

Health Consultation

Fruit and Vegetable Testing

SHERWOOD MEDICAL INDUSTRIES SUPERFUND SITE

DELAND, VOLUSIA COUNTY, FLORIDA

EPA FACILITY ID: FLD043861392

JUNE 13, 2008

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

Health Consultation: A Note of Explanation

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

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

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Prepared By:

Florida Department of Health Services
Office of Environmental and Occupational Toxicology
Under Cooperative Agreement with the
The U.S. Department of Health and Human Services
Agency for Toxic Substances and Disease Registry

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Foreword

In this health consultation report, the Florida Department of Health (DOH) evaluates the public health threat from metals found in collard greens, green beans, papayas and sweet potatoes from one garden near the Sherwood Medical Industries Superfund site in DeLand, Florida.

Evaluating exposure: Florida DOH scientists begin by reviewing available information about environmental conditions at the site. The first task is to find out how much contamination is present, where it is on the site, and how people might be exposed to it. Usually, Florida DOH does not collect its own environmental sampling data. We rely on information provided by the Florida Department of Environmental Protection (DEP), the U.S. Environmental Protection Agency (EPA), and other government agencies, businesses, and the public.

Evaluating health effects: If evidence is found that people are being exposed—or could be exposed—to hazardous substances, Florida DOH scientists will take steps to determine whether that exposure could be harmful to human health. Their assessment focuses on public health; that is, the health impact on the community as a whole, and is based on existing scientific information.

Developing recommendations: In an evaluation report—such as this exposure investigation report—Florida DOH outlines its conclusions regarding any potential health threat posed by a site, and offers recommendations for reducing or eliminating human exposure to contaminants. The role of Florida DOH in dealing with hazardous waste sites is primarily advisory. For that reason the evaluation report will typically recommend actions to be taken by other agencies—including the EPA and Florida DEP. If, however, the health threat is immediate, Florida DOH will issue a public health advisory warning people of the danger and will work to resolve the problem.

Soliciting community input: The evaluation process is interactive. Florida DOH solicits and evaluates information from various government agencies, the organizations or individuals responsible for cleaning up the site, and from community members who live near the site. Any conclusions are shared with the organizations and individuals who provided information. Once an evaluation report has been prepared, Florida DOH seeks feedback from the public. If you have questions or comments about this exposure investigation report, we encourage you to contact us.

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Summary and Statement of Issues

This health consultation report evaluates the public health threat from metals in collard greens, green beans, papayas and sweet potatoes from one garden near the former Sherwood Medical Industries Superfund site in Deland, Florida. The Volusia County Health Department (CHD) and the Department of Agriculture and Consumer Services (DACS) collected these homegrown fruits and vegetables. The DACS analyzed for metals. Although chromium was used at Sherwood, it was not found in the fruit or vegetables. None of the metals found in the fruits and vegetables are at levels likely to cause illness. The estimated dose for each metal is less than recommended dietary intake levels or less than or equal to ATSDR's minimal risk levels (MRLs). The levels of metals in these fruits and vegetables are no apparent public health hazard.

Purpose

This health consultation addresses the public health threat from eating fruits and vegetables (produce) from a garden near the Sherwood site. The name of the facility is now Tyco-Kendall. The Florida DOH initiated fruit and vegetable metal testing after nearby residents voiced their concerns at a January 2007 U.S. Environmental Protection Agency (EPA) public meeting. Due to contaminated ground water and soil at the site and possible storm water runoff, the residents wanted to know if neighborhood homegrown produce was safe to eat.

Background

Site Description

The Sherwood Medical Industries 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). Across from Sherwood along Kepler Road are several private residences served either by individual wells or by the City of Deland. At the southern end of the site, the Florida Department of Transportation occupies a 17-acre maintenance yard and construction office. The western boundary of the site transects Lake Miller and adjacent wooded areas and wetlands (EPA 2004). Lake Miller is about 8.15 acres and the eastern most portion is situated within the Sherwood property boundary.

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 (HRS 1992).

The facility was originally owned and operated by the Brunswick Corporation, which sold the facility to American Home Products Corporation in 1982. In 1998, American Home Products Corporation sold the facility to TYCO Industries, but retained responsibility for environmental contamination (EPA 2007a).

Between 1971 and 1980, Sherwood disposed of approximately two tons of liquid and sludge waste into two unlined percolation ponds. During this time, the facility removed solids from the ponds and placed them into onsite, unlined impoundments.

In the 1980s, Sherwood disposed of about two tons of potassium chromate contaminated liquid and sludge into an unlined surface impoundment. The impoundment is in the shallow aquifer overlying the Floridan Aquifer, which supplies water for numerous private and public wells, including the city of Deland's water supply well (EPA 2007b). From 1980 and 1982, Sherwood disposed of the wastes in an offsite landfill.

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 ground water onsite.

In July 1983, Sherwood constructed an industrial waste water treatment plant. The Florida DER permitted Sherwood to treat its waste water and to discharge the resulting effluent. At this time, the Florida DER recommended monitoring for nickel and halogenated solvents (EPA 2007b).

In 1985, nearby residents complained about the water quality in their private drinking water wells.

In late 1985, Sherwood installed an air stripper to remove chlorinated solvent from its Floridan Aquifer production well water.

In 1986, the Volusia County Health Department (CHD) conducted onsite testing and found trans 1,2-dichloroethylene, tetrachloroethylene, trichloroethylene and vinyl chloride in the Florida aquifer ground water. Also in 1986, the Volusia CHD sampled private wells and they were not contaminated with volatile organic compounds (VOCs) (HRS 1989).

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 HRS 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 ingestions of contaminated ground water when the plume of contamination at the site migrates to the Floridan Aquifer. They recommended a well monitoring system for both on-site and off-site ground water and that air testing be considered (HRS 1989).

In 1990 EPA's contractor found chromium in the surface soils (0-10 feet) surrounding the percolation ponds (125-262 parts per million, ppm) and adjacent to the tube mill building F

which is west of the main building onsite (318 ppm). Chromium was not in the most toxic hexavalent form but only in the less toxic forms (Weston 1992).

In 1990 and 1993, EPA's contractor found elevated levels of chromium in sediment samples from nearby Lake Miller. In 1994, they found much lower levels. The Florida Department of Environmental Protection (DEP) did not identify a definite correlation between toxicity and site-related contaminants in sediments. They also found chromium concentrations were not increasing in organisms higher on the food chain due to biomagnification. Consequently, EPA selected "no action with monitoring" for Lake Miller sediments (DEP 2008).

