Health Consultation

SANFORD DRY CLEANERS SITE

SANFORD, SEMINOLE COUNTY, FLORIDA

EPA FACILITY ID: FLD032728032

Prepared by
Florida Department of Health

JULY 28, 2015

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

Health Consultation: A Note of Explanation

A health consultation is a verbal or written response from ATSDR or ATSDR's Cooperative Agreement Partners 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 or ATSDR's Cooperative Agreement Partner which, in the Agency's opinion, indicates a need to revise or append the conclusions previously issued.

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Foreword

The Florida Department of Health (FDOH) evaluates the public health threat of hazardous waste sites through a cooperative agreement with the federal Agency for Toxic Substances and Disease Registry (ATSDR) in Atlanta, Georgia. This health consultation is part of an ongoing effort to evaluate health effects associated with groundwater, air, and soil from the Sanford Dry Cleaners hazardous waste site. The FDOH evaluated site-related public health issues through the following processes:

■ Evaluating exposure: FDOH 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 human exposures might occur. The United States Environmental Protection Agency (EPA) provided the information for this assessment.

■ Evaluating health effects: If we find evidence that exposures to hazardous substances are occurring or might occur, FDOH scientists will determine whether that exposure could be harmful to human health. We focus this report on public health; that is, the health impact on the community as a whole, and base it on existing scientific information.

■ Developing recommendations: In this report, the FDOH outlines, in plain language, its conclusions regarding potential health threats posed by groundwater, air and soil, and offers recommendations for reducing or eliminating human exposure to contaminants. The role of the FDOH in dealing with hazardous waste sites is primarily advisory. For that reason, the evaluation report will typically recommend actions for other agencies, including the EPA and the Florida Department of Environmental Protection (DEP). If, however, an immediate health threat exists or is imminent, FDOH 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. The FDOH starts by soliciting and evaluating information from various government agencies, individuals, or organizations responsible for cleaning up the site, and those living in communities near the site. We share our conclusions about the site with the groups and organizations providing the information. Once we prepare an evaluation report, the FDOH seeks feedback from the public.

If you have questions or comments about this report, we encourage you to contact us.

Please write to: Division of Disease Control and Health Protection
Public Health Toxicology Section
Florida Department Health
4052 Bald Cypress Way, Bin # A-08
Tallahassee, FL 32399-1712

Or call us at: 850 245-4299 or toll-free in Florida: 1-877-798-2772

Summary

INTRODUCTION

At the Sanford Dry Cleaners (SDC) hazardous waste site, the Florida Department of Health's (FDOH) and the US Agency for Toxic Substances and Disease Registry's (ATSDR) top priority is to ensure nearby residents have the best information to safeguard their health.

The SDC hazardous waste site is at 113, 117, and 121 South Palmetto Avenue in Sanford, Florida. EPA listed the site on the Superfund National Priorities List (NPL) September 29, 2010.

Since the 1940s, the owners used dry cleaning solvents at this site. Dry cleaning operation ceased in 2001 and the buildings are vacant. Disposal of dry-cleaning solvents resulted in soil and groundwater contamination on and near the site. One on-site building had indoor air contamination likely resulting from vapor intrusion. Vapor intrusion occurs when solvents from soil and shallow groundwater evaporate and enter buildings through cracks and holes in their foundations.

CONCLUSION #1

In the past, alley pedestrians (children 6 to 11 years old) may have had occasional exposure to levels of contaminants in soil that could have been harmful. This soil is no longer a health threat as EPA's contractor excavated the highly contaminated surface soil in December 2014.

BASIS FOR DECISION #1

Limited areas of highly contaminated soil were present at the rear of the site on both sides of an alleyway that was accessible to pedestrians. These areas were not fenced or covered.

FDOH compared the amounts of chemicals in soil children might have accidentally swallowed to amounts known to cause illness. The levels in the on-site soil were not suitable for short-term exposures for children, tetrachloroethylene exceeded the acute minimal risk level (MRL) and trichloroethylene exceeded the intermediate and chronic MRLs.

STEPS TAKEN #1

EPA's contractor dug up 6 feet of contaminated soil outside the building's footprint and disposed of it properly in December 2014. They also excavated contaminated soil in an area directly across the alley. They backfilled the excavated areas with clean material.

CONCLUSION #2	Daily long-term exposures to contaminant levels measured in indoor air in the former dry cleaner operations building should not have harmed people.
BASIS FOR DECISION #2	FDOH compared measured indoor-air levels with health effects known from medical and animal studies. No one legally lived in or used the on-site buildings while EPA planned and carried out the remedial actions, however reportedly homeless people lived there in the past.
STEPS TAKEN #2	EPA's contractors removed contaminated soil near the building in December 2014 and installed a soil vapor extraction system (SVES). Remediation plans include indoor air testing to assure this SVES is effective.
CONCLUSION #3	Indoor air is not an exposure pathway. Tests showed the air in buildings near the former Sanford Dry Cleaners site contained no solvents.
BASIS FOR DECISION #3	Each off-site indoor air sample had a paired sub-slab soil-gas sample. The indoor-air tests did not find solvents above health-based air screening values. The sub-slab tests did not find VOC sources for vapor intrusion into off-site buildings. In the past, testing found few areas with VOCs in shallow groundwater or surface soil under existing buildings off the site. VOCs must be at or above the water table to enter soil gas. If buildings are above areas with high concentrations of VOCs in soil gas and there is a pathway through the building foundations, VOCS may enter indoor air. *Recent remediation actions have addressed the potential soil and groundwater contamination sources for vapor intrusion.*
STEPS TAKEN #3	In addition to the soil vapor extraction system on the site, the EPA contractor treated areas where VOC concentrations exceeded 1,000 µg/L (hotspots) in groundwater with in-situ enhanced bioremediation (ISEB). They also injected treatments down gradient of the hotspots to enhance natural degradation in the less contaminated parts of the plume. They will continue to sample groundwater to measure the effectiveness of this remedy. EPA plans to monitor natural attenuation (MNA), which relies on natural biological processes, to address the dissolved contaminant plume in non-hotspot areas.

EPA's soil and groundwater treatment should mitigate the risk of future vapor intrusion. However, if future testing finds that shallow groundwater with VOCs has migrated beneath nearby buildings, we recommend additional indoor air testing for VOC vapor intrusion.

OTHER EPA REMEDIAL ACTION PLANS

EPA will continue to sample groundwater to measure the effectiveness of their remedial actions. In addition, the EPA plans to monitor natural attenuation, which relies on natural biological processes, to address the dissolved groundwater contamination in non-hotspot areas.

EPA will use institutional controls such as restrictive covenants, and land and groundwater use restrictions to ensure protectiveness until groundwater is clean. EPA anticipates the need for 5-year reviews to ensure the effectiveness of the selected remedy in protecting human health and the environment.

LIMITATIONS OF FINDINGS

All health assessments, to varying degrees, require the use of assumptions, judgments, and incomplete data. These contribute to the uncertainty of the final risk estimates. Some more important sources of uncertainty in this public health assessment include environment sampling and analysis. In some cases, the use of 0 to 12 inch soil data as was used here may dilute the contamination concentrations. Other sources of uncertainty include exposure parameter estimates, use of modeled (average) data, and present toxicological knowledge. We may overestimate or underestimate risk because of these uncertainties. This public health assessment does not represent an absolute estimate of risk to persons exposed to chemicals at or near the Sanford Dry Cleaners site.

FOR MORE INFORMATION

If you have concerns about your health or the health of your children, you should contact your health care provider. You may also call the FDOH toll-free at 877-798-2772 or 850-245-4444 x 2316 and ask for information about the SDC hazardous waste site.

Background and Statement of Issues

The purpose of this health consultation report is to assess the past public health threat from toxic chemicals in indoor air and soil at the former Sanford Dry Cleaners (SDC) hazardous waste site. This report also evaluates contaminated shallow groundwater as a potential source for vapor intrusion and for surface water contamination. This is the second assessment of this site by the Florida Department of Health (FDOH). FDOH first assessed this site when the United States Environmental Protection Agency (EPA) proposed it to their Superfund National Priorities List (NPL) in March 2010 [ATSDR 2011] and listed it in September 2010. The SDC hazardous waste site is on South Palmetto Avenue in Sanford, Seminole County, Florida, 32771 (Figures 1 and 2).

This assessment evaluates the potential for past exposures to site-related contaminants and the associated health impacts for alley pedestrians, workers, and off-site residents based on data from on-site and off-site soil, groundwater, soil-gas, and indoor air.

Site Description

The one-acre SDC site is in historic downtown Sanford. Since the early 1940s, different entities owned and operated a dry cleaning and laundry business at the site. The dry cleaning business used tetrachloroethylene (also known as perchloroethylene or PCE) as a cleaning agent. Figure 1 gives the general location of the SDC site and Figure 2 shows an aerial view.

The site includes three properties that were part of past SDC operations (Figure 2). From north to south, these are 113, 117, and 121 South Palmetto Avenue. The northern properties (113 and 117 S. Palmetto Ave) are adjoining one-story buildings. The southernmost property, 121 S. Palmetto is the two-story Sanford Dry Cleaners storefront. This two-story building continues across the block to the alley and joins a one-story building on the southeastern property corner. This corner building housed the dry cleaning machinery. A door provided access to the paved alley at the back of the building. For this assessment, we consider the alley off-site; a few feet of soil separate this alley from the site buildings.

The area outside this back door was the original source of contamination (Photographs 1-3). The information FDOH reviewed did not make it clear whether site personnel spilled, leaked, or intentionally dumped these wastes. Dry cleaning operations ceased in 2001. The current owner of the site is Metro Orlando Affordable Housing, Inc. [DEP 2009].

In January 1993, consultants for the former Thrifty Service Station found dry cleaning solvents in groundwater southeast of the SDC site [DEP 2009]. EPA added the SDC site to the NPL on September 29, 2010.

On April 11, 2013, FDOH staff visited the site. We observed the southeastern portion of the site (121 S. Palmetto Ave) had no public access. Plywood covered the doors and windows of the one-story buildings on the east side of this property. An 8-foot, chain-link fence with a locked gate secured the outside area around this one-story building that housed dry-cleaning equipment. Although site visitors noted that this one-story building showed evidence of occupation by homeless people in 2010, we saw no such evidence during our April 2013 visit. Contractors installed plywood and fencing at the front and rear of the building to secure the site and fenced a gap between the site and an adjacent building.

In 2010, site visitors noted a residence with an irrigation well across the alley, to the southeast (Photograph 4). EPA's contractor later tested this well and did not find contamination. We saw a small family restaurant and a Goodwill store across the alley, to the east. To the south, we noted an asphalt- and concrete-covered parking area and a building that housed the former Thrifty Service Station. We observed the eastern alley and service station property covered by asphalt and concrete with a few, small areas of weed-covered soil.

The building immediately north of the site, 109 S. Palmetto, is a historic building housing a first floor garage and art store and second floor apartments. The building north of that (301 East 1st Street) is two-stories and has shops on the first floor and apartments on the second floor. To the west, across South Palmetto Avenue are a newspaper operation and a wine store.

EPA added the site to the NPL on September 29, 2010. They completed the testing phase, called the Remedial Investigation in October 2012. EPA issued a proposed cleanup plan for the site in April 2013. In September 2013, they issued a Record of Decision (ROD), identifying the cleanup option they later used at the site.

EPA's contractor started remediation on the site in late 2014 and the remedial construction activities are now complete. These activities included soil excavation on and off the site, injection of in-situ enhanced bioremediation (ISEB) chemicals into groundwater on- and off-site and installation of an on-site soil vapor extraction system. EPA conducted the final inspection of these remedial activities on February 26, 2015.

