

# Health Consultation

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## EXPOSURE INVESTIGATION

Indoor Air Testing

SHERWOOD MEDICAL SITE  
DELAND, VOLUSIA COUNTY, FLORIDA

EPA FACILITY ID: FLD043861392

**Prepared by the  
Florida Department of Health**

MARCH 11, 2010

Prepared under a Cooperative Agreement with the  
U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES  
Agency for Toxic Substances and Disease Registry  
Division of Health Assessment and Consultation  
Atlanta, Georgia 30333

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HEALTH CONSULTATION

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Bureau of Community Environmental Health  
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## Summary

This Exposure Investigation (EI) addresses the public health threat of possible vapor intrusion into buildings located near volatile organic compound (VOC) groundwater contamination from the Sherwood Medical hazardous waste site in Deland, Florida. The main contaminants of concern originating in on-site groundwater and extending off-site are trichloroethylene (TCE) and tetrachloroethylene (PCE). In April 2008, the U.S. Agency for Toxic Substances and Disease Registry (ATSDR) approved Florida DOH's request for financial and technical support for indoor air testing. This Exposure Investigation reports the methods and findings of that testing.

After a review of all monitoring well data, the Florida Department of Health (DOH) determined that these two chemicals (TCE and PCE) in the upper and lower surficial groundwater were at high enough levels off-site to cause a concern for vapor intrusion into homes near the site. Other chemicals present in the surficial groundwater on-site (acetone, benzene, chloroform and 1,2-dichloroethylene (1,2-DCE)) are at low levels and have not been detected off-site; therefore, they are not a concern for vapor intrusion. DOH also reviewed the shallow off-site private well data and determined that chemicals were either not detected or found below screening values.

On April 29, 2008, the Volusia County Health Department (CHD) and the Florida DOH tested the indoor air of three buildings located above an area with the highest levels of groundwater contamination adjacent to the site and one background home about ½ mile from the site. The background home was not near any known groundwater contamination. Three 8-hour air samples were taken at each location and analyzed for VOCs.

The levels of VOCs detected in all three buildings near Sherwood Medical were similar to those detected in the background home. The main contaminants of concern in groundwater (TCE and PCE) were not found in the indoor air of the three buildings near the site. Low levels of PCE were detected in the background sample during one out of three sequential 8-hour tests. PCE is commonly found in sources such as dry-cleaning and household products.

Other VOCs, besides TCE and PCE, were detected at low levels in all 4 buildings: acetone, benzene, chloroform and 1,2-dichloroethane (1,2-DCA). Acetone, benzene and chloroform have been found in the shallow groundwater on-site but at low enough levels to not be a concern for vapor intrusion. In addition, these chemicals are common indoor air contaminants at the low levels that were detected and were found at the background site as well. Therefore, these contaminants are not likely to be associated with the groundwater contamination from Sherwood, but are probably present from another source such as household products. 1,2-DCA has not been found in contaminated groundwater from Sherwood but was found in the indoor air in one building that was tested and in the background location.

Acetone, benzene and chloroform were found at low levels and are not expected to cause any harmful health effects for typical residential exposures. 1,2-DCA was found in one test sample and the background sample at levels that may cause a low to moderate theoretical increased cancer risk if someone breathed those levels consistently for a long period of time (e.g., 70 yrs).

Florida DOH mailed letters with the sampling results to residents in June 2008. Although no vapor intrusion from contaminated groundwater was found during the indoor air sampling, Florida DOH recommends some actions for best public health practice for residents concerned about chemicals in their home. When using commercial or household products (e.g., cleaning

products and strong glues), residents should open windows for better ventilation, and should follow proper storage procedures. Residents may want to consider using non-toxic cleaning products.

Additional indoor air testing is not necessary at this time because vapor intrusion was not found to be occurring in the buildings tested. If additional chemicals are found in the groundwater or groundwater contaminant levels increase significantly, the Florida DOH will consider recommending additional indoor air sampling.

## **Objectives and Rationale**

This Exposure Investigation (EI) addresses the public health threat of possible vapor intrusion into buildings located near volatile organic compound (VOC) groundwater contamination from the Sherwood Medical hazardous waste site in Deland, Florida.

After a review of all monitoring well data, the Florida Department of Health (DOH) determined that TCE and PCE in the upper and lower surficial groundwater were at high enough levels off-site to cause a concern for vapor intrusion into homes near the site. Other chemicals present in the surficial groundwater on-site (acetone, benzene, chloroform and 1,2-dichloroethylene (1,2-DCE)) are at low levels and have not been detected off-site; therefore, they are not a concern for vapor intrusion. DOH also reviewed the off-site private well data and determined that chemicals were either not detected or found below drinking water screening values.

In April 2008, the Florida Department of Health (DOH) requested funding from the Agency for Toxic Substances and Disease Registry (ATSDR) for indoor air testing after reviewing groundwater data from monitoring wells in the neighborhood near the site. ATSDR provided the financial and technical support for this testing.

## **Background**

### **Site Description**

The Sherwood Medical Industries National Priorities List Superfund hazardous waste site (Sherwood) is at 2010 U.S. Highway 92, three miles northeast of Deland, Volusia County, Florida (Figures 1, 2, and 3). This 43-acre site is zoned for industrial land uses. The northern boundary of the site is U.S. Highway 92 (State Road 600), beyond which are several small subdivisions, woodlands, and pasture land. The eastern boundary of the site is Kepler Road (State Road 430A). Several residences are east of Kepler Road. Drinking water for these residences is provided by either individual private wells or by the City of Deland municipal water. South of the site is a 17-acre Florida Department of Transportation maintenance yard and construction office. The western boundary of the site transects Lake Miller and adjacent wooded areas and wetlands (EPA 2004). The eastern portion of the 8.15-acre Lake Miller is within the Sherwood property boundary.