By 1991, Sherwood was pumping approximately 175,000 gallons of water per day from the Floridan Aquifer. They used approximately 150,000 gallons per day for industrial processes such as cleaning, manufacturing, and cooling/evaporation. They used 25,000 gallons per day for domestic purposes.

In January 1991, EPA and Florida DER answered questions about the Interim Remedial Measures Report and took public comment on the Proposed Plan. By 1997 Sherwood had constructed and began operating the groundwater extraction system with air stripper.

In 1997, EPA required Sherwood to test Lake Miller sediment, surface water, and fish to confirm the effectiveness of the remedy. Semi-annual sampling of the sediments and surface water will continue on a semi-annual basis to monitor the potential threat to that ecosystem (DEP 2008).

In November 2003, EPA found chromium in Lake Miller fish was below levels of concern. Access to Lake Miller is restricted (EPA, 2007a). In their 2004 five-year-review, EPA found that contaminants are not migrating within the ecological system at levels harmful to humans. Monitoring of Lake Miller will continue on a semi-annual basis, however, until the groundwater is below levels of concern (EPA 2004b). EPA also found that after removing soil with more than 520 ppm chromium and industrial deed restrictions, further on-site soil cleanup is not necessary (EPA 2004b).

At a January 2007 public meeting, nearby residents expressed numerous health concerns. In February 2007, the Florida DOH began the public health assessment process to address those concerns. As part of this process, the Volusia CHD sampled 59 private drinking water wells in Cypress Lake Estates and Daytona Park Estates.

In October 2007, the Florida DOH and the Volusia CHD held an open house to discuss the private well sampling results. The results indicated that although there were contaminants detected in some wells, there were no concentrations above primary, health-based drinking water standards.

Land Use and Demographics

Within a one mile radius of the operating Sherwood facility, land use is varied. International Speedway runs along the northern border of the site, while a former Department of Transportation (DOT) maintenance yard is directly south. To the east, directly across Kepler

road, there are both commercial and residential properties. According to Google Earth, 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.

Community Health Concerns

At a January 2007 public meeting, nearby residents expressed concerns about eating homegrown fruits and vegetables.

Discussion

Chromium was used at Sherwood to produce hypodermic needles and sodium dichromate was used to treat cooling water. Chromium was found in soils at the site.

In March and April 2007, the Florida DOH and the Volusia CHD asked nearby residents if they had fruit or vegetables gardens. They also drove through the nearby neighborhoods searching for gardens. The Volusia CHD found only one garden on West Parkway ½ mile from the site.

On June 15, 2007, the Volusia CHD and the DACS collected approximately three pounds of collard greens, one pound of green beans and two papayas from this garden on West Parkway and hand-delivered the produce to the DACS laboratory for metal testing.

In November 2007 the Volusia CHD and the DACS collected ten small sweet potatoes (Appendix C) from the same resident's garden and hand-delivered them to the DACS lab for metal testing. Since solvents don't accumulate in plants, the laboratory did not test for solvents.

Fruit and Vegetable Laboratory Methods and Results

Florida DACS rinsed the collard greens, green beans, papayas and sweet potatoes and analyzed for metals using DACS's Food Laboratory ICP-MS semi quantitative method (Table I). Only those metals detected above the detection limit are reported.

Aluminum, barium, copper, manganese, molybdenum, rubidium and strontium were detected in collard greens, green beans, papayas and/or sweet potatoes from the garden near the site. Of these metals, dietary intake information is available for all except aluminum.

The calculated doses for eating the homegrown produce were less than recommended dietary intake levels and less than or equal to ATSDR's Minimal Risk Levels (MRL) (Table II and III). An MRL is an estimate of daily human exposure to a hazardous substance at or below which that substance is unlikely to pose a measurable risk of harmful (adverse), noncancerous effects. Therefore, we do not expect low levels of metals found in the fruit and vegetables to cause illness.

Consideration of Biological Testing

The level of metals found in the collected produce do not warrant blood or urine testing.

Child Health Considerations

In Daytona Estates where the produce was collected, the Florida DOH noted households with children.

Because the calculated doses for eating the collard greens, green beans, papayas and sweet potatoes were less than recommended dietary intake levels and less than or equal to ATSDR's Minimal Risk Levels, the levels are not likely to cause illness in children. In communities faced with air, water, or food contamination, the many physical differences between children and adults demand special emphasis. Children could be at greater risk than are adults from certain kinds of exposure to hazardous substances. Children play outdoors and sometimes engage in hand-to-mouth behaviors that increase their exposure potential. Children are shorter than are adults; this means 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. Finally, children are dependent on adults for access to housing, for access to medical care, and for risk identification. Thus adults need as much information as possible to make informed decisions regarding their children's health.

Conclusions

The levels of metals found in fruits and vegetables from a garden ½ mile from the Sherwood site are no apparent public health hazard. The levels of metals found in collard greens, green beans, papayas and sweet potatoes are not likely to cause illness. The calculated doses were less than recommended dietary intake levels and less than or equal to ATSDR's minimal risk levels (MRLs).

Recommendations

As with any home garden, gardeners should wash their hands after gardening and rinse fruits and vegetables before eating.

Public Health Action Plan

Planned Actions

The Florida DOH will continue to evaluate environmental data from the site as needed.

The Florida DOH plans to complete the Public Health Assessment report by fall 2008.

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References

[ASN] American Society for Nutrition. <http://jn.nutrition.org/nutinfo/content/trace.shtml>. Last viewed January 17, 2008.

[ATSDR] Agency for Toxic Substances and Disease Registry. 2006. Toxicological Profile for Aluminum.

[ATSDR] Agency for Toxic Substances and Disease Registry. 2005. Toxicological Profile for Barium.

[ATSDR] Agency for Toxic Substances and Disease Registry. 2004. Toxicological Profile for Copper.

[ATSDR] Agency for Toxic Substances and Disease Registry. 2000. Toxicological Profile for Manganese.

[ATSDR] Agency for Toxic Substances and Disease Registry. 2004. Toxicological Profile for Strontium.

[BOC] Bureau of the Census, US Department of Commerce. 2000. www.cesus.gov

[DEP] Sherwood Medical Industries Fact Sheet

www.dep.state.fl.us/waste/quick_topics/publications/wc/sites/summary/031.pdf. Last viewed January 17, 2008.

[Environmental Chemistry] Environmental Chemistry and Hazardous Material News, Careers and Resources <http://environmentalchemistry.com/yogi/periodic/Sr.html#Overview>. Last viewed January 17, 2008.