EPA's contractors will sample groundwater to measure the effectiveness of the ISEB remedy in hotspot areas and monitor natural attenuation, which relies on natural biological processes in non-hotspot areas. They will use institutional controls such as restrictive covenants, and land and groundwater use restrictions, to ensure protectiveness until the remedy is completed. EPA anticipates the need for 5-Year Reviews to ensure the effectiveness of the selected remedy in protecting human health and the environment. The EPA explains the Superfund process online at http://www.epa.gov/superfund/cleanup/index.htm.

Previous Health Consultation

In early 2010, FDOH began assessing the public health implications of the site by reviewing the available data. We found that homes and businesses near the site use city water. FDOH reviewed Sanford municipal (city) water supply test results and determined city water was not contaminated [ATSDR 2011].

FDOH also concluded there were no potential health hazards to nearby residents and businesses users from exposures to surface soil and groundwater. We determined the available data, however, did not show the extent of groundwater contamination nor did it address the potential for vapor intrusion into nearby buildings [ATSDR 2011].

Demographics

FDOH examines demographic and land use data to identify sensitive populations, such as young children, the elderly, and women of childbearing age. We do this to determine whether sensitive populations could be exposed to potential health risks. Demographics also provide details on population mobility and residential history in a particular area. This information helps FDOH evaluate how long residents might have been exposed to contaminants.

Approximately 6,650 people live within a 1-mile radius of the SDC site. Forty-seven percent (47%) are white, 46% are African-American, and 7% are other categories. Approximately 10% of the residents are less than 6 years old. About 14 % are 65 years old and older (Figure 3) [ATSDR 2012].

Land Use

Land use around the SDC site is primarily commercial. There is one single family home near the site and there are several second-story apartments above nearby shops. Lake Monroe is approximately one-quarter mile to the north.

Community Health Concerns

In our first health consultation report, FDOH noted little community concern about the Sanford Dry Cleaners site [ATSDR 2011]. We reported two persons who wanted to know the potential health effects of "perc" (a synonym for tetrachloroethylene, which was originally known as perchloroethylene) at the concentrations found at the site. FDOH addresses the potential health impacts of measured concentrations in the Public Health Implications and the Community Health Concerns Evaluation sections below.

At public meetings in 2011 and 2012, people expressed concerns about emphysema and miscarriages (Miranda McClure, Florida DEP, personal communication, 9/17/2012).

Discussion

Pathway Analyses

Chemical contamination in the environment can harm your health but only if you have contact with those contaminants (exposure). Without contact or exposure, there is no harm to health. If you have contact or exposure, how much of the contaminants you contact (concentration), how often you contact them (frequency), for how long you contact them (duration), and the danger of the contaminant (toxicity) all determine your risk of harm.

Knowing or estimating the frequency with which people could have contact with hazardous substances is essential to assessing the public health importance of these contaminants. To decide if people can contact contaminants at or near a site, FDOH looks at human exposure pathways. Exposure pathways have five parts. They are:

1. a source of contamination like a hazardous waste site,
2. an environmental medium like air, water, or soil that can hold or move the contamination,
3. a point where people are exposed to a contaminated medium like water at the tap or soil in the yard,
4. an exposure route like ingestion (swallowing contaminated soil or water) or breathing (inhaling contaminated air),
5. a population who could be exposed to contamination, like nearby residents.

FDOH eliminates an exposure pathway if at least one of the five parts referenced above is missing and is very unlikely to be present in the future. Exposure pathways not eliminated are either completed or potential pathways. For completed pathways, all five parts exist and exposure to a contaminant has occurred, is occurring, or will occur. For potential pathways, at least one of the five parts is missing but could exist. Also for potential pathways, exposure to a contaminant could have occurred, could be occurring, or could occur in the future.

The risk from dermal exposure (absorption of chemicals through the skin) is commonly much less than the risk involved in ingestion (eating soil or drinking water with chemicals), or inhalation (breathing air with chemicals) and therefore we do not address it in this report.

Pathways Summary

For this assessment, FDOH evaluated the health threats from contamination in surface soil and indoor air, on and off the site (Tables 1 – 3). We evaluated the results of testing by EPA's consultant [J.M. Waller 2011, 2012a, 2012b, 2012c].

EPA's consultant collected surface soil samples from 0-12". However, people are usually only exposed to the top 3 inches of soil. If all the contamination were present in the top 3

inches, and the contaminated soil was averaged with 9 additional inches of clean soil, the surface soil contamination might actually be three times as high as measured. For this reason, we triple the measured values to assess the risk associated with this data limitation. Incidental soil ingestion can occur when adults do not wash their hands after being outside or gardening and before eating or smoking. Children may ingest soil by putting their dirty fingers in their mouths.

Completed exposure pathways

FDOH evaluated two completed human exposure pathways (Table 1): past ingestion of contaminated surface soil on and off the site.

For surface soil, spilled or dumped dry cleaning solvents were the source of contamination. Storm water or liquid waste runoff also moved a limited amount of wastes to soil in the right-of-way across the alley from the site. Surface soil is the environmental media. The alley right-of-ways were the points of exposure before the EPA's contractor removed this soil during remediation. Incidental ingestion was the route of exposure and alley pedestrians (children 6 to 11 years old) were the exposed population.

Potential (past) exposure pathway

FDOH evaluated one potential human exposure pathway (Table 2): vapor intrusion into an on-site one-story building at the rear of 121 S. Palmetto Ave. This building was the location of the former dry cleaning operations.

For **vapor intrusion,** solvents from the Sanford Dry Cleaner business were the source, and gases emitted from contaminated soil and groundwater were the environmental media. Vapors from the contaminated media may have entered indoor air through the process of vapor intrusion. Indoor air was the point of exposure. Inhalation was the exposure route. FDOH prepared a general fact sheet on vapor intrusion (Attachment A).

The site building had no occupants during the time the indoor air measurements were taken, but workers could have been exposed to similar levels in the past. Currently, the on-site buildings are unoccupied, and EPA's contractors have installed a Soil Vapor Extraction System.

Eliminated exposure pathways

The following are all eliminated exposure pathways (Table 3):
Vapor Intrusion into nearby off-site buildings – Figures 5 and 7 show EPA's consultant did not detect contamination in shallow groundwater and soil near the site. Additionally, EPA did not detect solvent vapors above CREG screening levels in indoor air or in sub-slab soil gas below three buildings near the site. These buildings have shops on the first floor and apartments on the second floor, Figures 4 and 6.

Soil vapor extraction remediation currently treats the VOC source areas on the site and EPA's contractor removed areas of soil contamination on and near the site. Both remedial actions reduce the likelihood of shallow soil and groundwater sources moving beneath off-site buildings. These solvents do not volatilize into soil gas farther from the site because they sink in groundwater. To enter soil gas they must be present at the water table. Prior to remediation, the areas of shallow groundwater contamination were the yellow circles on Figure 5.

EPA will test the effectiveness of its remedial actions to assure they have effectively removed the sources for vapor intrusion. If future testing shows shallow groundwater sources of VOCs beneath nearby buildings, we recommend EPA tests indoor air to monitor for vapor intrusion.

Sanford municipal water supply wells – The City of Sanford provides water for drinking and other purposes to residents and businesses near the SDC site from public supply wells. These wells are approximately 3 to 4 miles southwest of the site. Groundwater flow from the SDC site is to the northeast, away from these public supply wells. Therefore, it would be unlikely these public supply wells would contain contamination from the site. Test results verify these wells do not contain dry cleaning chemicals.

Off-site irrigation well – An irrigation well 250' southeast of the site is an eliminated pathway because recent testing did not show contamination. Because it is up gradient of the site and much deeper (200 feet) than contamination at the site (60 feet), it is unlikely contaminated water from the site will enter this well.

Off-site private well – Only one private drinking water well was within a 1.0-mile radius of the SDC site. This well is approximately 1.0 mile up gradient of the SDC site. In 2006, this well was sampled and found to contain low levels of trihalomethanes (79 micrograms per liter, µg/L). Trihalomethanes are by-products of water chlorination and are not associated with the SDC site.

Lake Monroe water – Recent testing shows that groundwater with very low levels of contamination from the site is flowing into Lake Monroe. The slow rate of groundwater discharge into a large volume of water in Lake Monroe, however, dilutes contaminant concentrations to below detection limits.

Lake Monroe fish – Contaminants in the groundwater from SDC such as PCE and TCE do not readily bio-accumulate in fish. Therefore eating fish from Lake Monroe is not a likely human exposure pathway for site-related contaminants, although we did not have fish data to evaluate for this assessment.

Environmental Data

EPA's consultants collected soil, groundwater, lake water, lake sediment water, indoor and outdoor air and soil-gas samples in three sampling phases, May 2011, September and October 2011 and July and August 2011. FDOH evaluated these data to prepare this report. Tables 4-7 summarize the highest levels of contaminants measured in surface soil and indoor air, both on and off the site.

In on-site surface soil, levels of PCE and TCE exceeded screening guidelines in 1 of 5 locations. Tests showed maximum levels of PCE at 150,000 milligrams contaminant per kilograms soil (mg/kg) and TCE at 3,000 mg/kg (Table 4; SDCHA01, Figures 6 and 7).

In off-site surface soil, levels of PCE and TCE exceeded screening guidelines in 1 of 2 locations. Tests showed maximum levels of PCE at 3,700 mg/kg and TCE at 240 mg/kg, (Table 5; SDCHA04, Figures 6 and 7).

On-site indoor air levels of PCE and TCE exceeded screening guidelines in 2 of 4 - locations. Tests showed maximum levels at the rear of the site in the one-story building. PCE and TCE indoor air maximum levels were 32 micrograms contaminant per cubic meter of air ($\mu g/m^3$) and 2.5 $\mu g/m^3$, respectively and 3,700 $\mu g/m^3$ and 130 $\mu g/m^3$ in sub-slab soil gas (Table 6, Figure 4).

EPA's soil removal and soil vapor extraction remedial actions have addressed and will address these on-site indoor air levels. EPA plans post remediation sampling to confirm the efficacy of their remediation activities along with 5-Year Reviews to assure timely follow-up for what may be a lengthy process. *If people use this building as a residence prior to remediation completion, we recommend EPA adequately test for vapor intrusion. Such testing should include 8 hour-interval air sampling, in warm and cold weather, with appropriate use of air conditioning and heating.*

Although TCE in off-site, indoor air exceeded its screening guideline in 1 of 3 locations (SDCVI13); **it is unlikely soil gas was the TCE source at this location**. The TCE indoor air level was 0.086 $\mu g/m^3$, but TCE was below the detection level in the sub-slab soil gas (Table 7, Figure 4). EPA's consultant did not measure PCE above its screening level in this building's indoor air or its sub-slab pair.

Owners of two buildings at addresses 311 E 1st Street (vacant/storage) and 112 S. Sanford Ave. (Goodwill) refused air-sampling access. Because buildings nearer the site did not show vapor intrusion, and neither of these building appears to be above surface soil or ***shallow*** groundwater contamination (see DNAPL discussion above, second paragraph of Eliminated Pathways), vapor intrusion in these buildings may be unlikely. Neither building is residential.

Identifying Contaminants of Concern

FDOH compares the maximum concentrations of contaminants found at a site to ATSDR and other comparison values. Comparison values are specific for the medium contaminated (soil, water, air, etc.). We screen the environmental data using these comparison values:

- ATSDR Cancer Risk Evaluation Guides (CREGs)
- ATSDR Environmental Media Evaluation Guides (EMEGs)
- ATSDR Reference Media Evaluation Guides (RMEGs)
- Florida DEP Soil Cleanup Target Levels (SCTLs)

When determining which comparison value to use, FDOH follows ATSDR's general hierarchy and uses professional judgment.

We select for further evaluation contaminants with maximum concentrations above a comparison value. Comparison values, however, are not thresholds of toxicity and are not used to predict health effects or to establish clean-up levels. A concentration above a comparison value does not necessarily mean harm will occur. It does indicate, however, the need for further evaluation. We do not evaluate maximum contaminant concentrations below comparison values further, because it is unlikely these lower contaminant concentrations would cause adverse health effects.