### **Hydrogeology**

The hydrogeologic sequence at the site includes the surficial or water table aquifer, a confining unit composed of clay, sandy clay, and shell layers, and the confined Floridan Aquifer. In general, depth to water at the site ranges from 4.5' to 24.97'. The shallow wells are screened in the upper surficial aquifer (4.5' – 60' below ground surface). The deeper wells are screened in

the lower surficial aquifer (60' – 100' below ground surface). The Floridan Aquifer wells are 520 feet deep. The Floridan Aquifer is a highly productive aquifer and is encountered beneath the confining unit. The Floridan Aquifer is the source of drinking water for the local residents (EPA 2007c).

### **Site Background and History**

In 1959, Sherwood began manufacturing stainless steel medical supplies, primarily hypodermic needles. Sherwood withdrew water from the deep Floridan aquifer and discharged waste water containing chromium, nitrate, trichloroethylene (TCE) and tetrachloroethylene (PCE) into on-site septic tanks and unlined percolation ponds.

In December 1982, due to the threat of contamination from wastes stored in the holding ponds and impoundments, the Florida Department of Environmental Regulation (DER), proposed the site to the National Priorities List. Subsequent testing found contamination in the shallow groundwater onsite.

In 1986, the Volusia County Health Department (CHD) conducted on-site testing and found trans-1, 2-dichloroethylene, PCE, TCE, and vinyl chloride in the Floridan aquifer (deepest) groundwater. Also in 1986, the Volusia CHD sampled private wells off-site but did not find these VOCs.

Beginning in 1987, the U.S. EPA required Sherwood to test all of the private wells along Kepler Road every six months. These wells were immediately adjacent to the site and extend from the intersection of U.S. 92 and Kepler Road through the intersection of Marsh and Kepler Roads (Figure 2).

In 1989, the Florida DOH and the Agency for Toxic Substances and Disease Registry (ATSDR) concluded Sherwood was a potential public health concern because of possible exposure to hazardous substances. They concluded that human exposure to trans 1,2-dichloroethylene, tetrachloroethylene, trichloroethylene may occur through the ingestion of contaminated ground water. They recommended a monitoring well system for both on-site and off-site ground water and that air testing be considered.

By 1997, Sherwood had constructed and began operating the groundwater extraction system with an air stripper. In 1997, EPA required Sherwood to test Lake Miller sediment, surface water, and fish to confirm the effectiveness of the pump and treat remedy. Semi-annual sampling of the sediments and surface water continue to monitor the potential threat to that ecosystem (DEP 2008).

In January 2007, EPA held a public meeting to update the community on the progress of cleanup of the site. During this meeting, nearby residents expressed numerous health concerns. In March 2007, Volusia CHD requested assistance in responding to local residents concerned about groundwater contamination from the Sherwood Medical NPL site reaching their private drinking water wells. In addition, residents complained about the appearance, odor and clarity of their drinking water. DOH arranged for funding through the Florida Department of Environmental Protection (DEP) for the Volusia CHD to test private wells in the nearby Cypress Lake Estates and Daytona Park Estates neighborhoods. DOH held an open house March 14, 2007 to meet the

residents, explain the health assessment process, and collect additional health concerns beyond those already documented by the US EPA and Florida DEP at a meeting held in January.

In October 2007, the Florida DOH and the Volusia CHD held a second open house to discuss the private well sampling results. The Florida DOH prepared a letter health consultation dated September 4, 2008 evaluating contaminants in private drinking water wells (ATSDR 2008a). VOCs were detected in residential potable wells but at levels less than the drinking water standards (Table I). DOH determined the levels of contaminants in the wells are not likely to harm people's health. In August 2009, Florida DOH evaluated air stripper emission impacts in the neighborhood surrounding Sherwood, and concluded that PCE and TCE were very low in the air and not likely to harm people's health (ATSDR 2009).

Based on 2006 and 2007 surficial groundwater levels of PCE and TCE, Florida DOH determined groundwater vapor intrusion was possible. The shallow surficial groundwater (4.5-60' below ground surface) under the site and some of the residential area is contaminated with VOCs. For vapor intrusion, the shallow groundwater is the main concern because only the contaminants from the shallow groundwater are likely to enter the buildings located above the plume. In 2006, the highest PCE and TCE concentrations were 2400 and 940 µg/L respectively. In 2007, the highest PCE and TCE concentrations were 2000 and 460 µg/L respectively. The contaminant levels from the deeper lower surficial groundwater (60'-100' below ground surface) are not likely to enter the buildings above, as well as the even deeper, Floridan Aquifer (520' below ground surface). The drinking water wells are all located in the deep Floridan Aquifer. More groundwater contaminant information can be found in Table II and Appendix A of the EI Protocol (ATSDR 2008b).

## **Land Use and Demographics**

Land use near Sherwood is varied. International Speedway (U.S. Highway 92, State Road 600) runs along the northern border of the site, while a former Department of Transportation (DOT) maintenance yard is directly south. To the east, there are both commercial and residential properties. There are many commercial properties along Kepler road, approximately 40 single family homes in Cypress Lake Estates, and approximately 115 single family homes in Daytona Park Estates (Figures 2 & 3).

## **Community Health Concerns**

Some nearby residents are concerned that living near the Sherwood site is a threat to their health. On March 14, 2007, during a DOH open house for Daytona Park and Cypress Estates, neighborhood residents expressed numerous specific health concerns<sup>1</sup> and requested indoor air sampling of their homes.

- 
- <sup>1</sup> Birth defects, brittle teeth enamel/loss of teeth, deaths from colon cancer, death from leukemia, cancer in general, nerve damage and neuropathy, rashes, cough, diabetes, blindness due to diabetes, acute myelogenous leukemia, abdominal problems, h. Pylori, chronic obstructive pulmonary disease, bladder cancer, heart disease, kidney/gallbladder stones, prostate problems, sinus problems, stomach pains, and shortness of breath.