[EPA] Environmental Protection Agency. 1992.

<http://www.epa.gov/Region4/waste/reuse/fl/nplfln/SherwoodMedical.pdf>. Last viewed January 17, 2008.

[EPA] Exposure Factors Handbook Volume II: Food Ingestion Factors. 1997. Office of Research and Development. Washington, D.C.

[EPA] Environmental Protection Agency. 2004a. EPA Second Five Year Review for Sherwood Medical Industries NPL Site.

[EPA] Environmental Protection Agency. 2004b. EPA Second Five Year Review Memo from Wes Hardegree to Winston Smith for Sherwood Medical Industries NPL Site.
<http://www.epa.gov/superfund/sites/fiveyear/f05-04003.pdf>

[EPA] Environmental Protection Agency. 2007a.

<http://www.epa.gov/region4/waste/npl/nplfln/shrmedfl.htm>. Last viewed January 22, 2008.

[EPA] Environmental Protection Agency. 2007b.
<http://www.epa.gov/superfund/sites/npl/nar410.htm>. Last viewed January 17, 2008.

[EPA] Environmental Protection Agency. 2007c.
<http://www.epa.gov/superfund/sites/rods/fulltext/r0491092.pdf>. Last viewed January 17, 2008.

[HRS] Florida Department of Health and Rehabilititative Services. 1989. Preliminary Health Assessment for Sherwood Medical Industries.

[HRS] Florida Department of Health and Rehabilititative Services. 1992. Site Review and Update.
Sherwood Medical Industries.

[National Academies] The National Academies. Copper, Manganese and Molybdenum - Dietary Reference Intakes: Elements <http://www.iom.edu/Object.File/Master/7/294/0.pdf>. Last viewed January 17, 2008.

[Spectrum] Chemical Fact Sheet for Barium. www.speclab.com/elements/barium.htm. Last viewed January 17, 2008.

[UES] Universal Engineering Sciences. January through June 2007 Semi-Annual Sampling Report. 2007.

[Weston] Sherwood Medical Company Final Report on the Site Remedial Investigation. 1992. Prepared by Roy F. Weston for EPA.