Volatile gases measured indoors may have many sources, especially when detected at relatively low levels. While testing showed benzene in indoor air and in the outdoor background air sample, testing did not show benzene in groundwater or soil gas. Benzene is a component of gasoline and gasoline engine exhaust but it is not associated with the Sanford Dry Cleaners site. Because benzene is not associated with the site and the indoor levels are relatively low, FDOH did not include benzene as a contaminant of concern even though EPA's contractor measured it at levels slightly above its CREG in indoor and outdoor air.

FDOH selected tetrachloroethylene and trichloroethylene as contaminants of concern. Gasoline components other than benzene (ethylbenzene, toluene, trichlorobenzene, m,p-xylenes, and o-xylene) and dry-cleaning fluid degradation products (1,1-dichloroethene, cis-1,2-dichloroethene, trans-1,2-dichloroethene,) were measured below their comparison values (including CREGs) or were not detected. Testing did not measure vinyl chloride at or above the method-reporting limit of 0.12 $\mu g/m^3$ in any sample. The following sections discuss health effects known from studies for exposures to these contaminants of concern at specific levels (doses). Keep in mind that exposures below these specific exposure levels are unlikely to produce adverse health effects.

Tetrachloroethene (Perchloroethylene, PCE)

PCE is a manufactured chemical that is widely used for dry cleaning of fabrics and for degreasing metal. Manufacturers use PCE in consumer products. Products that may

contain PCE include water repellents, silicone lubricants, fabric finishers, spot removers, glues, and wood cleaners. Manufacturers also use PCE to make other chemicals.

PCE affects the central nervous system following either oral or inhalation exposure. In the past, doctors used PCE as a general anesthetic, because at high concentrations it causes loss of consciousness. Other effects known from medical studies of exposed workers include loss of color vision, slowed reactions, slowed thinking, sleepiness, and nausea. At elevated levels, PCE also affects the immune, developmental, reproductive, and blood-forming systems [ATSDR 2014].

Human epidemiologic studies associate PCE exposure with bladder cancer, non-Hodgkin lymphoma, and multiple myeloma using precise assessment methodologies. Epidemiologic studies with less precise exposure assessment methodologies associate PCE exposures with esophageal, kidney, liver, cervical, and breast cancer effects [EPA (IRIS) 2015a].

Trichloroethene (Trichloroethylene, TCE)

TCE is a manufactured chemical that is widely used for degreasing metal. Manufacturers also use TCE in correction fluid, dry-cleaning (in the past), paint removers, glues, and spot removers. TCE also forms as PCE breaks down.

TCE affects the central nervous system following either oral or inhalation exposure. In the past, doctors used TCE as an anesthetic, because at high concentration it causes sleepiness and loss of consciousness. Some workers who got TCE on their skin developed skin rashes. People who breathe moderate levels of TCE may have headaches or become dizzy. People who breathe high levels of TCE may have damage to their facial nerves. High exposure levels in humans have also resulted in changes in heartbeat, and liver and kidney damage [ATSDR 2014].

In animal studies, inhalation and ingestion exposures caused fetal heart defects, decreased thymus weights (an immune system gland), decreased immune response, and changes in kidney tissue that could lead to cancer [EPA (IRIS) 2011b].

Human epidemiologic studies associate TCE exposure with kidney cancer, non-Hodgkin's lymphoma and liver cancer. [EPA (IRIS) 2015b]. Epidemiologic data sets

with fewer studies, a mixed pattern of observed risk estimates, and the general absence of exposure-response data provide suggestive evidence of an association between TCE exposure and bladder, esophageal, prostate, cervical and breast cancer and childhood leukemia. Multiple studies identify some of the same cancer target tissues in rats and mice, including the kidney, liver and lymphoid tissues.

In the following sections, FDOH discusses non-cancer health risks and estimates increases in lifetime cancer risks from past incidental ingestion of alley surface soil containing PCE and TCE.

Public Health Implications

FDOH provides site-specific public health recommendations based on toxicological literature, levels of environmental contaminants, evaluation of potential exposure pathways, duration of exposure, and characteristics of the exposed population. Whether a person will be harmed depends on the type/amount of contaminant, how they are exposed, how long they are exposed, how much contaminant is absorbed, genetics, and individual lifestyles.

After identifying contaminants of concern, FDOH evaluated exposures by estimating daily doses for children and adults. Kamrin [1988] explains the concept of dose as follows:

> "…all chemicals, no matter what their characteristics, are toxic in large enough quantities. Thus, the amount of a chemical a person is exposed to is crucial in deciding the extent of toxicity that will occur. In attempting to place an exact number on the amount of a particular compound that is harmful, scientists recognize they must consider the size of an organism. It is unlikely, for example, that the same amount of a particular chemical that will cause toxic effects in a 1-pound rat will also cause toxicity in a 1-ton elephant.
>
> Thus instead of using the amount that is administered or to which an organism is exposed, it is more realistic to use the amount per weight of the organism. Thus, 1 ounce administered to a 1-pound rat is equivalent to 2,000 ounces to a 2,000-pound (1-ton) elephant. In each case, the amount per weight is the same; 1 ounce for each pound of animal."

This amount per weight is the *dose*. Toxicology uses dose to compare toxicity of different chemicals in different animals. We use the units of milligrams (mg) of contaminant per kilogram (kg) of body weight per day (mg/kg/day) to express doses in this assessment. A milligram is 1/1,000 of a gram; a kilogram is approximately 2 pounds.

To calculate the daily doses of each contaminant, FDOH uses standard factors needed for dose calculation [ATSDR 2005; EPA 2011]. We also make the health protective assumption that 100% of the ingested chemical is absorbed into the body. The percent actually absorbed into the body is likely less.

The general formula for estimating a dose is:

$$D = (C \times IR \times EF \times CF) / BW$$

Where:
D = exposure dose (mg/kg/day)
C = contaminant concentration (various units)
IR = intake rate (amount per day)
EF = exposure factor (unit less)
CF = conversion factor (10^{-6} kg/mg)
BW = body weight (kilograms or kg)

$$EF = F \times ED / AT$$

Where:
EF = exposure factor (unit less)
F = frequency of exposure (days/year)
ED = exposure duration (years)
AT = averaging time (days) (ED × 365 days/year for non-carcinogens; 78 years × 365 days/year for carcinogens)

ATSDR groups health effects by duration (length) of exposure. Acute exposures are those with duration of 14 days or less; intermediate exposures are those with duration of 15 – 364 days; and chronic exposures are those that occur for 365 days or more (or an equivalent period for animal exposures).

FDOH uses standard assumptions to estimate exposure from incidental ingestion of contaminated soil. For this site, we evaluated children 6 to 11 years old, ingesting an average of 100 mg of soil per day (about the weight of a postage stamp). Children in this age group may have been the most likely, highly exposed in the past. The average weight for 6 to 11 year olds is 31.8 kilograms.

For the evaluation of ingestion exposures, FDOH compares estimated exposure doses to ATSDR chemical specific minimal risk levels (MRLs). MRLs are comparison values that establish exposure levels many times lower than levels where no adverse health effects were observed in animals or human studies. ATSDR designs MRLs to protect the most sensitive, vulnerable individuals in a population. The chronic MRL is an exposure level below which non-cancerous harmful effects are unlikely, even after daily exposure over a lifetime. Exceeding a comparison value does not imply that adverse health effects are expected. If contaminant concentrations are above comparison values, FDOH health scientists further analyze exposure variables (for example, duration and frequency), toxicology of the contaminants, past epidemiology studies, and the weight of evidence for health effects. We use chronic MRLs where possible because exposures are usually longer than a year. If chronic MRLs are not available, we use intermediate length MRLs [ATSDR 2005].

For the evaluation of air exposures, FDOH compares the measured contaminant concentrations directly to the health guidelines (MRLs, RfCs) which are considered protective of all segments of the population.

For cancer, FDOH quantifies the increased estimated risk by using the general formula:

$$Risk_i = Di \times ED_i \times SF \times ADAF_i / LT$$

$Risk_i$ = Cancer risk
D_i = Age specific dose (mg/kg/day)
ED_i = Exposure duration (years)
SF = Slope factor $(mg/kg\text{-}day)^{-1}$
ADAFi = Age Dependent Adjustment Factor (adjustment for mutagenic chemicals)
LT = Lifetime (78 years)

This is a conservative estimate of the increased cancer risk. The actual increased cancer risk is likely lower. Because of large uncertainties in the way scientists estimate cancer risks, the actual cancer risk may be as low as zero.

Studies of animals exposed over their entire lifetime are the basis for calculating cancer slope factors and scientists know little about the cancer risk in animals from less than lifetime exposures. Therefore, we also estimate the cancer risk in people assuming lifetime exposure or 78 years. For less than lifetime exposures, we do not estimate a cancer risk.

FDOH estimated daily dose equivalents for pedestrians visiting the site once a week and possibly ingesting 100 mg of soil, for 5 years. The non-cancer exposure factor (EF) is = 0.14.

EF = F × ED / AT or 0.14 = 52 days/year × 5 years / 5 years × 365 days/year

Where:
EF = exposure factor (unit less)
F = frequency of exposure (days/year)
ED = exposure duration (years)
AT = averaging time (days) (ED × 365 days/year for non-carcinogens; 78 years × 365 days/year for carcinogens)

Past exposures to contaminants in on-site soil

Buildings and asphalt covered most of the contaminated on-site soil. FDOH estimated that alley pedestrians might have been exposed to the on-site surface soil at the rear of 121 S. Palmetto Avenue once a week (Photographs 2-4, SDCHA04, Figure 6). This was not a landscaped area. We estimated alley pedestrians 6 to 11 years old might have

incidentally ingested (swallowed) 100 mg of contaminated soil (equal in weight to ½ a postage stamp) once a week for a period of 5 years. The doses we estimated convert that one ingestion per week into a daily dose; we triple the highest level to compensate for 0 to 12 inch samples.

Photo 3 is a picture of the area that had the highest measured levels of soil in the alley. Because of the close proximity of much more attractive areas, (downtown shopping and sidewalks along Lake Monroe to the north) even a once a week exposure estimate in the past may be high. A passersby's actual rate of ingestion of this soil may have been lower. EPA's contractors excavated contaminated soil to the water table on both sides of the alley and filled the holes with clean soil. They completed this and other remediation activities in early 2015. Therefore, the exposure estimates we calculated apply only to possible past exposures. While our dose–estimate calculations show increased risks for non-cancer illness, it is also possible pedestrians did not ingest this soil, and therefore did not have increased risk of illness.

Tetrachloroethene

Non-Cancer Risk – The dose-estimate we calculated for alley-pedestrian children incidentally ingesting (swallowing) 100 mg of soil containing tetrachloroethylene at a concentration of 450,000 mg/kg, once weekly, is 25 times the MRL (0.008 mg/kg/day)[1] (Table 8). Although this dose exceeds the MRL, it is 13 times less than the lower of the two Lowest Observable Adverse Effect Levels (LOAELs) for PCE. Epidemiological studies link color vision loss in workers with PCE exposure levels of 2.6 mg/kg/day. Because the dose we calculated is above the MRL and below the LOAEL, FDOH cannot rule out past risk of illness for exposures.

Cancer Risk – The estimated increased lifetime cancer risk for children 6 to 11 years old visiting the site for 5 years incidentally ingesting soil containing 450,000 mg/kg PCE is 3×10^{-5} (Table 8). This is a very low estimated increased cancer risk of 3 additional cases in 100,000 people.

