Health Consultation

1529 WEST LASALLE STREET SITE PROPERTY

TAMPA, HILLSBOROUGH COUNTY, FLORIDA

EPA FACILITY ID: FLT060077807

APRIL 3, 2007

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
Bureau of Community Environmental Health
Under Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry

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Summary

In June 2006, the Florida Department of Environmental Protection (DEP) asked the Florida Department of Health (DOH) to evaluate soil and groundwater data from a residential property adjacent to the 1529 West La Salle Street (WLS) property in Tampa. The WLS property is in a mixed residential and light industrial/commercial area; previous owners had stored oil and manufactured other chemicals there.

While the extent of soil contamination in the neighborhood near the WLS property has not been adequately determined, soil at one residence was a “public health hazard”, prior to soil removal. Elevated levels of metals in soil on this residential property (adjacent to the WLS property) may have stemmed from chemical storage or processing there, before the property became residential. Potential exposure pathways for soil had been incidental soil ingestion and inhalation of dust.

DEP staff had cautioned the residents of the affected residence to refrain from daily contact with the soil. Theoretically, long-term, daily exposure to surface soil might allow persons to eat or inhale (ingest) soil accidentally. Over time, ingesting soil with the highest metals levels might have resulted in adverse health effects. However, US Environmental Protection Agency (EPA) staff removed the most highly contaminated soil from this residence, the week of December 18-22, 2006.

The current public health hazard category for this site is “indeterminate.” We are unable to make conclusions about the public health hazards of off-site soil at most other residences because too few samples were taken.

When we make statements concerning public health based on insufficient data, Florida DOH intentionally makes conservative and protective recommendations. People who want to avoid exposure to soil that may (or may not) have contamination can use these recommendations. We recommend that until the full extent of soil contamination is determined, residents can:

- refrain from mowing or landscaping during dry dusty conditions,
- use safe gardening practices (Appendix C), and
- only grow edible fruits and vegetables using clean soil or compost.

During their door-to-door delivery of soil sample results, DEP asked residents if they grew vegetables or fruits in their yard; the residents whose yards were tested told DEP they did not. As mentioned previously, the EPA has since removed soil from the one property with known soil contamination.

DEP’s contractor will collect additional surface and subsurface soil samples from the neighborhood in 2007. One goal of this additional sampling is to determine whether there is a second contamination source nearby. In addition to this goal, the Florida DOH recommends soil samples should be collected east of the residential property where soil was removed. The collected soil samples should be analyzed for metals to better assess the off-site impact of the WLS property. Florida DOH assessed the public health threat from contaminated groundwater in a separate report, and will evaluate additional data that DEP’s contractor collects.

Purpose

The Florida DOH evaluates the public health significance of environmental contamination through a cooperative agreement with the federal Agency for Toxic Substances and Disease Registry (ATSDR) in Atlanta, Georgia. In June 2006, the Florida Department of Environmental Protection (DEP) asked the Florida DOH to evaluate the public health threat from chemicals found in residential soils near the 1529 West La Salle Street (WLS) property in Tampa. This report evaluates the results of 2006 area soil testing. Florida DOH assesses groundwater in a separate report.

Background

The 0.22-acre West La Salle Street (WLS) property is in a mixed residential and light commercial/industrial area of Tampa two blocks south of Interstate 275 and one mile west of the Hillsborough River (Figures 1&2). While various owners have used the WLS property for businesses and manufacturing operations since1931, the specific sources of the contaminants of concern are not known at this time and elevated levels of soil contaminants have not been identified on the 1529 WLS property.

Elevated levels of metals in soil on a residential property (adjacent to the WLS property) may have stemmed from chemical storage or processing there at some time in the past, before there was a home there. According to aerial photos and maps (E&E, 2006), onsite operations included an oil warehouse (1931), Florida Orange Wood Corporation (1950) and Tarpon Chemical and Supply Company warehouse and distribution facility (1950s to mid-1980s). The site remained vacant after Tarpon Chemical ceased operations. Other chemical companies may have owned the site between the mid-1980s and 2001. In 2001, a non-profit redevelopment corporation built a concrete-block house on the property but it was never occupied. In 2002, the City of Tampa obtained the property and demolished the house. The Florida Department of Transportation (DOT) is purchasing homes north of the WLS property to expand Interstate 275.