Appendix A

Figures and Tables

FIGURE 1

Volusia County Map

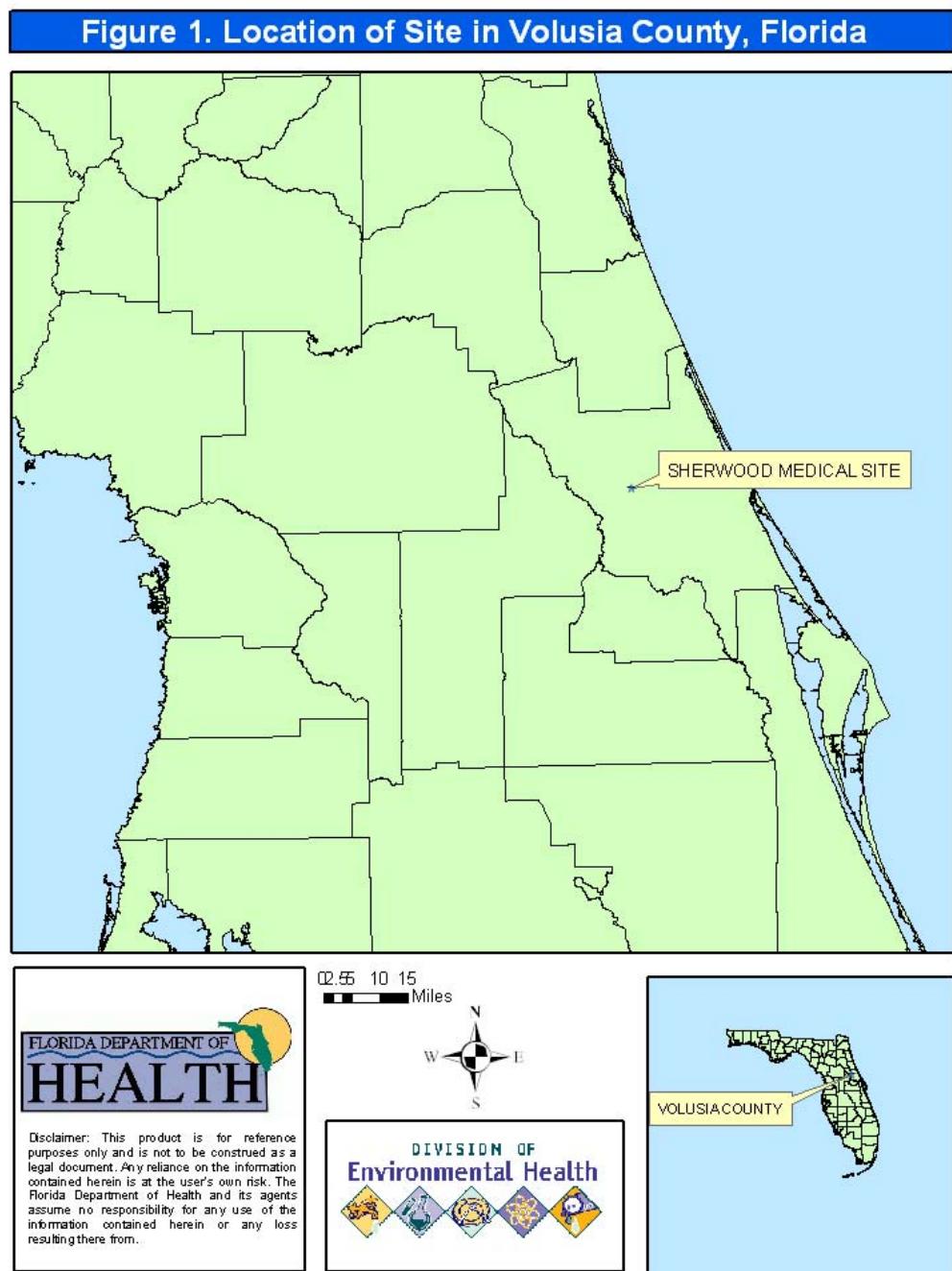


FIGURE 2

Aerial View Sherwood Medical Site

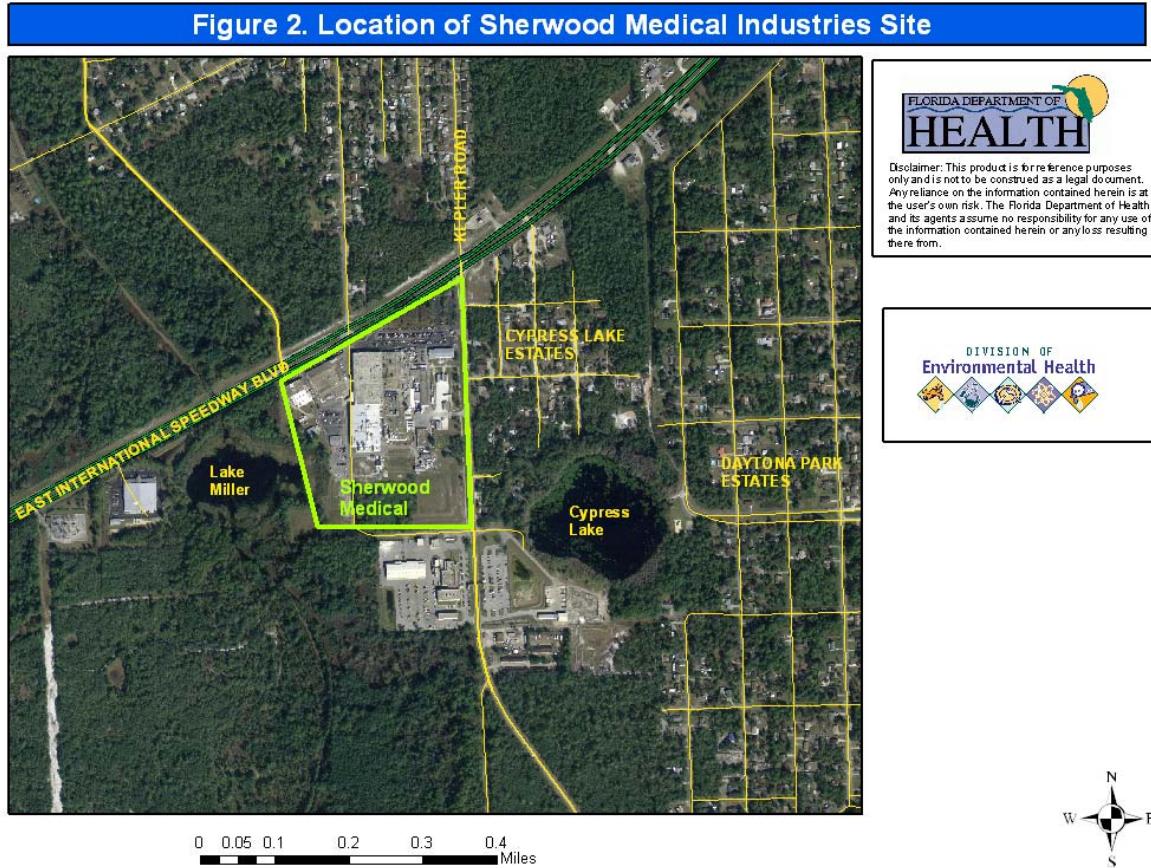
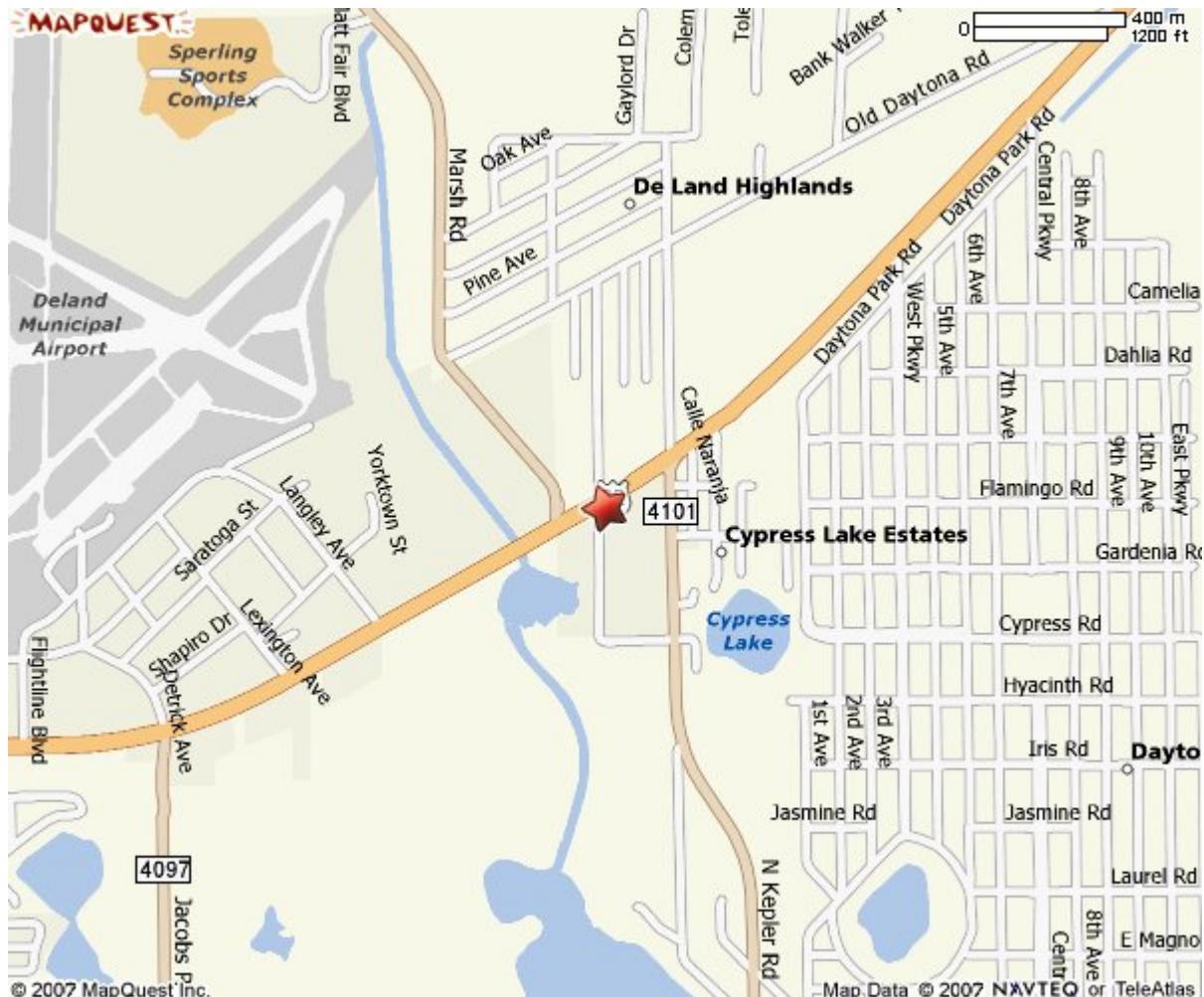