Trichloroethene

Non-Cancer Risk – The dose-estimate we calculated (0.005 mg/kg/day) for alley pedestrian children incidentally ingesting (swallowing) 100 mg of soil containing trichloroethylene at a concentration of 9,000 mg/kg, once weekly, is 10 times the MRL (0.0005 mg/kg/day) (Table 9). This dose exceeds the MRL, however it is 10 times less than the LOAEL linked with decreased thymus weight (which interferes with immune response), 0.048 mg/kg/day. Because the dose we calculated is above the MRL and below the LOAEL, FDOH cannot rule out past risk of illness for exposures

[1] A minimal risk level is 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. ATSDR calculates MRLs for a route of exposure (inhalation or oral) and length of time. Chronic refers to exposures lasting more than a year. MRLs should not be used as predictors of harmful (adverse) health effects. All MRLs are the same for PCE. In acute exposures are for less than 2 weeks, and intermediate exposures are 2 to 52 weeks.

Cancer Risk – The estimated increased lifetime cancer risk for children 6 to 11 years old visiting the site for 5 years incidentally ingesting soil containing 6,000 mg/kg TCE is 3 $\times 10^{-5}$ (Table 9). This is a very low estimated increased cancer risk of 3 additional cases in 100,000 people.

Exposures to contaminants in off-site soil

FDOH estimated that 6 to 11 year-old pedestrians might have contacted off-site soil along the alley in the past and incidentally ingested (swallowed) 100 mg of contaminated soil once a week for a period of 5 years. We triple the highest measured level to compensate for 0 to 12" sample intervals and we did not calculate a lifetime cancer risk for tetrachloroethylene. The doses we estimated convert that one ingestion per week into a daily dose. A passerby's actual rate of ingestion of this soil may have been lower or none.

Tetrachloroethene

Non-Cancer Risk – Past 6 to 11 year-old alley-pedestrians would not likely have suffered non-cancer illness from past incidental ingestion of off-site soil. The dose-estimate we calculated for children incidentally ingesting (swallowing) 100 mg of soil containing tetrachloroethylene at a concentration of 11,100 mg/kg, once weekly, is about two-thirds (63 percent) of the MRL (0.008 mg/kg/day)[2] (Table 10).

Cancer Risk – The estimated increased lifetime cancer risk for children 6 to 11 years old visiting the site for 5 years incidentally ingesting soil containing 11,100 mg/kg PCE is 7 $\times 10^{-7}$ (Table 10). This is an extremely low estimated increased cancer risk of 7 additional cases in 10 million people.

Trichloroethene

Non-Cancer Risk – Past 6 to 11 year-old alley-pedestrians would not likely have suffered non-cancer illness from incidental ingestion of off-site soil containing trichloroethylene at a concentration of 720 mg/kg. The dose-estimate we calculated is two-thirds the MRL of 0.0005 mg/kg/day (Table 11).

Cancer Risk – The estimated increased lifetime cancer risk for children 6 to 11 years old visiting the site for 5 years incidentally ingesting soil containing 480 mg/kg TCE is 3 $\times 10^{-6}$ (Table 11). This is a very low estimated increased cancer risk of 3 additional cases in one million people.

[2] A minimal risk level is 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. ATSDR calculates MRLs for a route of exposure (inhalation or oral) and length of time. Chronic refers to exposures lasting more than a year. MRLs should not be used as predictors of harmful (adverse) health effects. All MRLs are the same for PCE. In acute exposures are for less than 2 weeks, and intermediate exposures are 2 to 52 weeks.

Exposures to contaminants in on-site indoor air

From the October 2011 indoor air test results for the three on-site buildings, only the building that housed the former dry cleaning operations had PCE and TCE above air screening levels. Dry cleaning operations were in the one-story building at the rear of 121 S. Palmetto Avenue (Figure 2). All of the site buildings unoccupied, but homeless people were reportedly living there in the past. We evaluated these data for residential exposures and only found slight increases in cancer risks from our calculations.

EPA is treating the contaminated soil beneath the buildings with a soil vapor extraction system (SVES). Their remediation plans include indoor air testing to assure this SVES is effective. If people use these buildings before remediation is complete, we recommend that EPA test for vapor intrusion with 8-hour or longer samples, and typical air-conditioning and heating conditions in both warm and cool weather

The following paragraphs evaluate the only available on-site indoor air data for residential use.

Tetrachloroethene

Non-Cancer Risk – If residents had been in the building in the past, they would not likely have suffered non-cancer illness from inhalation of the highest concentration of tetrachloroethylene measured in the air of an on-site building at 32 $\mu g/m^3$ or 0.0045 ppm, which does not exceed the chronic ATSDR Minimal Risk Level (MRL) of 0.04 ppm (Table 12).

Cancer Risk – The estimated increased lifetime cancer risk if residents had lived in the building in the past that might have inhaled on-site indoor air with the highest measured level of tetrachloroethylene (32 $\mu g/m^3$) is 8×10^{-6} for continuous lifetime exposure. This is an extremely low predicted increased cancer risk of eight additional cases in one million people (Table 12).

Trichloroethene

Non-Cancer Risk – If residents had been in the building in the past, they would have been unlikely to suffer non-cancer illness from TCE inhalation. The highest concentration of trichloroethylene measured in an on-site building at 2.5 $\mu g/m^3$ exceeds the chronic ATSDR MRL of 2.0 $\mu g/m^3$ and the CREG of 0.24 ug/ m^3 (Table 12). However LOAEL studies found an adult immunological effect, decreased thymus weight in female mice at 190 $\mu g/m^3$ and increased rate of fetal cardiac malformation at 21 $\mu g/m^3$ in rats, the former is 76 times the amount measured, the latter is 52 times the amount measured.

Cancer Risk – The estimated increased lifetime cancer risk if past residents had inhaled on-site indoor air with the highest measured level of trichloroethylene (2.5 $\mu g/m^3$) is 1×10^{-5} for continuous lifetime exposure. This is a very low predicted increased cancer risk of one additional case in 100,000 people (Table 12).

Site Specific Limitations of Findings

We lack air data to address former worker's exposures. In addition, we cannot be certain that 0 to 12 inch samples accurately represent surface soil values. We tripled the measured values to assume that levels at the surface could have contained the highest levels of solvents and that cleaner underlying soil diluted these values.

Child Health Considerations

In communities faced with air, water, soil, 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 sometime engage in hand-to-mouth behaviors that increase their exposure potential. Children are shorter than adults are; 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 system 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.

The developing fetal nervous system may be particularly susceptible to the toxic effects of PCE. Studies in mice suggest that PCE can cross the placenta and that its breakdown metabolite, trichloroacetic acid (TCA), concentrates in the fetus. Studies found unmetabolized PCE in breast milk and in an exposed infant with liver damage. Studies detected health effects in children from Woburn, Massachusetts that may have been exposed to solvent-contaminated drinking water as infants or in the womb. This exposure possibly contributed to elevated incidences of acute lymphocytic leukemia or impaired immunity [ATSDR 1997a].

Premature babies and newborn infants have immature and developing organs and are more vulnerable to toxic substances in general than healthy adults. In addition, if the contaminant metabolic products are more toxic than the parent compound, they can cause greater toxicity in individuals with higher metabolic rates such as children and adolescents [ATSDR 1997b].

Other susceptible populations may have different or enhanced susceptibilities to chemicals than will most persons exposed to the same levels of that chemical in the environment. Reasons may include genetic makeup, age, health, nutritional status, and exposure to other toxic substances (like cigarette smoke and alcohol). These factors may limit that person's ability to detoxify or excrete harmful chemicals or may increase the effects of damage to their organs or systems.

Community Health Concerns Evaluation

Community members have expressed three health concerns: 1) potential health impacts of PCE found on the site, 2) emphysema, and 3) miscarriages.

Potential Health Impacts of PCE from the site - FDOH addresses on-site exposure to PCE and TCE in the sections above.

Emphysema - Emphysema is a long-term, progressive disease of the lungs that primarily causes shortness of breath. Emphysema is most often caused by tobacco smoking and long-term exposure to air pollution. In people with emphysema, the tissues necessary to support the physical shape and function of the lungs are destroyed.

Symptoms of emphysema progression include increasing shortness of breath, first with exertion, and later as the disease progresses, without exertion. Some persons also develop a barrel-shaped chest associated with air being trapped in the outer part of the lungs. Symptoms may also include a chronic cough (caused by accompanying bronchitis) and wheezing. In the more serious cases, oxygen uptake is also impaired.

Control of the disease depends on preventing more damage to the lungs and treating the symptoms. This means ceasing the exposure to cigarette smoke or other harmful chemicals, dilating the bronchioles, treating fluid retention, and providing additional oxygen if needed [AMA 1989].

Neither ATSDR toxicological profile for PCE or TCE finds an association between exposure to either of these chemicals and emphysema.

Miscarriages - Miscarriage is the loss of a pregnancy before the fetus fully develops (usually before 20 weeks). Fifteen to 20% of all pregnancies end in miscarriage. Vaginal bleeding (with or without pain) is the most common symptom of miscarriage. If bleeding occurs during pregnancy, a woman should consult a doctor immediately. Women past the age of 35 are at a greater risk of miscarriage. Women who smoke or have certain illnesses, such as diabetes, lupus, or hormonal imbalance, are at a greater risk of miscarriage. Doctors do not completely understand the causes but they are often times linked with physical problems in the mother. These problems include uterine fibroids (benign growths in the womb), abnormally shaped uterus, and scar tissue. In some instances, problems with the genetic material in the fetus may cause miscarriages (AMA 2003).

One study noted a higher incidence of miscarriages for nurses who administered trichloroethylene as an anesthetic. The study could not attribute this health effect solely to TCE exposure as the nurses in the study routinely contacted other solvents and chemicals [ATSDR 1997b]. Nurses were likely exposed to much higher levels than occasional pedestrians at the site would be.

Conclusions

1. In the past, occasional exposure of alley pedestrians (children 6 to 11 years old) to contaminated soil on the SDC site, could have harmed their health. This soil is no longer a health threat as EPA's contractor excavated the highly contaminated surface soil in December 2015.

2. Daily, long-term exposure to indoor air at the levels measured in the former dry cleaner operations building would have not likely have harmed health. At the measured levels, the estimated increased cancer risk would have been extremely low. While our estimates are consistent with residential property use, no one is legally living on the property. EPA is currently treating the threat of vapor intrusion from the soil and groundwater below the building with soil vapor extraction equipment.

3. Indoor air testing in buildings near the former Sanford Dry Cleaners site did not find site-related contamination. Sub-slab soil gas testing paired with the indoor air tests did not find vapor intrusion sources. Two commercial building owners declined vapor intrusion (VI) testing: one property was vacant, and one was farther from the site than another tested commercial building that did not show vapor intrusion**.**

Recommendations

1. EPA does not anticipate tearing down the historical buildings on the site and is currently treating the vapor intrusion sources beneath the buildings (contaminated soil and shallow groundwater) with a soil vapor extraction. If the owners choose to live in or rent the on-site building before the cleanup is completed, we recommend 8-hour testing of the indoor air in warm and cool seasons with the air conditioning and heating systems on to insure that the system adequately addresses vapor intrusion. We recommend long-term estimates of indoor air concentrations for health assessment of on-site occupied buildings as long as tests show subsurface contamination above screening levels[3].

2. EPA's soil and groundwater treatment should mitigate the risk of future vapor intrusion. However, if future testing finds shallow groundwater with VOCs has migrated beneath nearby buildings, we recommend additional indoor air testing for VOC vapor intrusion as described in the first recommendation.

Public Health Action Plan

Actions Undertaken

When FDOH began working on the site in early 2010, staff reviewed previous contamination assessment reports and spoke with county, state, and federal

[3] Section 5.3.1 of EPA's *Indoor Air Vapor Intrusion Mitigation Approaches* provides more information at http://www.clu-in.org/download/char/600r08115.pdf.

environmental officials. No reports or individuals indicated awareness of health concerns related to the site. On May 19, 2010, the FDOH and the Seminole County Health Department (SCHD) staff made a site visit (discussed in the Site Description).