## **Methods**

### **Exposure Investigation Design**

#### ***Selection of Homes for Indoor Air Testing***

The shallow groundwater under some of the homes in the Cypress Lake Estates neighborhood near Sherwood is contaminated with TCE and PCE. The shallowest depth to groundwater in the residential neighborhood is 12-14 feet (UES 2008).

Based on an evaluation of the potential for vapor intrusion using the groundwater concentrations shown in Table II, the DOH proposed the collection and analysis of indoor air samples for VOCs to look for TCE and PCE traveling from shallow groundwater to indoor air.

The Florida DOH used the highest levels of VOCs detected in the upper surficial groundwater monitoring wells for selecting buildings for indoor air testing. Florida DOH selected one business and two homes in Cypress Lake Estates above the highest groundwater contamination off-site and one sample from a background home in Daytona Park Estates. DOH selected buildings built on slab. Florida DOH followed ATSDR's VOC vapor intrusion guidance in creating their sampling protocol (ATSDR 2008c).

#### ***Data Collection/Sampling Procedures***

In spring of 2008, Florida DOH discussed the possibility of testing indoor air with nearby residents. Several weeks before testing, all participants signed consent forms and agreed not to use products containing VOCs in their home 72 hours prior to, and during, testing (ATSDR 2008b). They also agreed to keep all windows closed during this timeframe. DOH confirmed that no residents smoked in their homes/business.

On April 29, 2008, the Florida DOH and the Volusia CHD staff collected three sequential 8-hour samples in stainless steel Summa© canisters from four locations. The staff began testing at the first location at 7:00 a.m. on April 29, 2008 and ended all testing at all four locations by 7:28 a.m. on April 30, 2008 for a total of 24 hours at each location (three 8-hour samples). DOH and Volusia CHD placed the canisters approximately 3 feet off the floor in a central location that each resident or business owner occupies the most. Before testing, the staff double checked that all windows and doors were closed and reminded the household members to keep them closed. They also reminded each resident to not use the household products containing VOCs (ATSDR 2008b).

Before the staff opened the canister valve for testing, they double checked there was a proper seal between the regulator and the canister to assure proper testing and no air leaks. During the first 8-hour test at the background location, DOH thought the regulator was malfunctioning so the canister was turned off for approximately one hour and 40 minutes. This did not affect the results of the testing; but it shortened the total air collection time to 22 hours rather than 24 hours.

On April 30<sup>th</sup>, DOH staff prepared the regulators and canisters and shipped them overnight to Data Chem Laboratories in Utah. They included chain-of-custody forms, laboratory analytical request forms, canister serial numbers, collection times, and pressure readings. Data Chem Laboratories received all twelve air canisters and regulators within the holding time and in good condition.

### **Laboratory Analytic Procedures**

Data Chem Laboratories analyzed the twelve air samples for 57 volatile organic compounds using EPA Method Total Organic 15 (<http://www.epa.gov/ttn/amtic/files/ambient/airtox/to-15r.pdf>). They also tested one method blank and one duplicate for each canister sampled. The quality assurance/control data were acceptable except for acetone which had a lower percent recovery (79.9%). For all other volatiles, the percent recovery ranged from 90-118%. No VOCs were detected in the laboratory blank sample.

### **Data Analysis Procedures**

The Florida DOH used ATSDR and EPA air screening values (Tables IV) for analyzing the results. If the chemical level exceeded a screening value, then DOH evaluated the finding in more detail. If the level was less than the screening value or not detected at all, then that chemical was dropped from the evaluation and considered to be no health concern.

### **Results**

The indoor air results are included in Table III. The levels of VOCs detected in all three buildings near Sherwood Medical were similar to those detected in the background home. All VOC concentrations are at levels that are commonly found in indoor air. In June 2008, the Florida DOH sent letters to each resident explaining their specific results.

The main contaminants of concern in the shallow groundwater underlying the homes, TCE and PCE, were not found in the indoor air of the three buildings tested that were located over the contaminated groundwater. PCE was detected in the background sample during one out of three sequential 8-hour tests, but was below screening values. PCE is commonly found in sources such as dry-cleaned clothing and household products.

Benzene, chloroform, and 1,2-DCA were detected at low levels, but the maximum 8-hr average was above a screening value for cancer effects at one or more locations and will be evaluated further in the next section. Several other VOCs (see Table III for list) were detected at low levels but below screening values; therefore, they will not be evaluated any further.

Acetone, benzene and chloroform have been found in the shallow groundwater on-site but at low enough levels to not be a concern for vapor intrusion. In addition, these chemicals are common indoor air contaminants at the low levels that were detected and were found at the background site as well. Therefore, these contaminants are not likely to be associated with the groundwater contamination from Sherwood, but are probably present from another source such as household products.

1,2-DCA has not been found in contaminated groundwater from Sherwood but was found in the indoor air in one building that was tested (location #2, 39  $\mu\text{g}/\text{m}^3$ ) and in the background location (22  $\mu\text{g}/\text{m}^3$ ) above the cancer screening value.

### **Discussion**

The three contaminants detected above screening values (benzene, chloroform, and 1,2-DCA) are discussed further in this section (Table IV). In summary, benzene and chloroform were found at low levels and are not expected to cause any harmful health effects for typical residential exposures. 1,2-DCA was found in one test sample and the background sample at levels that may cause a low to moderate theoretical increased cancer risk if someone breathed those levels

consistently for a long period of time (30-70 yrs).

### Benzene

Benzene was detected at location #2 ( $2.6 \mu\text{g}/\text{m}^3$ ) and location #4 (background) ( $2.7 \mu\text{g}/\text{m}^3$ ). These values are below screening values for non-cancer health effects ( $10 \mu\text{g}/\text{m}^3$ ), but above the screening value for cancer effects ( $0.1 \mu\text{g}/\text{m}^3$ ). Major sources of benzene in air are tobacco smoke, gasoline, vehicle exhaust and industrial emissions. A few glues, paints, furniture wax and detergents contain low amounts of benzene also. It is commonly found in indoor air at about  $5 \mu\text{g}/\text{m}^3$  (EPA, 1998). Benzene levels detected during this air testing were below this average indoor air value.