FIGURE 3

Sherwood Medical Site

DeLand, Florida



Reference: www.mapquest.com

TABLE I
Metal Concentrations Found in Collards, Green Beans and Papayas in a
Garden Near Sherwood Medical Site
Tested in 2007

	Collards	Green Beans	Papayas	Sweet Potatoes
Metals Analyzed	mg/kg	mg/kg	mg/kg	mg/kg
Aluminum	1.3	BLOQ	BDL	BLOQ
Barium	0.75	0.12	BDL	0.15
Copper	0.52	0.89	0.16	1.7
Manganese	6.7	2.4	0.12	0.95
Molybdenum	0.55	0.63	BDL	BLOQ
Rubidium	3.2	1.1	1.5	1.7
Strontium	12.0	1.4	0.92	1.6

BDL = “below detection limit” (<3x the calibration blank)

BLOQ = “below limit of quantitation” (greater than 3x but less than 10x the calibration blank)

mg/kg = milligrams per kilogram

Results for the nutrient elements Sodium, Calcium, Magnesium, Potassium, Iron and Zinc are not reported.

In addition to the elements in the above table, the following elements were tested for in collards, green beans and papayas and were BDL. Sweet potatoes were tested for all elements below except titanium. All results were BDL. The BDL levels are acceptable and below levels of concern.

Antimony, arsenic, beryllium, bismuth, boron, cadmium, calcium, cerium, cesium, chromium, cobalt, europium, gadolinium, dysprosium, erbium, gallium, germanium, gold, holmium, hafnium, indium, iridium, iron, lanthanum, lithium, luteium, mercury, lead, magnesium, neodymium, nickel, niobium, osmium, palladium, platinum, potassium, praseodymium, rhenium, rughenium, samarium, scandium, selenium, silver, sodium, tantalum, tellerium, terbium, thallium, titanium, thulium, thorium, rhodium, tungsten, uranium, vanadium, yttrium, ytterbium, zinc, zirconium

TABLE II

Comparison of Calculated Doses in Metals vs. ATSDR Minimal Risk Levels (MRLs) in Garden near the Sherwood Medical site for Collards, Green Beans and Papayas 2007

	Collards	Green Beans	Papayas	Sweet Potatoes	MRL*
Metals Analyzed					
Aluminum	0.00026	N/A	N/A	N/A	1.0 interm;1.0 chronic (9/06)
Barium	0.00014	0.000024	N/A	0.0000059	0.7 interm;0.6 chronic (9/05)
Copper	0.000098	0.000178	0.0000002	0.0000663	0.01 acute;0.01 interm (9/04)
Manganese	0.00127	0.00048	0.0000001	0.0000371	0.005 chronic (9/00)
Molybdenum	0.00010	0.000126	N/A	N/A	none
Rubidium	0.00060	0.00022	0.0000015	0.0000663	none
Strontium	0.00230	0.00028	0.0000009	0.0000624	2.0 interm (4/04)

All doses and MRLs are in milligrams per kilogram per day (mg/kg/day)

Note: Even if we assume the worst case scenario and calculate all doses using 10 times the dietary intake amount for each fruit and vegetable, the dose would still be less than the available ATSDR MRLs

NA = not analyzed

acute = 1-14 days

interm = intermediate = 14-364 days

chronic = over 365 days

*MRL = minimal risk level and date of ATSDR toxicological profile

TABLE III
Calculated Doses and Dietary Intakes for Metals Found in Collards, Green Beans, Papayas and Sweet Potatoes in a Garden Near Sherwood Medical Site

Chemical	Highest Calculated Doses*	Highest Calculated Doses (mg/day)**	MRL oral	NOAEL humans	Tox Profile Date	Daily Dietary Intake
	Doses*	Doses (mg/day)**				
	(mg/kg/day)					
Aluminum	0.000025 (collards)	0.112	1.0 interm 1.0 chronic		6-Aug	
Barium	0.000024 (beans)	0.015	0.6 chronic 0.7 interm		Aug-05	1.3 mg/day typical dietary intake (Spectrum 2007)
Copper	0.000178 (beans)	0.135	0.01acute 0.01 interm		Sep-04	1-10 mg/day 1 mg/day -1yr old 10 mg/day=30- 70yrs (Natl Academies 2007)
Manganese	0.00048 (beans)	0.576	none	0.005 chronic	Sep-00	2-5 mg/day daily intake (Natl Academies 2007)
Molybdenum	0.00001 (collards)	0.095	none			0.3-1.1 mg/day 1-13 yrs 1.7 mg/day 14-18 yrs 2 mg/day 19-70yrs (Natl Academies 2007)
Rubidium	0.00022 (beans)	0.275	none			1-5 mg/day dietary intake (Am Society for Nutrition 2007)
Strontium	0.00023 (collards)	1.03	2.00 interm		Apr-04	0.8-5 mg/day dietary intake (Environmental Chemistry 2007)

Note: Calculated doses in mg/day were calculated using the mean daily intake of produce (all ages) Table 9-22 in EPA Factors handbook. The mean vegetable intake per day is 86 g/day for green beans, 39.2 g/day for collards which had the highest levels found in the produce.

APPENDIX B

Example of Fruit and Vegetable Calculations

$\mu\text{g/g} = \text{mg/kg}$

$(X \mu\text{g/g metal in vegetable}) (\text{consumption intake rate } \underline{\text{grams vegetable}}) = \text{dose in } \mu\text{g/kg/day}$

Then convert to mg/kg/day and compare final dose with ATSDR MRL to see if above or below the guidelines.

Example:

0.12 $\mu\text{g/g}$ of manganese is detected in papayas

The Average Consumption Rate for papayas is 0.001 grams of papayas per kg bw per day

Average kg bw for an adult is 70 kg; for a child is 15 kg

$(0.12 \mu\text{g/g manganese in papayas})(0.001 \text{ g papayas /kg bw/day}) = 0.0001 \mu\text{g/kg/day} = 0.0000001 \text{ mg/kg/day}$

μg = microgram

g = gram

kg = kilogram

bw = body weight

MRL = Minimal Risk Level

kg bw per day

APPENDIX C

Photos of Sweet Potatoes Collected



APPENDIX D

ATSDR Glossary of Environmental Health Terms

This glossary defines words used by the Agency for Toxic Substances and Disease Registry (ATSDR) in communications with the public. It is not a complete dictionary of environmental health terms. If you have questions or comments, call ATSDR's toll-free telephone number, 1-888-422-8737.