In February 2011, prior to their education outreach, FDOH telephoned 66 downtown business owners within a half-mile of the site and questioned 33 of them about their knowledge of the site. FDOH learned that most respondents (73%) did not know anything about the site, or groundwater, or other types of contamination. One respondent expressed concerns about "contaminated dust" (from an unspecified source).
In late April 2011, FDOH received one health concern forwarded from an EPA public meeting concerning the site. Two citizens wanted to know the potential health impacts of 'perc' at the concentrations found at the site.

Beginning in July 2011, FDOH solicited public comments on the public comment draft report. We sent out postcards to nearby businesses to alert them about upcoming FDOH door-to-door visits concerning the site. For the convenience of nearby businesses, the visits served in lieu of a public meeting. On July 26, representatives from FDOH spent the day talking with roughly fifty business owners and others. While there, FDOH also distributed a fact sheet about the site summarizing the findings of the draft report. FDOH also provided a survey form to gather health concerns and comments on the report prior to finalization.

Also in July 2011, FDOH issued a press release resulting in a newspaper article published in July and posted the draft report on their web site. We did not receive additional comments or health concerns. In September 2011, after their educational outreach, FDOH again called downtown business owners. Knowledge of the existence of the site increased from 18% to 60% and knowledge of existence of ground water contamination increased from 25% to 76%. By conducting a pre- and post-intervention telephone survey, FDOH was able to demonstrate a considerable gain in knowledge about the site amongst nearby businesses.

In January 2012, FDOH distributed a fact sheet to about 50 downtown businesses on the availability of the final release of our first health consultation report.

Actions Planned

This is the final version of the second report we prepared for this site. FDOH will distribute this report or a summary to Seminole County Health Department, nearby residents, and Florida DEP.

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Appendix A – Tables

Table 1. Completed Human Exposure Pathways at the Sanford Dry Cleaners Hazardous Waste Site

COMPLETED PATHWAY NAME	COMPLETED EXPOSURE PATHWAY ELEMENTS					TIME
	SOURCE	ENVIRON-MENTAL MEDIA	POINT OF EXPOSURE	ROUTE OF EXPOSURE	EXPOSED POPULA-TION	
Surface soil on and near the site	Dry cleaner solvents from Sanford Dry Cleaners	Surface soil	Alley right-of-ways	Incidental ingestion	Alley pedestrians	Past (1940 to early 2015)

Table 2. Potential Human Exposure Pathways at the Sanford Dry Cleaners Hazardous Waste Site

POTENTIAL PATHWAY NAME	POTENTIAL EXPOSURE PATHWAY ELEMENTS					TIME
	SOURCE	ENVIRON-MENTAL MEDIA	POINT OF EXPOSURE	ROUTE OF EXPOSURE	POTENTIALLY EXPOSED POPULATION	
Vapor intrusion into on-site buildings	Dry cleaner solvents from Sanford Dry Cleaners	Groundwater or soil	Inside the former dry-cleaning operations	Inhalation	Future workers or residents	Future

Table 3. Eliminated Human Exposure Pathways at the Sanford Dry Cleaners Hazardous Waste Site

ELIMINATED PATHWAY NAME	ELIMINATED EXPOSURE PATHWAY ELEMENTS					TIME
	SOURCE	ENVIRON-MENTAL MEDIA	POINT OF EXPOSURE	ROUTE OF EXPOSURE	EXPOSED POPULA-TION	
Vapor intrusion into nearby off-site buildings	Dry cleaner solvents from Sanford Dry Cleaners	Groundwater	Inside nearby commercial and residential buildings	Inhalation	None	---
Sanford municipal water supply wells	Dry cleaner solvents from Sanford Dry Cleaners	Groundwater	City of Sanford municipal water supply	Ingestion, inhalation of vapors or skin contact with groundwater	None	---
Off-site irrigation well	Dry cleaner solvents from Sanford Dry Cleaners	Groundwater	Off-site irrigation well water	Inhalation of vapors or skin contact with groundwater	None	---
Off-site private well	Dry cleaner solvents from Sanford Dry Cleaners	Groundwater	Off-site private well water	Ingestion, inhalation of vapors or skin contact with groundwater	None	---
Lake Monroe water	Dry cleaner solvents from Sanford Dry Cleaners	Groundwater discharging to surface water	Lake Monroe	Skin contact	None	---
Lake Monroe fish	Dry cleaner solvents from Sanford Dry Cleaners	Fish	Lake Monroe	Ingestion	None	---

Table 4. Sanford Dry Cleaners Past (2011*) On-site Surface Soil (0-12 inches deep) VOC Concentrations

Contaminants of Concern	Concentration Range (mg/kg)	Screening Guideline (mg/kg)	Source of Screening Guideline	# Above Screening Guideline/ Total #
Tetrachloroethylene (PCE)	< 4.2-150,000	330	ATSDR CREG	1/5
Trichloroethylene (TCE)	< 4.2-3,000	15	ATSDR CREG	1/5

mg/kg = milligrams per kilogram
ATSDR CREG – Agency for Toxic Substances and Disease Registry Cancer Risk Evaluation Guide
[J.M. Waller 2012c]

Table 5. Sanford Dry Cleaners Past (2011*) Off-site Surface Soil (0-12 inches deep) VOC Concentrations

Contaminants of Concern	Concentration (in mg/kg)	Screening Guideline (mg/kg)	ATSDR Screening Guideline	# Above Screening Guideline/ Total #
Tetrachloroethylene (PCE)	< 3.0-3,700	330	ATSDR CREG	1/2
Trichloroethylene (TCE)	< 3.0-240	15	ATSDR CREG	1/2

mg/kg = milligrams per kilogram
ATSDR CREG – Agency for Toxic Substances and Disease Registry Cancer Risk Evaluation Guide
[J.M. Waller 2012c]
*These samples are from May 2011. In December 2014, EPA's contractor removed contaminated soil near the site building, installed a SVES, and began treating groundwater with in-situ bioremediation. Because they replaced contaminated soil with clean soil, these levels apply to past exposures only.

Table 6. Sanford Dry Cleaners 2011* On-site Indoor Air VOC Concentrations

Contaminants of Concern	Concentration Range (µg/m^3)	Screening Guideline (µg/m^3)	Source of Screening Guideline	# Above Screening Guideline/ Total #
Tetrachloroethylene (PCE)	0.3-32	3.8	ATSDR CREG	2/4
Trichloroethylene (TCE)	< 0.13-2.5	0.24	ATSDR CREG	2/4

µg/m^3= micrograms of contaminant per cubic meter of air
ATSDR CREG – Agency for Toxic Substances and Disease Registry, Cancer Risk Evaluation Guide
[J.M. Waller 2012c]

Table 7. Sanford Dry Cleaners 2011* Off-site Indoor Air VOC Concentrations

Contaminants of Concern	Concentration Range (µg/m^3)	Screening Guideline (µg/m^3)	Source of Screening Guideline	# Above Screening Guideline/ Total #
Tetrachloroethylene (PCE)	< 0.41-1.3	3.8	ATSDR CREG	0/3
Trichloroethylene (TCE)	< 0.41-0.86	0.24	ATSDR CREG	1/3

µg/m^3= micrograms of contaminant per cubic meter of air
ATSDR CREG – Agency for Toxic Substances and Disease Registry, Cancer Risk Evaluation Guide
[J.M. Waller 2012c]
*These samples are from September and October 2011. In December 2014, EPA's contractor removed contaminated soil near the site building, installed SVES, and began treating groundwater with in-situ bioremediation. More current testing will be necessary to evaluate current indoor air health risks.

Table 8. Estimated Doses for PCE in 2011 On-site Surface Soil (0-12") and Increased Cancer Risk for Past Alley Pedestrians

Age Group (years)	Body Weight (kg)	*Maximum Surface Soil Concentration (mg/kg)	Estimated Average Ingestion Dose (mg/kg/day)	Comparison Value (mg/kg/day)	Oral Cancer Slope Factor $(mg/kg/day)^{-1}$	Estimated Increased Cancer Risk (unitless)
6 to <11	31.8	150,000 × 3 = 450,000	0.2	0.008 (Chronic ATSDR MRL) — 0.006 (Chronic EPA RfD)	0.0021	3×10^{-5}

kg = kilograms
mg/kg = milligrams per kilogram
mg/kg/day = milligrams per kilogram per day
ATSDR MRL = Agency for Toxic Substances and Disease Registry's Minimal Risk Level. An MRL is an estimate of the daily human exposure to a hazardous substance that is likely to be without appreciable risk of adverse non-cancer health effects over a specified duration of exposure. This MRL is for acute (less than 2 week), intermediate (2 to 52 week) and chronic exposures (> 52 week) exposures.
EPA RfD = US Environmental Protection Agency's Reference Dose. The oral Reference Dose (RfD) is based on the assumption that thresholds exist for certain toxic effects such as cell death. We express doses in units of mg/kg-day. The RfD is an estimate (with uncertainty factor of 1000) of a daily exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious non-cancer effects during a lifetime.

*We tripled the value to account for the use of 0-12' samples for surface soil. These samples are from May 2011. In December 2014, EPA's contractor removed contaminated soil near the site building, installed a soil vapor extraction system, and began treating groundwater with in-situ bioremediation. Because they replaced contaminated soil with clean soil, these levels apply to past exposures only.

Table 9. Estimated Doses for TCE in On-site Surface Soil (0-12”) and Increased Cancer Risk for Past Alley Pedestrians

Age Group (years)	Body Weight (kg)	*Maximum Surface Soil Concentration (mg/kg)	Estimated Average Ingestion Dose (mg/kg/day)	Comparison Value (mg/kg/day)	Oral Cancer Slope Factor $(mg/kg/day)^{-1}$	Estimated Increased Cancer Risk (unitless)
6 to <11	31.8	3,000 × 3 = 9,000	0.005	0.00050 (Chronic ATSDR MRL) — 0.0005 (Chronic EPA RfD)	0.046	Age dependent adjustment factor (exposure at a young age increases cancer risk) 3×10^{-5}

kg = kilograms
mg/kg = milligrams per kilogram
mg/kg/day = milligrams per kilogram per day
ATSDR MRL = Agency for Toxic Substances and Disease Registry’s Minimal Risk Level. An MRL is an estimate of the daily human exposure to a hazardous substance that is likely to be without appreciable risk of adverse non-cancer health effects over a specified duration of exposure. This MRL is for acute exposures, meaning those lasting longer than 365 days. They are for developmental effects.
EPA RfD = US Environmental Protection Agency’s Reference Dose. The oral Reference Dose (RfD) is based on the assumption that thresholds exist for certain toxic effects such as cell death. We express doses in units of mg/kg-day. The RfD is an estimate (with uncertainty factor of 1000) of a daily exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious non-cancer effects during a lifetime.

*We tripled the value to account for the use of 0-12’ samples for surface soil. These samples are from May 2011. In December 2014, EPA’s contractor removed contaminated soil near the site building, installed a soil vapor extraction system, and began treating groundwater with in-situ bioremediation. Because they replaced contaminated soil with clean soil, these levels apply to past exposures only.