Because the cancer screening value was exceeded, Florida DOH calculated the cancer risk from exposure to benzene and determined a very low theoretical increased risk.

Benzene levels detected during this air testing are not likely to harm people's health because the cancer risk is very low.

### Chloroform

Chloroform was detected at locations #1 ( $1.8 \mu\text{g}/\text{m}^3$ ), #2 ( $2.2 \mu\text{g}/\text{m}^3$ ), and #4 background ( $1.8 \mu\text{g}/\text{m}^3$ ). These values are below screening values for non-cancer health effects ( $100 \mu\text{g}/\text{m}^3$ ), but above the screening value for cancer effects ( $0.04 \mu\text{g}/\text{m}^3$ ).

Chloroform enters the environment from chemical companies, paper mills and other sources. Chloroform can enter the air directly from factories that make or use it and by evaporating from contaminated water and soil. It evaporates easily into the air. Chloroform enters indoor air from hot showers and other vaporization of chlorinated municipal water. EPA reports typical indoor levels of  $1 \mu\text{g}/\text{m}^3$  (EPA 1998). The maximum 8-hr chloroform levels found in the indoor air of locations #1, #2 and #4 are slightly above this typical indoor air level. The 24-hr average levels for each location are much closer to the  $1 \mu\text{g}/\text{m}^3$  typical indoor air level.

Because the cancer screening value was exceeded, Florida DOH calculated the cancer risk from chloroform and determined a very low theoretical increased risk.

Chloroform levels detected during this air testing are not likely to harm people's health because the cancer risk is very low. Proper ventilation (fan exhausts, HVAC, or open windows) would decrease the levels.

### 1,2-DCA

1,2-DCA was detected at locations #2 ( $61 \mu\text{g}/\text{m}^3$ ) and location #4 background ( $65 \mu\text{g}/\text{m}^3$ ). These values are below screening values for non-cancer health effects ( $2000 \mu\text{g}/\text{m}^3$ ), but above the screening value for cancer effects ( $0.04 \mu\text{g}/\text{m}^3$ ).

1,2-DCA is most commonly used in the production of vinyl chloride, which is used to make a variety of plastic and vinyl products including polyvinyl chloride (PVC) pipes, furniture and automobile upholstery, wall coverings, house wares, and automobile parts. It is also used as a solvent and is added to leaded gasoline to remove lead. Old cleaning solutions, pesticides, wallpaper/ carpeting glue, and some paint/varnish/finish removers also contain 1,2-DCA. 1,2-DCA has not been detected in shallow or deep contaminated groundwater from Sherwood.

Because the cancer screening value was exceeded, Florida DOH calculated the cancer risk from 1,2-DCA. The cancer risk for 24-hour averages of 1,2-DCA was found to be a low to moderate increased theoretical cancer risk for lifetime exposure (70 years). The 24 hour averages for location #2 and #4 were  $39.0 \mu\text{g}/\text{m}^3$  and  $22.4 \mu\text{g}/\text{m}^3$ , respectively (non-detects were calculated as  $\frac{1}{2}$  the detection limit). Using EPA's inhalation unit risk factor, DOH estimates the theoretical increased cancer risk from lifetime (70 year) inhalation of the highest 24-hour time weighted average indoor air concentration of 1,2-DCA ( $39.0 \mu\text{g}/\text{m}^3$ ) is about 1 in 1,000 or a "moderate" increased cancer risk. This is an upper-bound risk estimate. The actual risk may be lower and may be as low as zero. To put this into context, the American Cancer Society estimates that one out of every three Americans (or 333 in 1,000) will be diagnosed with some form of cancer in their lifetime. Adding the upper-bound estimate of the theoretical increased cancer risk from lifetime exposure to  $39.0 \mu\text{g}/\text{m}^3$  1,2-DCA near Sherwood would increase the cancer incidence from 333 in 1,000 to 334 in 1,000.

## Limitations

There are at least two limitations for this investigation. First, the Florida DOH and the Volusia CHD collected three 8-hour samples for a total of 24 hours from four locations. Indoor air concentrations may be different on other days or in other seasons. Second, although indoor air samples were collected from homes above the highest shallow groundwater contamination, the air in other homes in the neighborhood may have been different.

## Child Health Considerations

Little information exists on how VOCs differ in their effects between children and adults (ATSDR 1997). Children drink more fluids, eat more food, and breathe more air per kilogram of body weight than do adults. Children have a larger skin surface in proportion to their body volume. Therefore, children may be more sensitive to the effects of VOCs than adults.

Florida DOH reviewed the air test results in terms of sensitive populations such as pregnant women, nursing mothers and children, and found that the VOCs detected in indoor air are not likely to harm the health of sensitive subpopulations.

## Conclusions

- TCE and PCE were not found in the indoor air of homes overlying the shallow groundwater contamination; therefore, no vapor intrusion was found in this exposure investigation.
- The VOCs that were detected in indoor air of homes overlying the shallow groundwater (benzene, chloroform, and 1,2-DCA) were not detected in the shallow groundwater contamination; therefore, these VOCs were not present due to vapor intrusion.
- 1,2-DCA may harm people's health in locations #2 and #4 by causing a low to moderate increased risk of cancer, if people breathed those levels of 1,2-DCA for a very long time (about 70 years). However, this exposure scenario is very unlikely. Shorter-term exposures to the levels of 1,2-DCA detected in this study are not likely to harm people's health.
- The other VOCs detected during this air testing were at levels commonly found in indoor air, and are not expected to harm people's health.