Absorption

The process of taking in. For a person or an animal, absorption is the process of a substance getting into the body through the eyes, skin, stomach, intestines, or lungs.

Acute

Occurring over a short time [compare with chronic].

Acute exposure

Contact with a substance that occurs once or for only a short time (up to 14 days) [compare with intermediate duration exposure and chronic exposure].

Additive effect

A biologic response to exposure to multiple substances that equals the sum of responses of all the individual substances added together [compare with antagonistic effect and synergistic effect].

Adverse health effect

A change in body function or cell structure that might lead to disease or health problems

Aerobic

Requiring oxygen [compare with anaerobic].

The Agency for Toxic Substances and Disease Registry (ATSDR)

The Agency for Toxic Substances and Disease Registry (ATSDR) is a federal public health agency with headquarters in Atlanta, Georgia, and 10 regional offices in the United States. ATSDR's mission is to serve the public by using the best science, taking responsive public health actions, and providing trusted health information to prevent harmful exposures and diseases related to toxic substances.

Ambient

Surrounding (for example, *ambient* air).

Anaerobic

Requiring the absence of oxygen [compare with aerobic].

Analyte

A substance measured in the laboratory. A chemical for which a sample (such as water, air, or blood) is tested in a laboratory. For example, if the analyte is mercury, the laboratory test will determine the amount of mercury in the sample.

Analytic epidemiologic study

A study that evaluates the association between exposure to hazardous substances and disease by testing scientific hypotheses.

Antagonistic effect

A biologic response to exposure to multiple substances that is **less** than would be expected if the known effects of the individual substances were added together [compare with additive effect and synergistic effect].

Background level

An average or expected amount of a substance or radioactive material in a specific environment, or typical amounts of substances that occur naturally in an environment.

Biodegradation

Decomposition or breakdown of a substance through the action of microorganisms (such as bacteria or fungi) or other natural physical processes (such as sunlight).

Biologic indicators of exposure study

A study that uses (a) biomedical testing or (b) the measurement of a substance [an analyte], its metabolite, or another marker of exposure in human body fluids or tissues to confirm human exposure to a hazardous substance [also see exposure investigation].

Biologic monitoring

Measuring hazardous substances in biologic materials (such as blood, hair, urine, or breath) to determine whether exposure has occurred. A blood test for lead is an example of biologic monitoring.

Biologic uptake

The transfer of substances from the environment to plants, animals, and humans.

Biota

Plants and animals in an environment. Some of these plants and animals might be sources of food, clothing, or medicines for people.

CAP [see Community Assistance Panel.]**Cancer**

Any one of a group of diseases that occur when cells in the body become abnormal and grow or multiply out of control.

Cancer risk

A theoretical risk for getting cancer if exposed to a substance every day for 70 years (a lifetime exposure). The true risk might be lower.

Carcinogen

A substance that causes cancer.

Case study

A medical or epidemiologic evaluation of one person or a small group of people to gather information about specific health conditions and past exposures.

Case-control study

A study that compares exposures of people who have a disease or condition (cases) with people who do not have the disease or condition (controls). Exposures that are more common among the cases may be considered as possible risk factors for the disease.

Central nervous system

The part of the nervous system that consists of the brain and the spinal cord.

CERCLA [see Comprehensive Environmental Response, Compensation, and Liability Act of 1980]**Chronic**

Occurring over a long time [compare with acute].

Chronic exposure

Contact with a substance that occurs over a long time (more than 1 year) [compare with acute exposure and intermediate duration exposure]

Cluster investigation

A review of an unusual number, real or perceived, of health events (for example, reports of cancer) grouped together in time and location. Cluster investigations are designed to confirm case reports; determine whether they represent an unusual disease occurrence; and, if possible, explore possible causes and contributing environmental factors.

Community Assistance Panel (CAP)

A group of people from a community and from health and environmental agencies who work with ATSDR to resolve issues and problems related to hazardous substances in the community. CAP members work with ATSDR to gather and review community health concerns, provide information on how people might have been or might now be exposed to hazardous substances, and inform ATSDR on ways to involve the community in its activities.

Comparison value (CV)

Calculated concentration of a substance in air, water, food, or soil that is unlikely to cause harmful (adverse) health effects in exposed people. The CV is used as a screening level during the public health assessment process. Substances found in amounts greater than their CVs might be selected for further evaluation in the public health assessment process.

Completed exposure pathway [see exposure pathway].**Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA)**

CERCLA, also known as Superfund, is the federal law that concerns the removal or cleanup of hazardous substances in the environment and at hazardous waste sites. ATSDR, which was created by CERCLA, is responsible for assessing health issues and supporting public health activities related to hazardous waste sites or other environmental releases of hazardous substances. This law was later amended by the Superfund Amendments and Reauthorization Act (SARA).

Concentration

The amount of a substance present in a certain amount of soil, water, air, food, blood, hair, urine, breath, or any other media.

Contaminant

A substance that is either present in an environment where it does not belong or is present at levels that might cause harmful (adverse) health effects.

Delayed health effect

A disease or an injury that happens as a result of exposures that might have occurred in the past.

Dermal

Referring to the skin. For example, dermal absorption means passing through the skin.

Dermal contact

Contact with (touching) the skin [see route of exposure].

Descriptive epidemiology

The study of the amount and distribution of a disease in a specified population by person, place, and time.

Detection limit

The lowest concentration of a chemical that can reliably be distinguished from a zero concentration.

Dose (for chemicals that are not radioactive)

The amount of a substance to which a person is exposed over some time period. Dose is a measurement of exposure. Dose is often expressed as milligram (amount) per kilogram (a measure of body weight) per day (a measure of time) when people eat or drink contaminated water, food, or soil. In general, the greater the dose, the greater the likelihood of an effect. An “exposure dose” is how much of a substance is encountered in the environment. An “absorbed dose” is the amount of a substance that actually got into the body through the eyes, skin, stomach, intestines, or lungs.

Dose (for radioactive chemicals)

The radiation dose is the amount of energy from radiation that is actually absorbed by the body. This is not the same as measurements of the amount of radiation in the environment.