Table 10. Estimated Doses for PCE in Off-site Surface Soil (0-12”) and Increased Cancer Risk for Past Alley Pedestrians

Age Group (years)	Body Weight (kg)	*Maximum Surface Soil Concentration (mg/kg)	Estimated Average Ingestion Dose (mg/kg/day)	Comparison Value (mg/kg/day)	Oral Cancer Slope Factor $(mg/kg/day)^{-1}$	Estimated Increased Cancer Risk (unitless)
	31.8	3,700 × 3 = 11,100	0.005	0.008 (Chronic) — 0.006 (Chronic)	0.0021	7×10^{-7}

kg = kilograms
mg/kg = milligrams per kilogram
mg/kg/day = milligrams per kilogram per day
ATSDR MRL = Agency for Toxic Substances and Disease Registry’s Minimal Risk Level. An MRL is an estimate of the daily human exposure to a hazardous substance that is likely to be without appreciable risk of adverse non-cancer health effects over a specified duration of exposure. This MRL is for acute (less than 2 week), intermediate (2 to 52 week) and chronic exposures (> 52 week) exposures.
EPA RfD = US Environmental Protection Agency’s Reference Dose. The oral Reference Dose (RfD) is based on the assumption that thresholds exist for certain toxic effects such as cell death. We express doses in units of mg/kg-day. The RfD is an estimate (with uncertainty factor of 1000) of a daily exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious non-cancer effects during a lifetime.

*We tripled the value to account for the use of 0-12’ samples for surface soil. These samples are from May 2011. In December 2014, EPA’s contractor removed contaminated soil near the site building, installed a soil vapor extraction system, and began treating groundwater with in-situ bioremediation. Because they replaced contaminated soil with clean soil, these levels apply to past exposures only.

Table 11. Estimated Doses for TCE in Off-site Surface Soil (0-12”) and Increased Cancer Risk for Alley Pedestrians

Age Group (years)	Body Weight (kg)	*Maximum Concentration (mg/kg)	Estimated Ingestion Dose (mg/kg/day)	ATSDR MRL/ EPA RfD	Oral Cancer Slope Factor	Estimated Increased Cancer Risk (unitless)
			Average			
6 to <11	31.8	240 × 3 = 720	0.0003	0.0005 (Chronic) — 0.0005 (Chr)	0.046	Age dependent adjustment factor (exposure at a young age increases cancer risk) 3×10^{-6}

kg = kilograms
mg/kg = milligrams per kilogram
mg/kg/day = milligrams per kilogram per day
ATSDR MRL = Agency for Toxic Substances and Disease Registry’s Minimal Risk Level. An MRL is an estimate of the daily human exposure to a hazardous substance that is likely to be without appreciable risk of adverse non-cancer health effects over a specified duration of exposure. This MRL is for acute exposures, meaning those lasting longer than 365 days. They are for developmental effects.
EPA RfD = US Environmental Protection Agency’s Reference Dose. The oral Reference Dose (RfD) is based on the assumption that thresholds exist for certain toxic effects such as cell death. We express doses in units of mg/kg-day. The RfD is an estimate (with uncertainty factor of 1000) of a daily exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious non-cancer effects during a lifetime.

*We tripled the value to account for the use of 0-12’ samples for surface soil. These samples are from May 2011. In December 2014, EPA’s contractor removed contaminated soil near the site building, installed a soil vapor extraction system, and began treating groundwater with in-situ bioremediation. Because they replaced contaminated soil with clean soil, these levels apply to past exposures only.

Table 12. Maximum Past (2011*) Indoor Air Concentrations and Increased Lifetime Cancer Risk for Residential Use of the Sanford Dry Cleaners Site Buildings

Contaminants	Maximum Concentration in Indoor Air ($\mu g/m^3$)	Maximum Concentration in Indoor Air (ppm)	ATSDR MRL (ppm)	Inhalation Unit Risk (per $\mu g/m^3$)	Estimated Increased Cancer Risk (unitless)
Tetrachloroethylene (PCE)	32		0.008 (chr.)	2.6×10^{-7}	8×10^{-6}
Trichloroethylene (TCE)	2.5		0.0005 (chr.)	4.1×10^{-6}	1.2×10^{-5}

ATSDR = Agency for Toxic Substances and Disease Registry
MRL = ATSDR Minimal Risk Level An MRL is an estimate of the daily human exposure to a hazardous substance that is likely to be without appreciable risk of adverse non-cancer health effects over a specified duration of exposure.
$\mu g/m^3$ = micrograms per cubic meter
ppm = parts per million
chr. = chronic
Source of data: [EPA 2011]

*These samples are from September and October 2011. In December 2014, EPA's contractor removed contaminated soil near the site building, installed a soil vapor extraction system, and began treating groundwater with in-situ bioremediation. More current testing will be necessary to evaluate current indoor air health risks.