## **Recommendations**

- When using commercial or household products containing 1,2-DCA, residents should open windows to ventilate. Concerned residents should also consider using non-toxic cleaning products.
- Residents concerned about any chemical detected in their home can decrease VOC exposure by following proper storage procedures for any product in the home containing VOCs and using proper ventilation (e.g., open windows, use exhaust fans, run HVAC system) when using a product high in VOCs.
- If additional chemicals are found in the groundwater or groundwater contaminant levels increase significantly, the Florida DOH will consider recommending additional indoor air monitoring.

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# FIGURE 1 Volusia County Map

Figure 1. Location of Site in Volusia County, Florida



**FLORIDA DEPARTMENT OF  
HEALTH**

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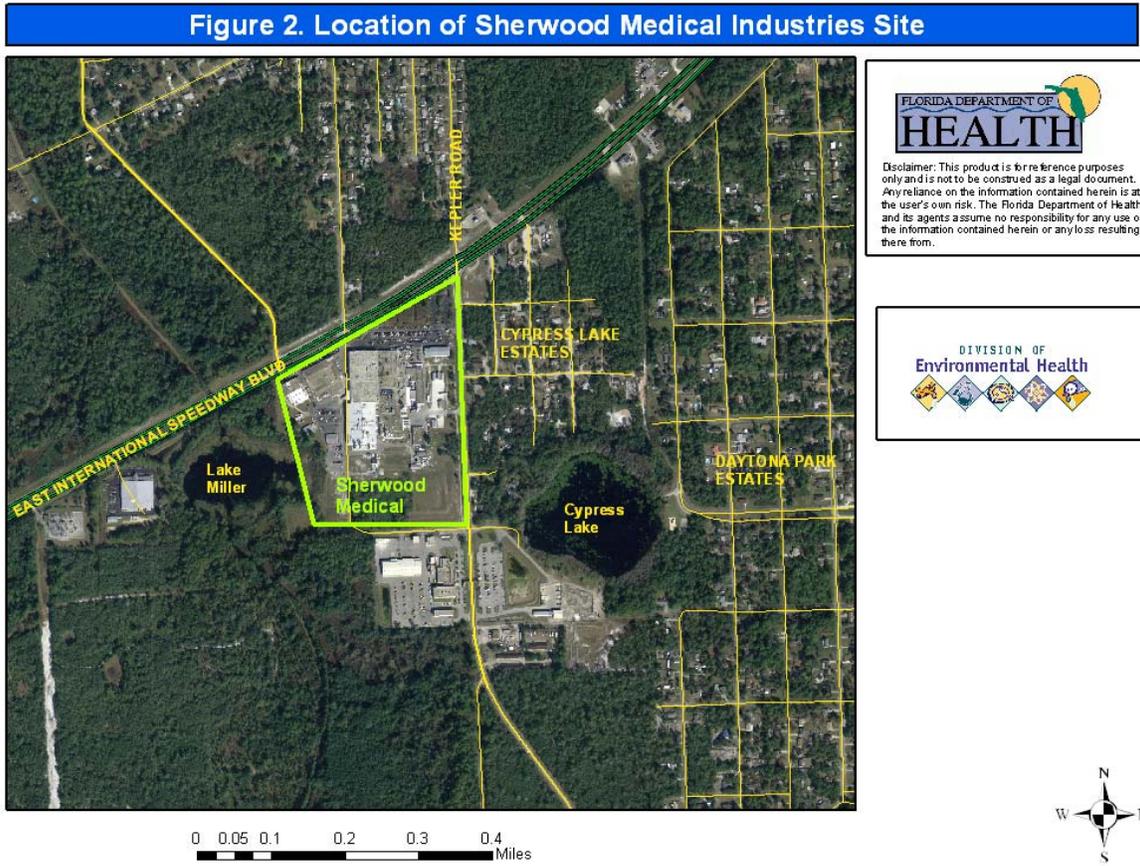
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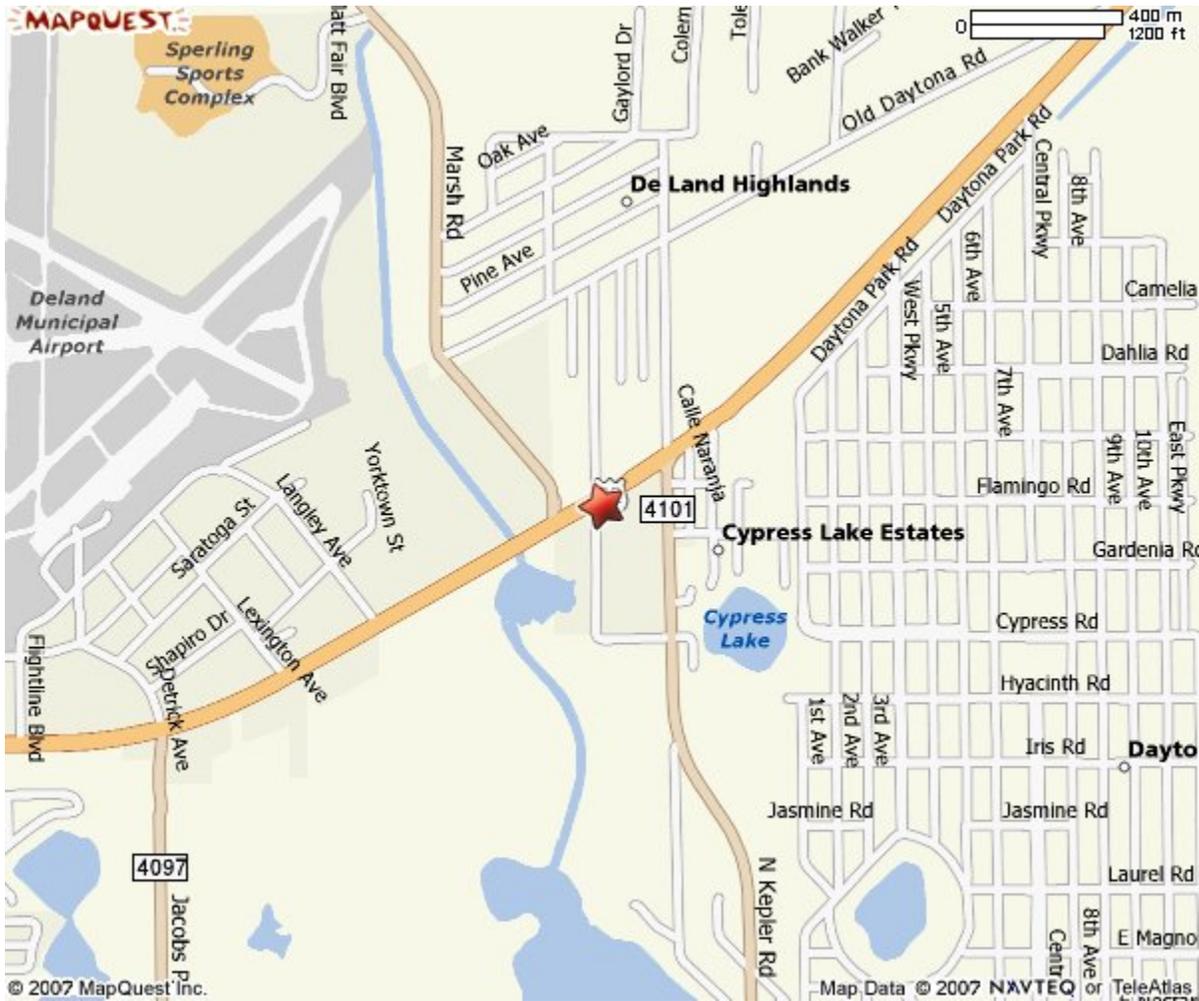
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# FIGURE 2 Aerial View Sherwood Medical Site