Investigational History

In January 2001, Post, Buckley, Shuh and Jernigan conducted a limited investigation on the WLS property for the Florida DOT. They field-screened 5 soil samples for volatile organic compounds (VOCs) and analyzed 1 groundwater sample from a shallow monitoring well (6 to 7 feet below the ground surface). The groundwater samples measured volatile organic aromatics (VOAs), semi-volatile organic compounds (SVOCs), metals and petroleum hydrocarbons above the Florida Drinking water standards.

In October 2003 and January 2005, Gannett Fleming, Inc. investigated the property for the City of Tampa. They collected 25 soil samples, and 6 groundwater samples (from 5 shallow and 1 deep monitoring well) and excavated two test pits (38’ long, 3 feet wide and 3 feet deep). They measured VOCs, semi-volatile organic compounds (SVOCs), petroleum compounds, and metals in the soil and groundwater. Soil in the test pits was dark-green. Gannett Fleming’s test results indicted that contamination might not be confined to the property.

In early 2006, Florida DEP’s contractor Ecology and Environment tested a number of soil samples from this and nearby properties (E&E 2006a). On May 22, 2006 Florida DEP hand-delivered test results. Florida DEP cautioned residents to avoid contact with the contaminated soil and avoid gardening or landscaping in dusty conditions.

On May 31, 2006, the US Environmental Protection Agency (EPA) attempted to test for arsenic in surface and subsurface soil on two nearby properties using x-ray fractionation (XRF). The XRF machine, however, malfunctioned due to the extremely hot and humid weather. EPA did test soil on one property using conventional laboratory analysis. They removed contaminated soil from this property between December 18 and 22, 2006.

In August 2006, one nearby family (two persons) had their urine tested for metals. The results were within normal ranges.

Area Population— In 2000, an estimated 1,397 persons lived within a 1/4-mile radius of the site. Approximately 88% were black, 9% were Latino/Hispanic, and 4% were white. American Indian/Alaska Native, Asian/Pacific Islander, and all other racial/ethnic groups made up less than 1% of the population (US Census Bureau 2000).

Other nearby sites included on the EPA's Envirofacts website include:

- the Rechem Transport site, a Resource Conservation and Recovery Act (RCRA) facility, 3/10ths mile southwest,
- Tampa Housing Authority (a hazardous waste producer), ¼ mile northeast, and
- another RCRA site, a former industrial and chemical supplies store (including acid tanks and a solvent staging area) 200 feet southwest (southeast corner of La Salle and N. Rome).

Carver Junior High School 1/8 mile southeast, Dunbar Elementary ¼ mile northwest across Interstate 275, and several area churches could be locations of sensitive younger or older subpopulations .

Groundwater Contamination — Shallow groundwater under the WLS property is contaminated and flows northeast towards the Hillsborough River. Although municipal water is available in the WLS area, the Hillsborough County Health Department reports several private wells within ½ mile. Testing these wells has not found chemicals above Florida drinking water standards. Florida DOH will assess groundwater contamination and possible vapor intrusion in a separate health consultation report. Florida DEP reports that area houses do not have irrigation wells.

Community Health Concerns --- Some nearby residents are concerned about their children playing outside.

Discussion

In this report, Florida DOH evaluates soil test data. Along with accidental ingestion of soil, we also estimate air-borne dust exposures using a computer program (Risk Assistant 1.1). Tables 2a and 2b list completed and potential soil exposure pathways.