Appendix B – Figures

Figure 1. General Location of the Sanford Dry Cleaners Site

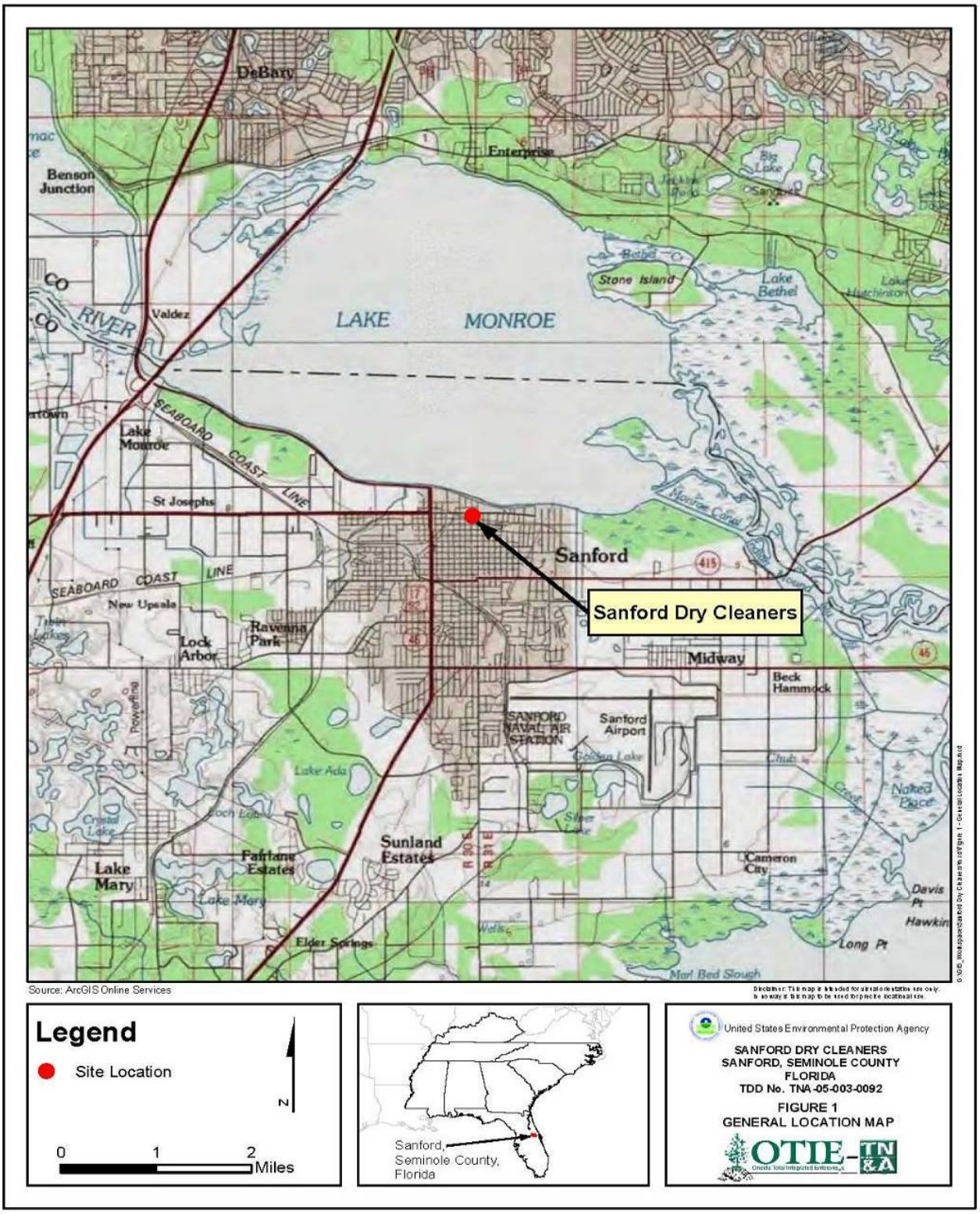


Figure 2. Sanford Dry Cleaners Site Boundaries & Building Addresses

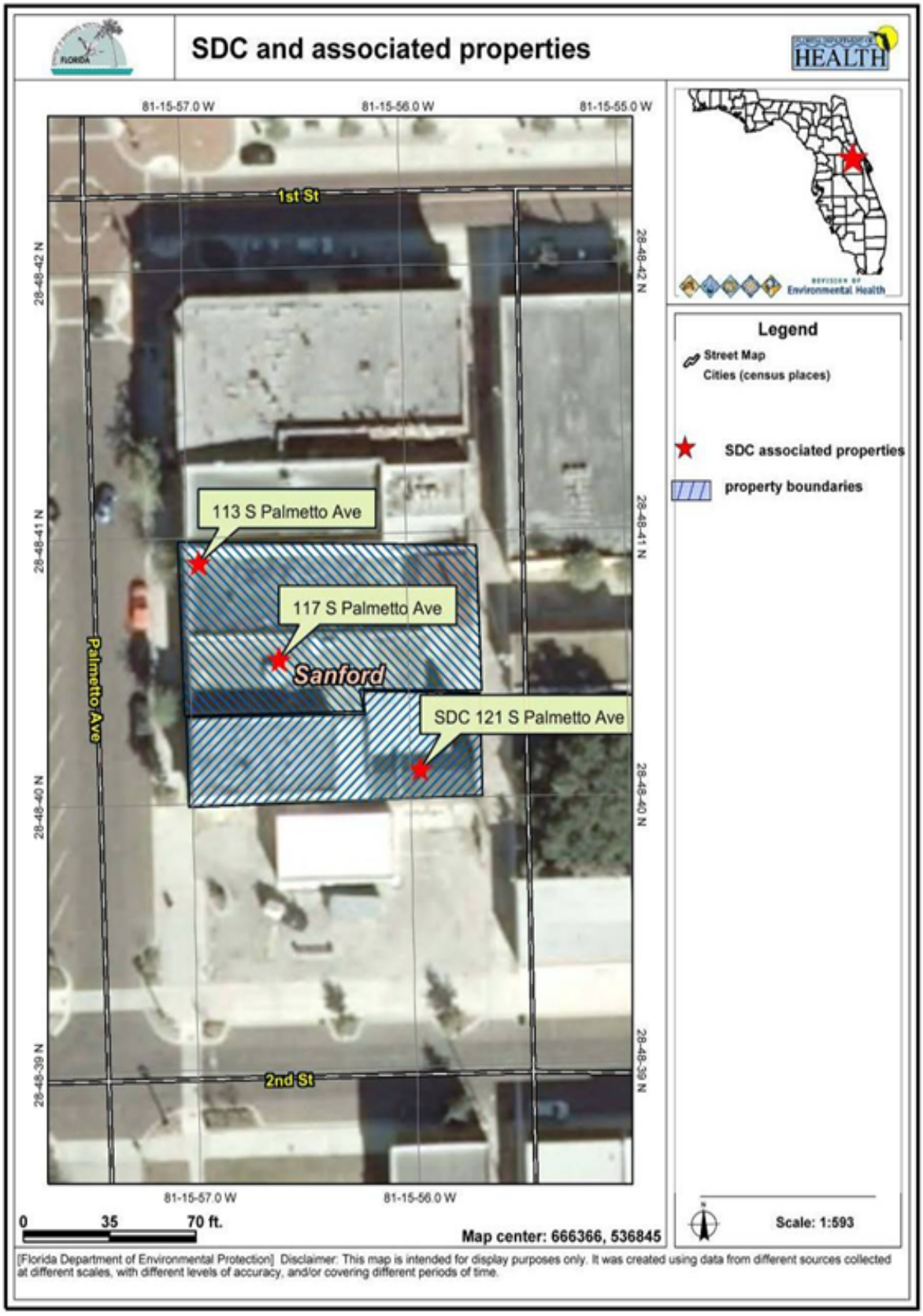


Figure 3. Sanford Dry Cleaners site Demographics

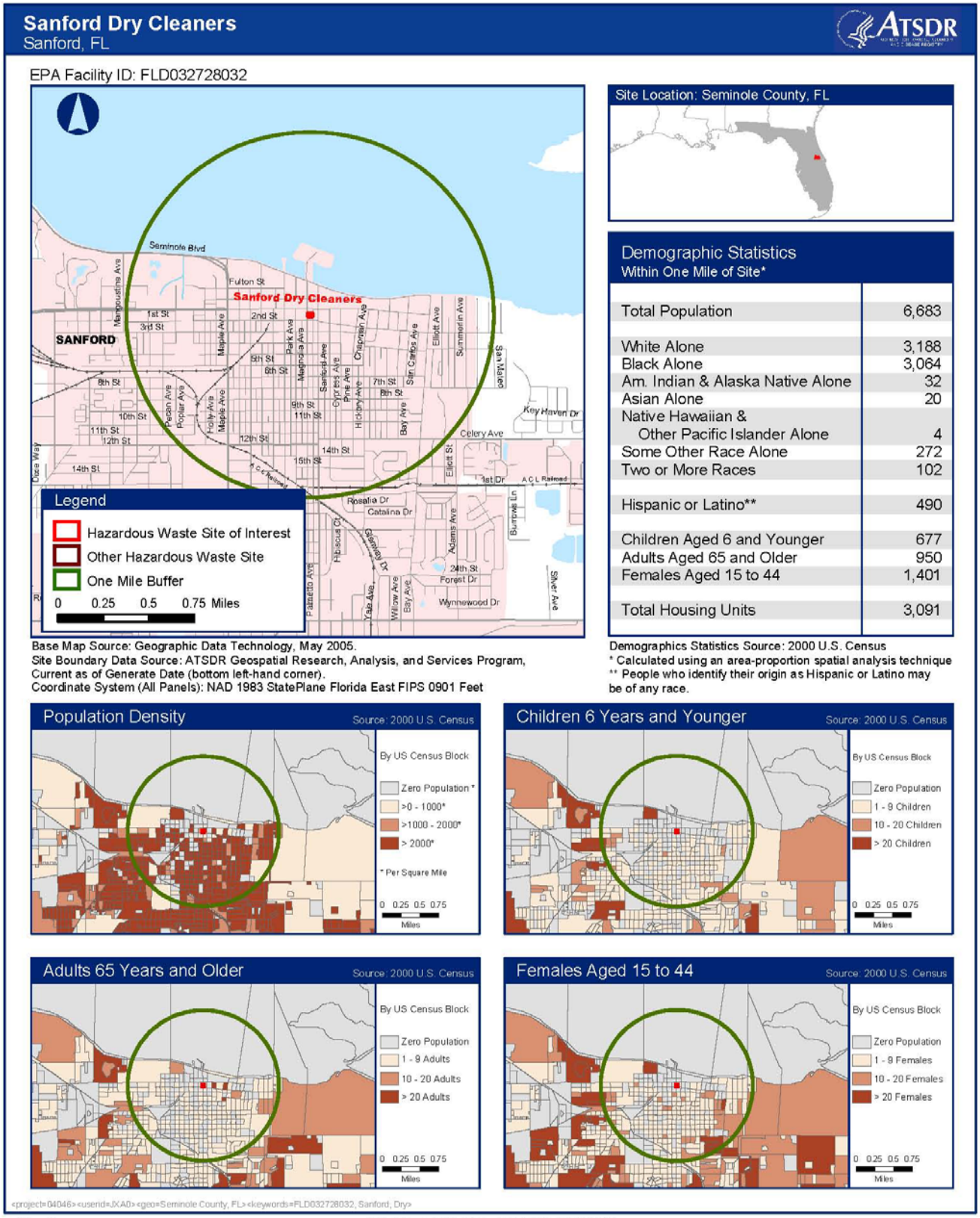
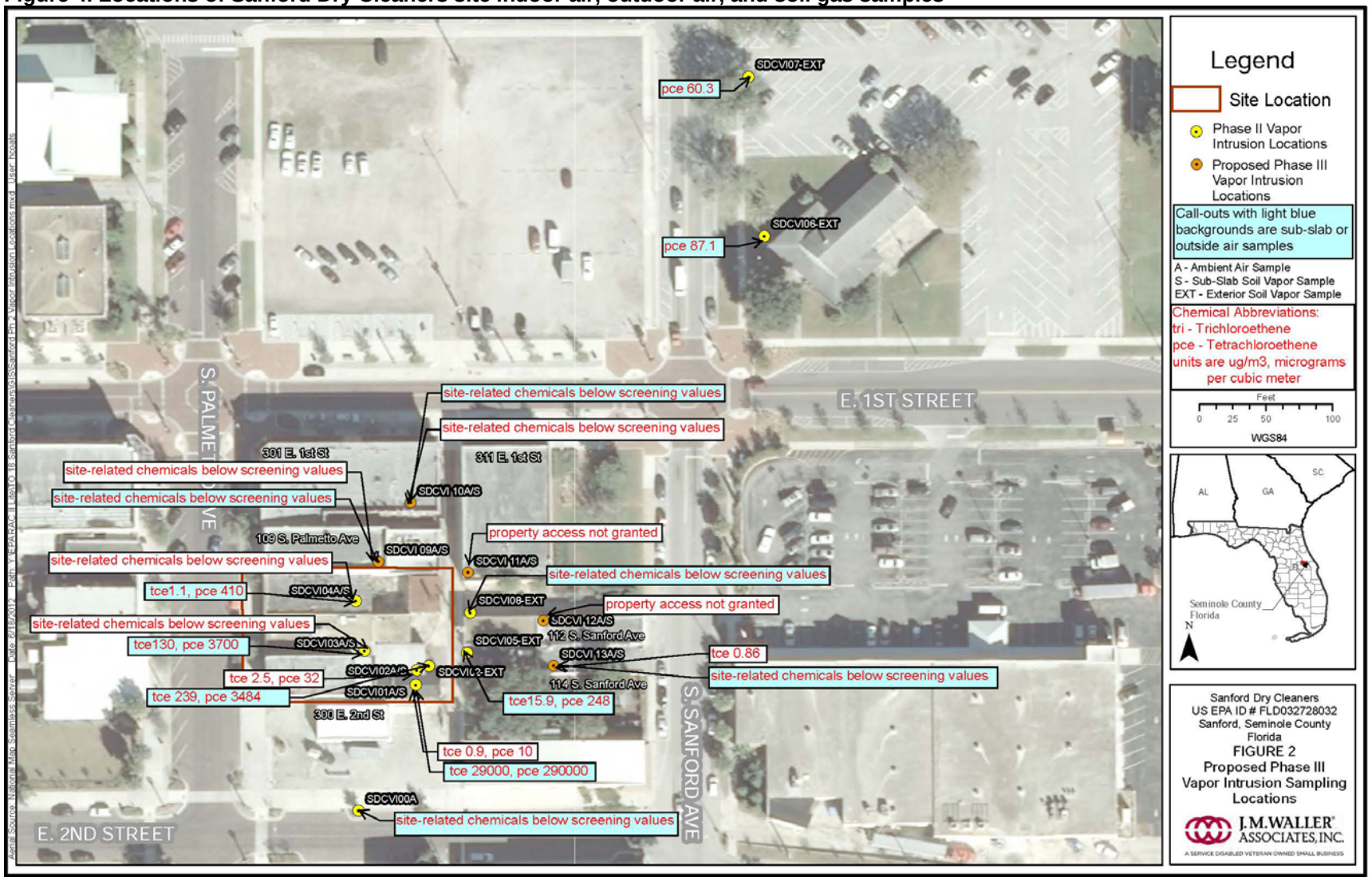


Figure 4. Locations of Sanford Dry Cleaners site indoor air, outdoor air, and soil gas samples



Interpretation for Figures 4 and 5

Vapor Intrusion

To establish groundwater contamination and soil gas as the indoor air contaminant source, EPA's contractor paired indoor-air testing with soil-gas testing below the buildings they were evaluating. They measured elevated PCE and TCE in soil gas and indoor air in and near on-site buildings where soil and shallow groundwater also contain elevated PCE and TCE. In Figure 4, the call-out boxes with blue backgrounds show soil-gas or exterior air values. The call-out boxes with white backgrounds show indoor air measurements or report that owners did not grant property access.

FDOH plotted the shallow (0-15') monitoring well test intervals with VOCs exceeding their groundwater screening values on Figure 5. The dark yellow lines outline areas are where shallow groundwater contains VOCs above drinking water standards that could evaporate into the soil. Soil gas can become available for vapor intrusion if there are overlying buildings.

Volatile gases measured indoors may have other sources, especially when detected at low levels. At 114 S. Sanford Avenue (offsite), the indoor air TCE level exceeded its screening level, but testing did not detect TCE in soil gas there.

Testing for this site revealed a second source of VOC contamination at the intersection of East 1st Street, and Sanford Avenue. Testing found shallow groundwater contaminated there (Figure 5). The source for this contamination is not known. Soil gas testing showed PCE above its screening value east of the Chamber of Commerce Building (Figure 4). Soil-gas testing also found PCE in soil gas between the Chamber of Commerce property and the Civic Center (Figure 4).

The surface of the shallow groundwater (the groundwater table) is the only location where groundwater contaminants can evaporate into soil gas. The groundwater table gradually rises from nine feet bls at the site, to essentially 0' at Lake Monroe. It is important to understand that the site-related contaminants are denser than water and sink. They can only evaporate at the water table surface. Areas in Figure 5 with contamination in groundwater at deeper levels (light and dark blue circles) are unlikely to contribute to soil gas and potential vapor intrusion.

Figure 5. Sanford Dry Cleaners site groundwater shallow, mid and deep locations with VOC concentrations exceeding screening values

