaneous abortions than non-exposed women (ATSDR 2003).

Results in animal studies, conducted with amounts of PCE much higher than most people are normally exposed to, show that PCE can cause liver and kidney damage and also liver and kidney cancers. Although studies have not shown PCE to cause cancer in humans, the International Agency for Research on Cancer (IARC) has determined that PCE also is probably carcinogenic to humans. Exposure to very high levels of PCE in animals has shown to produce neurological deficits and developmental problems (ATSDR 1997).

EPA has set a Maximum Contaminant Level (MCL) for PCE in drinking water at 0.005 milligrams per liter (0.005mg/L) or 5 parts per billion parts water. Occupational Health and Safety (OSHA) has set an exposure limit of 100 parts of PCE per million parts of air (100ppm) for an 8-hour workday, 40-hour workweek.

Community Health Concerns

On July 16, 2003, TDH and TDSF staff visited 24 residences. Three dwellings were vacant, and no one was available at twelve homes. One resident had just moved into the neighborhood four days prior to our visit. TDH and TDSF spoke with several residents who voiced concerns. At the residence with the highest PCE levels, the lady of the house had multiple complaints of health problems including stomach pains, and dizziness. She also reported that her residence has a smell constantly, which she was unable to describe. However, we were unable to detect any odor on our visit.

We also received information from two of the residents that might provide a clue to the source of the PCE contamination. One resident informed us that many years ago there had been a boat manufacturing company on Bryan Boulevard in the area with the higher PCE contamination. The second resident, whose well tested highest for PCE, told us that the resident next door was in the dry cleaning business and may have stored some filled drums on his property. TDSF is looking into this allegation

Child Health Considerations

The many physical differences between children and adults demand special emphasis when considering environmental exposure. Exposure of children in the Bryan Boulevard

community was carefully considered in the preparation of this document. Children reside in the three residences with the higher PCE levels. Children could be at greater risk from certain kinds of exposure to hazardous substances. Children play outdoors and engage in hand-to-mouth behaviors that increase their exposure potential. Children are smaller in stature than adults; as a result they breathe dust, soil, and vapors close to the ground. A child's lower body weight and higher intake rate results in a greater dose of hazardous substance per unit of body weight. If toxic exposure levels are high enough during critical growth stages, the developing body systems of children can sustain permanent damage (ATSDR 1997, 1998).

Several children reside in the Bryan Boulevard subdivision and may be potentially exposed to TCE via the drinking water and bathing. As well, many of the women who live in the subdivision are of child bearing age and are at risk for exposure of PCE to their fetuses.

No health effects have been directly linked to the exposure of children to PCE at this site; however, there are several PCE specific studies that do indicate PCE may have a public health effect on children. The developing fetus, children, and especially the developing nervous system may be particularly susceptible to the toxic effects of tetrachloroethylene (Frederiksson et al. 1993). Studies in mice suggest that PCE can cross the placenta and concentrates in the fetus (Ghantous et al. 1986). Unmetabolized PCE has been excreted in breast milk and was detected in an exposed infant with liver damage (Bagnell and Ellenberger 1977). In addition, possible chemical effects were detected in children in Woburn, Massachusetts. These children may have been exposed to solvent contaminated drinking water as infants or *in utero*, and they had elevated incidences of acute lymphocytic leukemia or impaired immunity (Byers et al. 1988). Again, no health effects have been directly linked to children at this site; however, prudent public health practice dictates that children's exposures to PCE should be eliminated.

CONCLUSIONS

No apparent public health hazard exists for the three households using well water with PCE at or above the MCL. The drinking water meets or exceed the Maximum Contaminant Level (MCL) of 5 ppb for PCE at three homes, and potable well water in at least eight other households is contaminated with lower levels of PCE. However, with the PCE levels found in ambient air or drinking water at this site, the risk of adverse health effects to the general population is minimal.

ATSDR and TDH recognize that a resident of the home with the highest levels of PCE is experiencing symptoms such as dizziness and stomach pains. PCE exposure has been associated with such symptoms, although this association is generally seen at higher levels of exposure than are occurring at this site. Residents with specific health concerns are encouraged to speak to their private physician to discuss their individual circumstances.

RECOMMENDATIONS

1. In order to eliminate exposures to contaminated groundwater at 3 households, a safe, alternative water source should be provided. Options include the placement of subdivision residents on the city water source, or providing bottled water for drinking and filters for other household purposes.
2. In order to aid in preventing future exposures, additional site characterization should be conducted to determine the source of the PCE plume in the groundwater. The migration of PCE in groundwater should be monitored.

PUBLIC HEALTH ACTION PLAN

1. Provide community health education for residents, particularly the three effected households, regarding PCE.
2. Provide educational materials on PCE to residents' physicians upon request.
3. TDH will continue discussions with TDSF about preventing both current and any potential future exposure to contaminated water.

References

United States Geologic Survey. 2002. Preliminary Results Report on CVOC Detections on Bryan Road. Reston, VA: US Department of the Interior.

Tennessee Department of Superfund. 2003. Summary of Well Water Sampling for Bryan Boulevard Subdivision. Nashville: TN Department of Environment and Conservation.

Agency for Toxic Substances and Disease Registry. 1997. Toxicological report for tetrachloroethylene. Atlanta: US Department of Health and Human Services.

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Agency for Toxic Substances and Disease Registry. 1997. Healthy children—toxic environments. Report of the Child Health Workgroup presented to the Board of Scientific Counselors. Atlanta: US Department of Health and Human Services.

Agency for Toxic Substances and Disease Registry. 1998. Promoting children's health—progress report of the Child Health Workgroup, Board of Scientific Counselors. Atlanta: US Department of Health and Human Services.