In March 2006, Florida DEP's contractor E&E collected:

* 12 surface soil samples (0-6" deep) including 1 background, and

* 15 subsurface soil samples (6-24" deep) including 1 background

E&E analyzed soil for volatile organic chemicals (VOCs), semi-volatile organic chemicals (SVOCs), metals, and total recoverable petroleum hydrocarbons (TRPHs). Additionally, E&E

analyzed green-colored subsurface soil sample HB-13 for glycols, hexavalent chromium, and National Institute of Standards Technology VOCs and SVOCs.

The highest soil chemical levels were measured on a residential property adjacent to the WLS property. The presence of metals there may relate to past use when this property was part of an operating facility. Figure 3 shows soil locations with levels above ATSDR screening guidelines and Florida residential Soil Target Cleanup Levels.

For the purpose of this health consultation report, the location and levels of soil contamination near the WLS property has not been adequately determined. It is not possible to evaluate the public health impact fully without additional soil testing.

Public Health Implications

To assess the public health implications of soil exposures, we separated soil data into three categories: on-site, off-site residential yards, and off-site “other” locations. These “other” locations include alleys, vacant lots, and road right-of-ways. We calculate the potential for health implications to areas that may not currently be exposure pathways, for example, subsurface soil, so that state regulators will have information to base cleanup decisions or recommendations on. Based on our chronic exposure dose calculations, DEP may require deed restrictions, or other engineering or institutional controls to prevent future exposures, should land use change or should soil be excavated.

None of the chemicals that were measured occurred at levels that might cause adverse health effects for short exposures (those lasting from several days to a year). In order to provide a conservative and protective evaluation, Florida DOH estimates daily, long-term (chronic) ingestion and inhalation doses for children and adults (Tables 7-10) for the highest chemical levels measured (Tables 3-6). Dose is an amount of chemical per body weight reported in milligrams (mg) of contaminant per kilogram (kg) of body weight per day (mg/kg/day). We consider the inhalation and ingestion doses together. We compare this total estimated dose to doses having known health effects (Tables 11-13).

For carcinogenic chemicals, we discuss the largest increase in theoretical cancer risk. Our dose calculations assume children will be exposed for 3 years and adults will be exposed for 20 years. We recalculate these shorter exposure doses to a 60-year exposure length, called a lifetime average daily dose. To determine the increased cancer risk we multiply these lifetime average daily doses by chemicals-specific cancer slopes.

Pathways Analysis

Florida DOH determines exposure to environmental contamination by identifying exposure pathways. An exposure pathway is generally classified by environmental medium (e.g., water, soil, air, food). A completed exposure pathway consists of five elements: a source of contamination; transport through an environmental medium; a point of exposure; a route of exposure; and a receptor population. A completed exposure pathway exists when people are actually exposed through ingestion or inhalation of, or by skin contact with a contaminated medium.

In completed exposure pathways, all five elements exist, and exposure to a contaminant has occurred in the past, is occurring, or will occur in the future. In potential exposure pathways, at least one of the five elements is not clearly defined, but could exist. Therefore, exposure seems possible. Potential pathways indicate that exposure to a contaminant could have occurred in the past, could be occurring, or could occur in the future. However, key information regarding a potential pathway may not be available. It should be noted that the identification of a completed or potential exposure pathway does not necessarily result in human health effects. An exposure pathway can be eliminated if at least one of the five elements is missing and will never be present.

Florida DOH reviewed the site's history, community concerns, and available environmental sampling data. Based on this review, Florida DOH has determined the soil on one property contains arsenic and lead at levels that could affect the health of adults or children who had long-term daily exposures that would allow them to ingest soil accidentally. Inhalation of contaminated dust might add to these residents' overall exposure levels, but would be unlikely to have adverse health effects on their own. Current data does not indicate soil contamination on the site that was originally investigated, and off-site soil data is limited and incomplete.