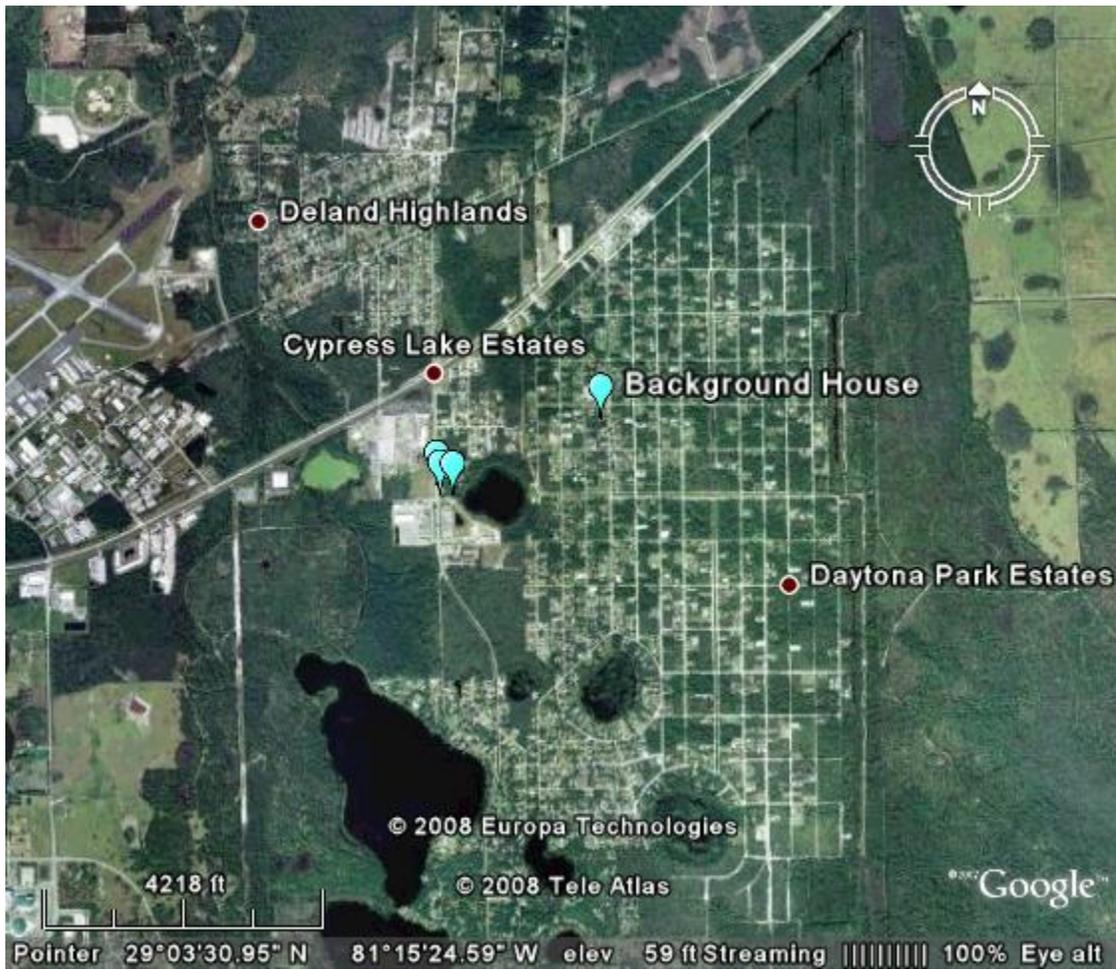


**FIGURE 3**  
**Street Map - Sherwood Medical Site**  
**Deland, Florida**



Reference: [www.mapquest.com](http://www.mapquest.com)