Fredriksson A, Danielsson BRG, Eriksson P. 1993. Altered behavior in adult mice orally exposed to tri- and tetrachloroethylene as neonates. *Toxicol Lett* 1993;66:13-9.

Ghantous H, Danielsson BRG, Dencker L, et al. 1986. Trichloroacetic acid accumulates in murine amniotic fluid after tri- and tetrachloroethylene inhalation. *Acta Pharmacol Toxicol* 1986;58:105-14.

Byers VS, Levin AS, Ozonoff DM, et al. 1988. Association between clinical symptoms and lymphocyte abnormalities in a population with chronic domestic exposure to industrial solvent-contaminated domestic water supply and a high incidence of leukemia. *Cancer Immunol Immunother* 1988;27:77-81.

Bagnell PC, Ellenberger HA.. Obstructive jaundice due to a chlorinated hydrocarbon in breast milk. *Can Med Assoc J* 1977;117:1047-8.

Preparers of the Report

Ms. Carol Pope, Public Health Nursing Consultant
Ms. Bonnie Bashor, Director of Environmental Epidemiology
Tennessee Department of Health (TD)
Communicable and Environmental Disease Services (CEDS)
Environmental Epidemiology
4th Floor Cordell Hull Building
425 5th Avenue North
Nashville, TN 37247

Reviewers of the Report

Mr. Ron Clendening, TDEC, TDSF

ATSDR Technical Project Officer

Mr. Alan Yarbrough
Division of Health Assessment and Consultation
Superfund Site Assessment Branch

CERTIFICATION

This Bryan Boulevard Subdivision Wells Health Consultation was prepared by the Tennessee Department of Health 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 health consultation was begun.

Alan W. Yarbrough

Technical Project Officer, SPS, SSAB, DHAC, ATSDR

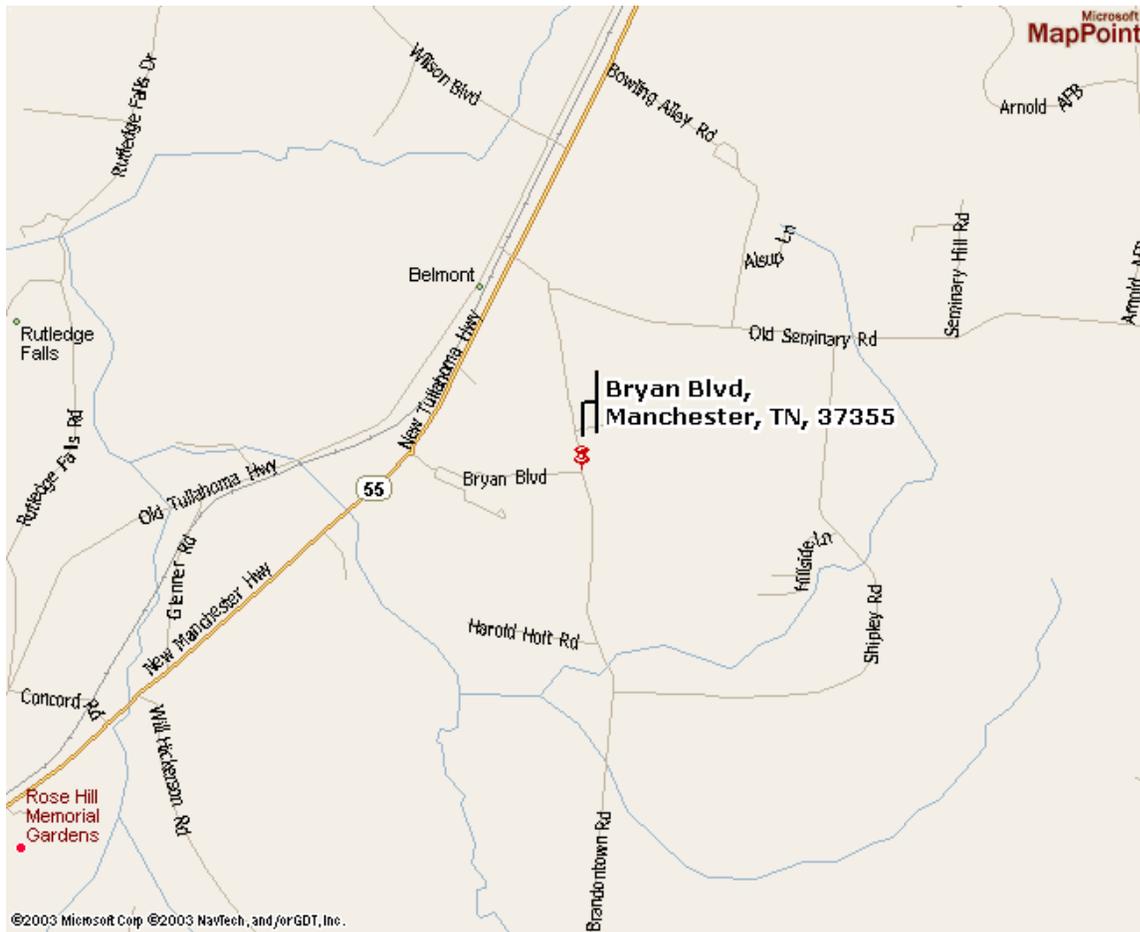
The Division of Health Assessment and Consultation, ATSDR, has reviewed this public health consultation and concurs with the findings.

Roberta Erlwein

Chief, State Program Section, SSAB, DHAC, ATSDR

Electronic Document

Figure 1. Map of Bryan Boulevard Subdivision, Manchester, Coffee County, Tennessee



(Map Courtesy of Map Quest)

Figure 2. Well sampling being performed by Tennessee Department of Superfund Staff



(Photo Credit: Carol Pope, THD)