Dose-response relationship

The relationship between the amount of exposure [dose] to a substance and the resulting changes in body function or health (response).

Environmental media

Soil, water, air, biota (plants and animals), or any other parts of the environment that can contain contaminants.

Environmental media and transport mechanism

Environmental media include water, air, soil, and biota (plants and animals). Transport mechanisms move contaminants from the source to points where human exposure can occur. The environmental media and transport mechanism is the second part of an exposure pathway.

EPA

United States Environmental Protection Agency.

Epidemiologic surveillance [see Public health surveillance].

Epidemiology

The study of the distribution and determinants of disease or health status in a population; the study of the occurrence and causes of health effects in humans.

Exposure

Contact with a substance by swallowing, breathing, or touching the skin or eyes. Exposure may be short-term [acute exposure], of intermediate duration, or long-term [chronic exposure].

Exposure assessment

The process of finding out how people come into contact with a hazardous substance, how often and for how long they are in contact with the substance, and how much of the substance they are in contact with.

Exposure-dose reconstruction

A method of estimating the amount of people’s past exposure to hazardous substances. Computer and approximation methods are used when past information is limited, not available, or missing.

Exposure investigation

The collection and analysis of site-specific information and biologic tests (when appropriate) to determine whether people have been exposed to hazardous substances.

Exposure pathway

The route a substance takes from its source (where it began) to its end point (where it ends), and how people can come into contact with (or get exposed to) it. An exposure pathway has

five parts: a source of contamination (such as an abandoned business); an environmental media and transport mechanism (such as movement through groundwater); a point of exposure (such as a private well); a route of exposure (eating, drinking, breathing, or touching), and a receptor population (people potentially or actually exposed). When all five parts are present, the exposure pathway is termed a completed exposure pathway.

Exposure registry

A system of ongoing follow up of people who have had documented environmental exposures.

Feasibility study

A study by EPA to determine the best way to clean up environmental contamination. A number of factors are considered, including health risk, costs, and what methods will work well.

Groundwater

Water beneath the earth's surface in the spaces between soil particles and between rock surfaces [compare with surface water].

Hazard

A source of potential harm from past, current, or future exposures.

Hazardous Substance Release and Health Effects Database (HazDat)

The scientific and administrative database system developed by ATSDR to manage data collection, retrieval, and analysis of site-specific information on hazardous substances, community health concerns, and public health activities.

Hazardous waste

Potentially harmful substances that have been released or discarded into the environment.

Health investigation

The collection and evaluation of information about the health of community residents. This information is used to describe or count the occurrence of a disease, symptom, or clinical measure and to evaluate the possible association between the occurrence and exposure to hazardous substances.

Indeterminate public health hazard

The category used in ATSDR's public health assessment documents when a professional judgment about the level of health hazard cannot be made because information critical to such a decision is lacking.

Incidence

The number of new cases of disease in a defined population over a specific time period [contrast with prevalence].

Ingestion

The act of swallowing something through eating, drinking, or mouthing objects. A hazardous substance can enter the body this way [see route of exposure].

Inhalation

The act of breathing. A hazardous substance can enter the body this way [see route of exposure].

Intermediate duration exposure

Contact with a substance that occurs for more than 14 days and less than a year [compare with acute exposure and chronic exposure].

In vitro

In an artificial environment outside a living organism or body. For example, some toxicity

testing is done on cell cultures or slices of tissue grown in the laboratory, rather than on a living animal [compare with *in vivo*].

In vivo

Within a living organism or body. For example, some toxicity testing is done on whole animals, such as rats or mice [compare with *in vitro*].

Lowest-observed-adverse-effect level (LOAEL)

The lowest tested dose of a substance that has been reported to cause harmful (adverse) health effects in people or animals.

Medical monitoring

A set of medical tests and physical exams specifically designed to evaluate whether an individual's exposure could negatively affect that person's health.

Metabolism

The conversion or breakdown of a substance from one form to another by a living organism.

Metabolite

Any product of metabolism.

mg/kg

Milligram per kilogram.

mg/cm²

Milligram per square centimeter (of a surface).

mg/m³

Milligram per cubic meter; a measure of the concentration of a chemical in a known volume (a cubic meter) of air, soil, or water.

Migration

Moving from one location to another.

Minimal risk level (MRL)

An ATSDR estimate of daily human exposure to a hazardous substance at or below which that substance is unlikely to pose a measurable risk of harmful (adverse), noncancerous effects. MRLs are calculated for a route of exposure (inhalation or oral) over a specified time period (acute, intermediate, or chronic). MRLs should not be used as predictors of harmful (adverse) health effects [see reference dose].

National Priorities List for Uncontrolled Hazardous Waste Sites (National Priorities List or NPL)

EPA's list of the most serious uncontrolled or abandoned hazardous waste sites in the United States. The NPL is updated on a regular basis.

National Toxicology Program (NTP)

Part of the Department of Health and Human Services. NTP develops and carries out tests to predict whether a chemical will cause harm to humans.

No apparent public health hazard

A category used in ATSDR's public health assessments for sites where human exposure to contaminated media might be occurring, might have occurred in the past, or might occur in the future, but where the exposure is not expected to cause any harmful health effects.

No-observed-adverse-effect level (NOAEL)

The highest tested dose of a substance that has been reported to have no harmful (adverse) health effects on people or animals.

No public health hazard

A category used in ATSDR's public health assessment documents for sites where people have never and will never come into contact with harmful amounts of site-related substances.

NPL [see National Priorities List for Uncontrolled Hazardous Waste Sites]**Plume**

A volume of a substance that moves from its source to places farther away from the source. Plumes can be described by the volume of air or water they occupy and the direction they move. For example, a plume can be a column of smoke from a chimney or a substance moving with groundwater.

Point of exposure

The place where someone can come into contact with a substance present in the environment [see exposure pathway].

Population

A group or number of people living within a specified area or sharing similar characteristics (such as occupation or age).

Potentially responsible party (PRP)

A company, government, or person legally responsible for cleaning up the pollution at a hazardous waste site under Superfund. There may be more than one PRP for a particular site.

ppb

Parts per billion.

ppm

Parts per million.

Public availability session

An informal, drop-by meeting at which community members can meet one-on-one with ATSDR staff members to discuss health and site-related concerns.

Public comment period

An opportunity for the public to comment on agency findings or proposed activities contained in draft reports or documents. The public comment period is a limited time period during which comments will be accepted.

Public health action

A list of steps to protect public health.