**Figure 4**  
**Air Sampling Locations**  
**(3 near the site and 1 background)**



**Table I**  
**Residential Potable Well Contaminants near Sherwood**  
**All values in micrograms per liter (µg/L)**

Well ID	Chemical	6/06	12/06	6/07	12/07
	PCE	<0.6	<0.65	<0.65	<0.47
	TCE	<0.3	<0.71	<0.71	<0.30
<b>Kepler Rd</b>	cis 1,2-DCE	0.5 l	<0.75	<0.75	1
	trans 1,2-DCE	<0.8	<0.83	<0.83	<0.58
	PCE	<0.6	<0.65	<0.65	<0.47
<b>San Antonio Street</b>	TCE	<0.3	<0.71	<0.71	<0.30
	cis 1,2-DCE	2	1.2	1.9	3.5
	trans 1,2-DCE	<0.8	<0.83	<0.83	<0.58
	PCE	<0.6	<0.65	<0.65	<0.47
<b>N. Blue Lake Ave</b>	TCE	<0.3	<0.71	<0.71	<0.30
	cis 1,2-DCE	<0.3	<0.75	<0.75	<0.34
	trans 1,2-DCE	<0.8	<0.83	<0.83	<0.58
	PCE	<0.6	Well out of service - Connected to municipal supply		
<b>Calle Alto Vista</b>	TCE	<0.3			
	cis 1,2-DCE	<0.3			
	trans 1,2-DCE	<0.8			
	PCE	<0.6<0.6	Well being repaired	<0.65	<0.47
<b>Kepler Rd</b>	TCE	0.6 l/0.7 l		<0.71	0.90 l
	cis 1,2-DCE	2/2		<0.75	5
	trans 1,2-DCE	<0.8/<0.8		<0.83	0.58
	PCE	NS	NS	<0.65	<0.47
<b>Calle Revilla</b>	TCE	NS	NS	<0.71	<0.30
	cis 1,2-DCE	NS	NS	<0.75	0.41 l
	trans 1,2-DCE	NS	NS	<0.83	<0.58
	PCE	NS	NS	<0.65	<0.47
<b>2160 Calle Revilla Dr</b>	TCE	NS	NS	<0.71	<0.30
	cis 1,2-DCE	NS	NS	<0.75	0.47 l
	trans 1,2-DCE	NS	NS	<0.83	<0.58
	PCE	NS	NS	<0.65	<0.47
<b>1891 Calle Narauja</b>	TCE	NS	NS	<0.71	<0.30
	cis 1,2-DCE	NS	NS	<0.75	0.55 l
	trans 1,2-DCE	NS	NS	<0.83	<0.58
	PCE	NS	NS	Well Not Available	<0.47
<b>1850 Calle Buena Vista</b>	TCE	NS	NS		<0.30
	cis 1,2-DCE	NS	NS		<0.34
	trans 1,2-DCE	NS	NS		<0.58

NS = not sampled

**Table II**  
**Sherwood Area Ranges of TCE and PCE Groundwater Concentrations in 2006 & 2007 (micrograms per liter)**

	<b>Upper Surficial Aquifer (4.5'-60' below ground surface)</b>	<b>Lower Surficial Aquifer (60'-100' below ground surface)</b>	<b>Groundwater Cleanup Target Level</b>
<b>PCE</b>			
<b>2006</b>	<b>&lt;0.6</b> (MW 111-113)      ⇒ <b>2400</b> (MW 106)	<b>&lt;0.6</b> (IW2,IW8,IW10)      ⇒ <b>279</b> (IW6)	3
<b>2007</b>	<b>&lt;0.7</b> (MW 101&111-113&124)      ⇒ <b>2000</b> (MW 106)	<b>&lt;0.5</b> (IW 8,IW10,IW13,IW30&IW40)      ⇒ <b>100</b> (IW6)	
<b>TCE</b>			
<b>2006</b>	<b>&lt;0.3</b> (MW109,110,112,113)      ⇒ <b>940</b> (MW-105)	<b>&lt;0.3</b> (IW2,IW10,IW18)      ⇒ <b>322</b> (IW12)	3
<b>2007</b>	<b>&lt;0.7</b> (MW 101,109,110,111,113&124)      ⇒ <b>460</b> (MW 105)	<b>&lt;0.3</b> (IW2, IW10,IW13,IW30,IW40)      ⇒ <b>270</b> (IW12)	

**MW = monitoring wells**

**IW = lower surficial aquifer wells**

**Table III**  
**2008 Indoor Air Concentrations (8 hour samples)**  
**(micrograms per cubic meter =  $\mu\text{g}/\text{m}^3$ )**

Chemical <sup>2</sup>	Location #1			Location #2			Location #3			Location #4 (background)		
	Morning	Afternoon/ Evening	Late Eve/ Early Morn	Morning	Afternoon/ Evening	Late Eve/ Early Morn	Morning	Afternoon/ Evening	Late Eve/ Early Morn	Morning <sup>3</sup>	Afternoon/ Evening	Late Evening Early Morn
1,2-Dichloroethane	ND	ND	ND	ND	55.0	61.0	ND	ND	ND	ND	65.0	ND
1,4-Dichlorobenzene	1.9 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Butanone	ND	ND	ND	2.9	5.6	7.9	ND	ND	ND	2.6	6.1	ND
Acetone <sup>4</sup>	120 E	43	38	96.0 E	130 E	140 E	19.0	25.0	19.0	44.0	170 E	93.0 E
Benzene	ND	ND	ND	ND	2.6	2.6	ND	ND	ND	ND	2.7	1.4 J
Chloroform	1.8 J	ND	ND	2.1 J	2.2J	ND	ND	ND	ND	ND	1.8 J	1.8 J
Chloromethane	2.1	ND	ND	2.5	ND	ND	1.5	ND	ND	ND	ND	3.1
Dichlorodifluoromethane	3.0	3.4	3.5	3.0	93	130 E	3.3	2.9 J	3.3	3.4	140 E	3.0
Ethyl Acetate	ND	ND	ND	45	ND	ND	ND	ND	ND	ND	ND	45.0
Ethylbenzene	ND	ND	ND	ND	2.1 J	2.3	ND	ND	ND	ND	2.4	ND
4-Ethyltoluene	ND	4.4	5.8	ND	1.5 J	1.4 J	ND	ND	ND	2.9	2.0 J	ND
Freon 11	ND	8.8	9.7	ND	3.1	3.0	3.0	2.4	2.6 J	8.1	3.3	ND
Heptane	1.7 J	ND	2.1	1.4 J	3.4	4.6	ND	ND	ND	3.0	4.2	2.7
Hexane	ND	10.0	ND	ND	1.9	22.0	1.7 J	ND	20.0	ND	2.5	ND
Styrene	ND	ND	ND	ND	1.3 J	1.4 J	ND	ND	ND	ND	1.6 J	ND
Tetrachloroethene (PCE)	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.7 J	ND	ND
Toluene	4.2	8.9	ND	3.8	15.0	17.0	16.0	8.6	9.5	8.9	17.0	8.2
1,3,5-Trimethylbenzene	ND	5.1	6.6	ND	1.6 J	1.4 J	ND	ND	ND	4.1	2.0 J	ND
1,2,4-Trimethylbenzene	3.2	17	22.0	2.6	3.8	3.2	ND	ND	ND	14.0	4.8	3.2
m,p-Xylene	ND	5.0	4.7	ND	3.6 J	3.9 J	ND	ND	ND	3.6 J	3.9 J	2.8 J
o-Xylene	ND	ND	3.9	ND	ND	1.3 J	ND	ND	ND	2.5	ND	ND