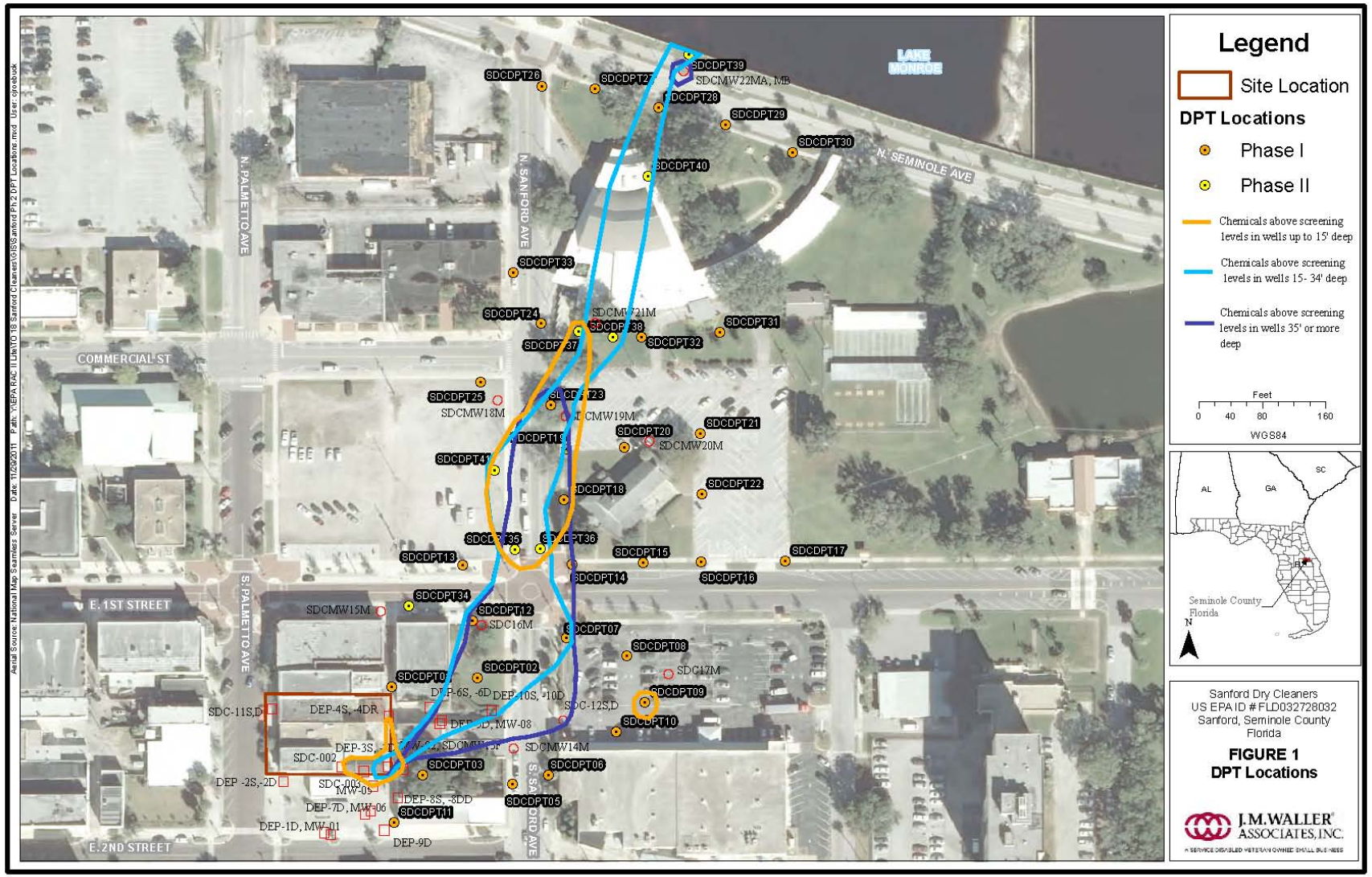


Figure 6. Locations of Sanford Dry Cleaners site surface soil samples.

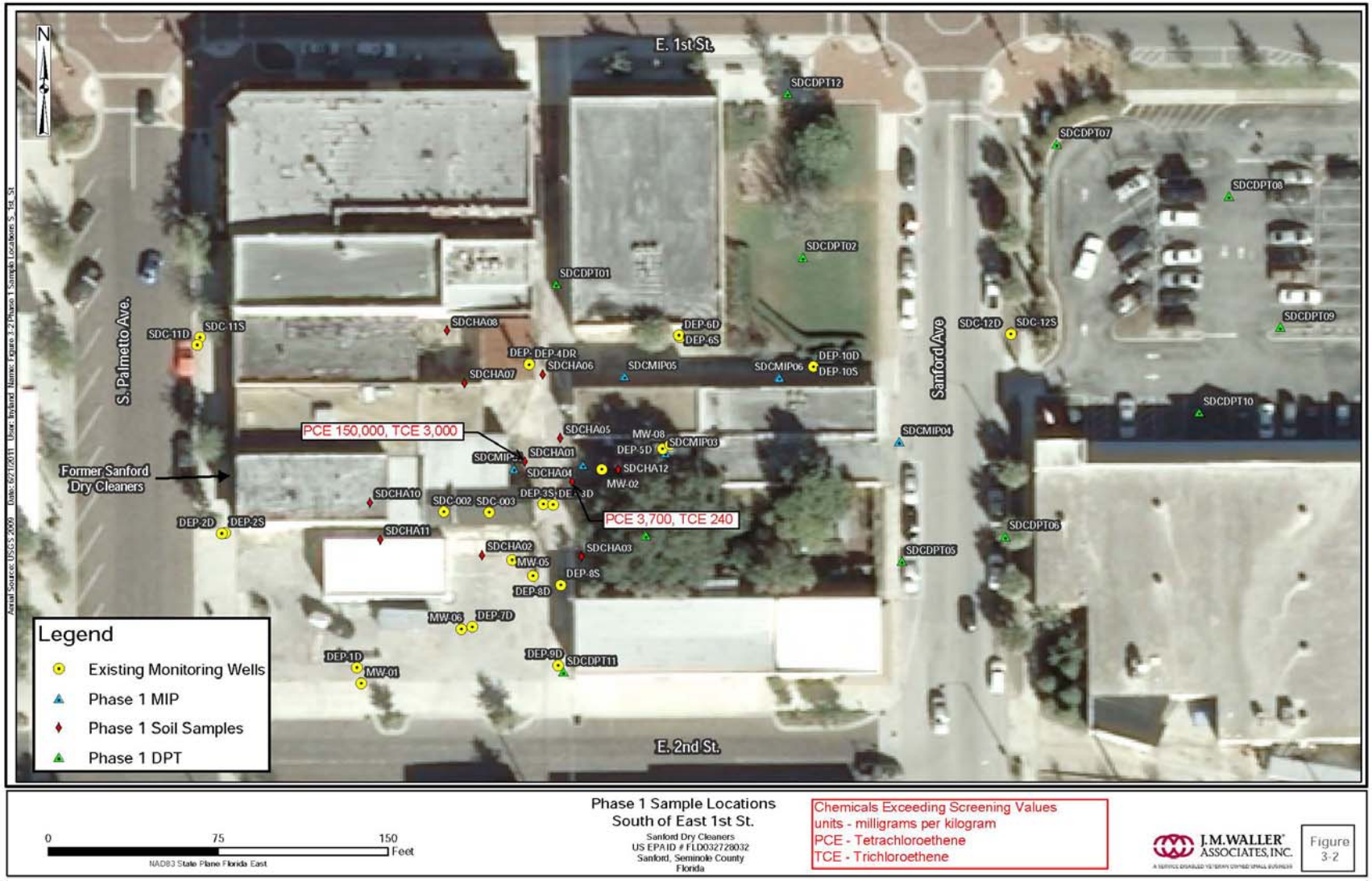
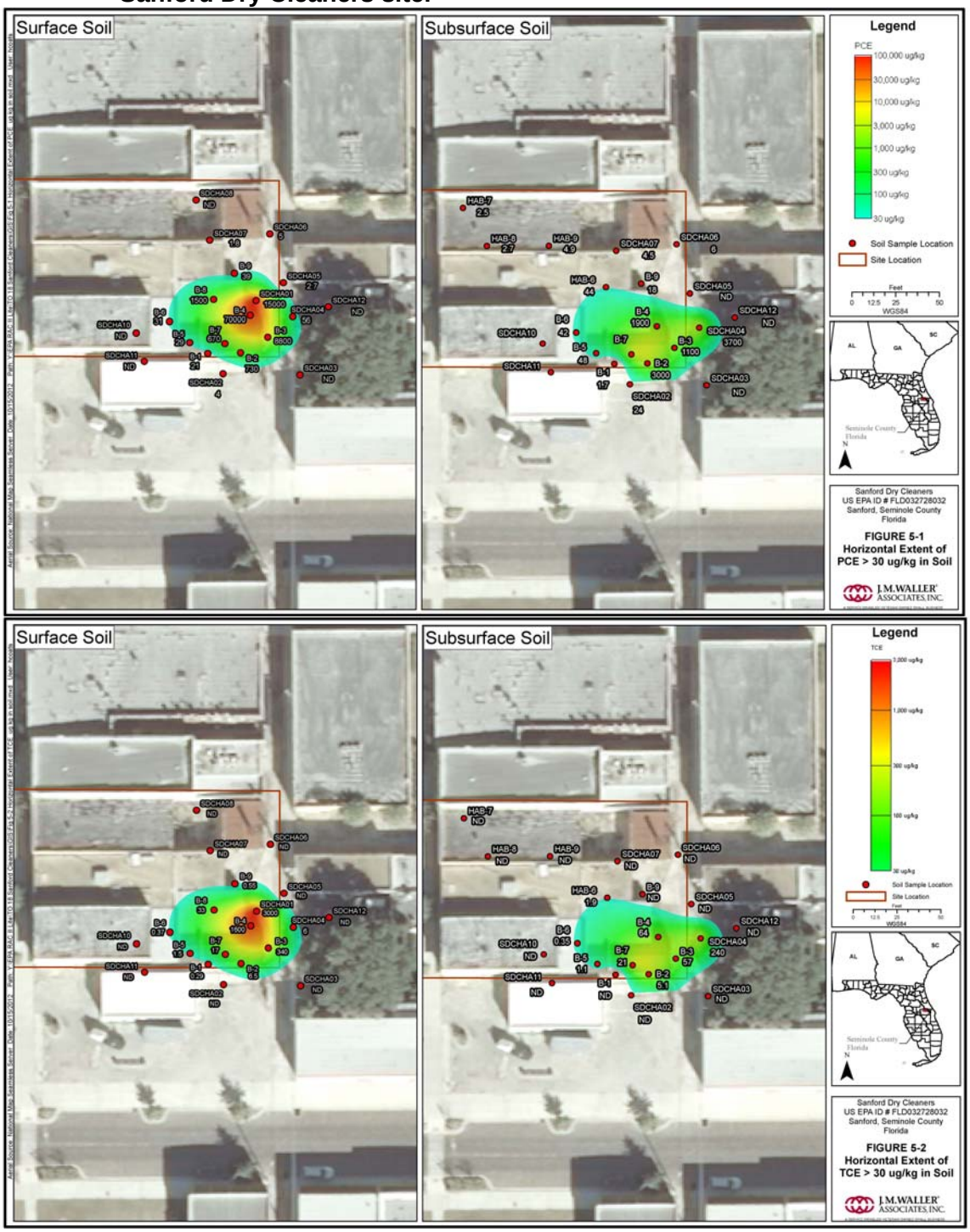


Figure 7. Contoured surface and subsurface soil levels of PCE and TCE at the Sanford Dry Cleaners site.



Photograph 1. Front of the site (three low buildings) in 2013.

Photograph 2. Rear of the site in 2013.

Photograph 3. East side of SDC site, view of locked gate at rear of building looking NW.

Photograph 4. East side of SDC site, looking SW. Location of on-site soil sample (#SDCHA01) with elevated VOCs

Photograph 5. Location of off-site soil sample (#SDCHA04) with elevated VOCs.

REPORT PREPARATION

The Florida Department of Health prepared this Health Consultation for the Sanford Dry Cleaners site under a cooperative agreement with ATSDR. It is in accordance with the approved agency methods, policies, procedures existing at the date of publication. The cooperative agreement partner, ATSDR, completed editorial review of this document and concurs with its findings, based on the information presented.

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Appendix C – 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.

Acute
Occurring over a short time.

Acute exposure
Contact with a substance that occurs once or for only a short time (up to 14 days).

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

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.

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

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

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

Chronic
Occurring over a long time.

Chronic exposure
Contact with a substance that occurs over a long time (more than 1 year).

Comparison Value
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.

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.

Dermal

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

Dermal contact

Contact with, (touching) the skin.

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.

Environmental media

Soil, water, air, 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.

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, of intermediate duration, or long-term.

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 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.

Groundwater
Water beneath the earth's surface in the spaces between soil particles and between rock surfaces.

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

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.

Ingestion
The act of swallowing something through eating, drinking, or mouthing objects. A hazardous substance can enter the body this way.

Inhalation
The act of breathing. A hazardous substance can enter the body this way.

mg/kg
Milligram per kilogram.

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.

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.

NPL see National Priorities List for Uncontrolled Hazardous Waste Sites.

Point of exposure
The place where someone can come into contact with a substance present in the environment.

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

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 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.

Receptor population
People who could come into contact with hazardous substances.

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.

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)

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. 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.

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.

Substance
A chemical.

Superfund Federal monies to clean up hazardous waste sites where no company would or could handle the financial responsibility of site cleanup. From the federal 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.

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.