Public health advisory

A statement made by ATSDR to EPA or a state regulatory agency that a release of hazardous substances poses an immediate threat to human health. The advisory includes recommended measures to reduce exposure and reduce the threat to human health.

Public health assessment (PHA)

An ATSDR document that examines hazardous substances, health outcomes, and community concerns at a hazardous waste site to determine whether people could be harmed from coming into contact with those substances. The PHA also lists actions that need to be taken to protect public health.

Public health hazard

A category used in ATSDR's public health assessments for sites that pose a public health hazard because of long-term exposures (greater than 1 year) to sufficiently high levels of hazardous substances or radionuclides that could result in harmful health effects.

Public health hazard categories

Public health hazard categories are statements about whether people could be harmed by

conditions present at the site in the past, present, or future. One or more hazard categories might be appropriate for each site. The five public health hazard categories are no public health hazard, no apparent public health hazard, indeterminate public health hazard, public health hazard, and urgent public health hazard.

Public health statement

The first chapter of an ATSDR toxicological profile. The public health statement is a summary written in words that are easy to understand. The public health statement explains how people might be exposed to a specific substance and describes the known health effects of that substance.

Public health surveillance

The ongoing, systematic collection, analysis, and interpretation of health data. This activity also involves timely dissemination of the data and use for public health programs.

Receptor population

People who could come into contact with hazardous substances [see exposure pathway].

Reference dose (RfD)

An EPA estimate, with uncertainty or safety factors built in, of the daily lifetime dose of a substance that is unlikely to cause harm in humans.

Remedial investigation

The CERCLA process of determining the type and extent of hazardous material contamination at a site.

RfD [see reference dose]

Risk

The probability that something will cause injury or harm.

Risk reduction

Actions that can decrease the likelihood that individuals, groups, or communities will experience disease or other health conditions.

Risk communication

The exchange of information to increase understanding of health risks.

Route of exposure

The way people come into contact with a hazardous substance. Three routes of exposure are breathing [inhalation], eating or drinking [ingestion], or contact with the skin [dermal contact].

Safety factor [see uncertainty factor]

SARA [see Superfund Amendments and Reauthorization Act]

Sample

A portion or piece of a whole. A selected subset of a population or subset of whatever is being studied. For example, in a study of people the sample is a number of people chosen from a larger population [see population]. An environmental sample (for example, a small amount of soil or water) might be collected to measure contamination in the environment at a specific location.

Sample size

The number of units chosen from a population or an environment.

Source of contamination

The place where a hazardous substance comes from, such as a landfill, waste pond,

incinerator, storage tank, or drum. A source of contamination is the first part of an exposure pathway.

Special populations

People who might be more sensitive or susceptible to exposure to hazardous substances because of factors such as age, occupation, sex, or behaviors (for example, cigarette smoking). Children, pregnant women, and older people are often considered special populations.

Statistics

A branch of mathematics that deals with collecting, reviewing, summarizing, and interpreting data or information. Statistics are used to determine whether differences between study groups are meaningful.

Substance

A chemical.

Superfund [see Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and Superfund Amendments and Reauthorization Act (SARA)]

Superfund Amendments and Reauthorization Act (SARA)

In 1986, SARA amended the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and expanded the health-related responsibilities of ATSDR. CERCLA and SARA direct ATSDR to look into the health effects from substance exposures at hazardous waste sites and to perform activities including health education, health studies, surveillance, health consultations, and toxicological profiles.

Surface water

Water on the surface of the earth, such as in lakes, rivers, streams, ponds, and springs [compare with groundwater].

Surveillance [see public health surveillance]

Survey

A systematic collection of information or data. A survey can be conducted to collect information from a group of people or from the environment. Surveys of a group of people can be conducted by telephone, by mail, or in person. Some surveys are done by interviewing a group of people [see prevalence survey].

Synergistic effect

A biologic response to multiple substances where one substance worsens the effect of another substance. The combined effect of the substances acting together is greater than the sum of the effects of the substances acting by themselves [see additive effect and antagonistic effect].

Teratogen

A substance that causes defects in development between conception and birth. A teratogen is a substance that causes a structural or functional birth defect.

Toxic agent

Chemical or physical (for example, radiation, heat, cold, microwaves) agents that, under certain circumstances of exposure, can cause harmful effects to living organisms.

Toxicological profile

An ATSDR document that examines, summarizes, and interprets information about a hazardous substance to determine harmful levels of exposure and associated health effects. A toxicological profile also identifies significant gaps in knowledge on the substance and describes areas where further research is needed.

Toxicology

The study of the harmful effects of substances on humans or animals.

Tumor

An abnormal mass of tissue that results from excessive cell division that is uncontrolled and progressive. Tumors perform no useful body function. Tumors can be either benign (not cancer) or malignant (cancer).

Uncertainty factor

Mathematical adjustments for reasons of safety when knowledge is incomplete. For example, factors used in the calculation of doses that are not harmful (adverse) to people. These factors are applied to the lowest-observed-adverse-effect-level (LOAEL) or the no-observed-adverse-effect-level (NOAEL) to derive a minimal risk level (MRL). Uncertainty factors are used to account for variations in people's sensitivity, for differences between animals and humans, and for differences between a LOAEL and a NOAEL. Scientists use uncertainty factors when they have some, but not all, the information from animal or human studies to decide whether an exposure will cause harm to people [also sometimes called a safety factor].

Urgent public health hazard

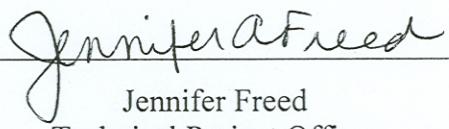
A category used in ATSDR's public health assessments for sites where short-term exposures (less than 1 year) to hazardous substances or conditions could result in harmful health effects that require rapid intervention.

Volatile organic compounds (VOCs)

Organic compounds that evaporate readily into the air. VOCs include substances such as benzene, toluene, and methylene chloride.

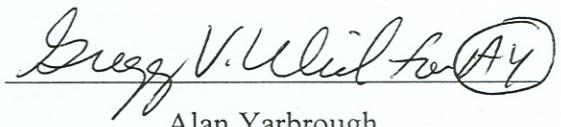
CERTIFICATION

The Florida Department of Health, Bureau of Community Environmental Health prepared this Health Consultation under a cooperative agreement with the Agency for Toxic Substances and Disease Registry. It followed approved methodology and procedures existing at the time it began. The Cooperative Agreement Partner completed editorial review.



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



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