ND= non-detect

J= the value is between the Maximum Detection Limit (MDL) and Practical Quantitation Limit (PQL). It is also used for indicating an estimated value for tentatively identified compounds in mass Spectrometry where a 1:1 response is assumed.

E= indicates a reported value above the analytical linear range.

<sup>2</sup> 36 other VOCs were tested and were not detected.

<sup>3</sup> The first morning sample for Location #4 canister was turned off for 1 hour and 40 minutes due to a pressure gauge misunderstanding.

<sup>4</sup> The Quality Control data had a lower percent recovery for acetone (79.9%).

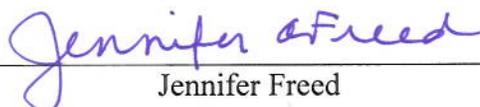
**Table IV**  
**VOC Comparison Values and Maximum Sampling Results**

Volatile Organic Compounds	ATSDR Comparison Values				EPA Comparison Values		Sampling Results	
	acute (ug/m <sup>3</sup> )	interm (ug/m <sup>3</sup> )	chronic (ug/m <sup>3</sup> )	cancer (ug/m <sup>3</sup> )	EPA RFC (ug/m <sup>3</sup> )	EPA Inhalation Unit Risk ( ug/m <sup>3</sup> ) <sup>-1</sup>	Maximum 8-hr conc detected (ug/m <sup>3</sup> )	Above a comparison value?
1,4-Dichlorobenzene	10,000	1000	60	None	800	none	1.9J	No
1,2-dichloroethane	none	none	2000	<b>0.04</b>	none	2.6E-05	<b>65</b>	<b>Yes</b>
2-Butanone	none	none	none	None	5000	none	7.9	No
Acetone	60000	30000	30000	None	none	none	170	No
Benzene	30	20	10	<b>0.1</b>	30	7.8 E-06	<b>2.7</b>	<b>Yes</b>
Chloroform	500	200	100	<b>0.04</b>	none	2.3E-05	<b>2.2</b>	<b>Yes</b>
Chloromethane	1000	400	100	None	none	none	3.1	No
Dichlorodifluoromethane	none	none	none	None	none	none	140	n/a
Ethyl Acetate	none	none	none	None	none	none	45	n/a
Ethylbenzene	none	4000	none	None	1000	none	2.4	No
4-Ethyl Toluene	none	none	none	None	none	none	5.8	n/a
Freon 11	none	none	none	None	none	none	9.7	n/a
Heptane	none	none	none	None	none	none	4.6	n/a
Hexane	none	none	2000	None	700	none	22.0	No
Styrene	none	none	300	None	1000	none	1.6	No
Tetrachloroethene	1000	none	300	None	none	none	2.7	No
Toluene	4000	none	300	None	5000	none	17	No
1,3,5-Trimethylbenzene	none	none	none	None	none	none	6.6	n/a
1,2,4-Trimethylbenzene	none	none	none	None	none	none	22	n/a
Xylenes (total)	9000	3000	200	None	100	none	5	No

Bold and underline cells indicate an exceedance of a comparison value.

### Certification

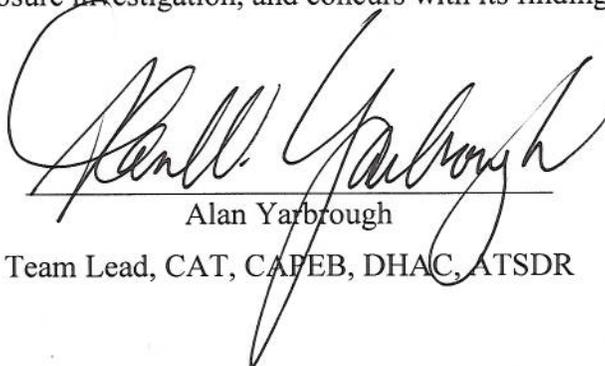
The Florida DOH, Bureau of Community Environmental Health, under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR) prepared this report on air sampling for the Sherwood Medical Site Exposure Investigation. This Exposure Investigation was prepared in accordance with approved methodology and procedures existing at the time. Editorial review was completed by the Cooperative Agreement Partner.



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Jennifer Freed  
Technical Project Officer, CAT, CAPEB, DHAC

The Division of Health Assessment and Consultation, ATSDR, has reviewed this exposure investigation, and concurs with its findings.



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Alan Yarbrough  
Team Lead, CAT, CAPEB, DHAC, ATSDR