Evaluation Process

For each environmental pathway, Florida DOH examines the contaminant types and levels of concern. Florida DOH uses ATSDR comparison values and other established agencies' reference values to screen contaminant levels that may warrant further evaluation. Comparison values (CVs) are concentrations of chemicals that can reasonably (and conservatively) be regarded as harmless, assuming the most likely conditions of exposure. The CVs include ample safety factors to ensure protection of sensitive human populations. Because CVs do not represent thresholds of toxicity, exposure to contaminant concentrations above CVs will not necessarily lead to adverse health effects. Florida DOH then considers how people may come into contact with the contaminants.

Exposure to site related contaminants at one residence could occur through ingestion of soil and inhalation of contaminated dust. The following paragraphs describe the potential public health impact of exposure to the highest measured levels of contaminants measured in off-site residential soil. Tables 11-13 summarize the relationships between the doses we calculated and reports of the doses linked with illness in medical and animal studies.

Arsenic

Numerous medical studies document adverse health effects for long-term ingestion of water contaminated with the metal arsenic. While we compare the highest estimated daily soil doses for children and adults to the results of these studies, recent animal studies indicate that mammals absorb between a quarter and a third of the arsenic that they ingest with their food (DEP 2005). Therefore, soil ingestion could result in a lower absorbed dose of arsenic than would result from ingestion of arsenic-contaminated water. Therefore, the following discussion may overestimate the potential for arsenic-related illness at the soil levels measured prior to EPA's soil removal.

Soil the EPA removed contained arsenic measured at a level that our dose calculations predicted the potential for adverse health effects for exposed children and adults, cerebrovascular disease and cerebral infarctions (an interruption of the blood supply to any part of the brain, resulting in damaged brain tissue). Although the current residents do not have children living in the home, the doses we calculated for children were the same as doses linked with adverse skin and developmental effects. The theoretical increased cancer risk we calculated for the removed soil (due to arsenic) was "moderate" (2 in 1,000).

The highest arsenic concentrations measured in soil on the WPS property, at other residential properties, and "other" properties are unlikely to cause illness.

Cadmium
The highest estimated dose of cadmium from contaminated soil, the EPA has since removed, was unlikely to cause non-cancer health effects or to increase the cancer risks significantly (ATSDR 1999)

Chromium
The highest estimated dose of chromium from contaminated soil, the EPA has since removed, was unlikely to cause non-cancer illnesses. The theoretical increased cancer risk we calculated for the removed soil (due to chromium) was between "no apparent" and "low" (3 in 100,000). Some chromium VI compounds have been associated with lung cancer in workers and have caused cancer in animals. The Department of Health and Human Services has determined calcium chromate, chromium trioxide, lead chromate, strontium chromate and zinc chromate are known human carcinogens (ATSDR 2000b).

Copper
The highest estimated dose of copper from contaminated soil, the EPA has since removed, was slightly higher than the dose associated with gastrointestinal symptoms in a person drinking copper-sulfate contaminated water. While copper is an essential nutrient and is readily metabolized by the body, sensitive children might experience similar symptoms. Copper is not classified as a carcinogen.

Lead

The maximum concentration of lead (1,600 ppm) detected in off-site surface soil exceeded the Florida Soil Target Cleanup Level for residential properties (400 ppm). No Minimum Risk Level is available for lead. Accumulation of lead in the body can cause damage to the nervous or gastrointestinal system, kidneys, or red blood cells (ATSDR 1999, 2006). Children, infants, and fetuses are the most sensitive populations. Lead may cause learning difficulties and stunted growth, or may endanger fetal development. Health effects associated with lead exposure, particularly changes in children's neurobehavioral development, may occur at blood lead levels so low as to be essentially without a threshold (i.e., neither a No Observable Adverse Effect Level nor a Lowest Observable Adverse Effect Level is available, ATSDR 1999, 2006). As such, theoretical lead exposures for children encountering lead measured in surface soil near the WLS site were evaluated and are presented in the Child Health Considerations section.

The Environmental Protections Agency (EPA) considers lead to be a probable human carcinogen. While worker studies have shown limited associations between elemental lead exposure and lung, stomach, kidney, and brain and spinal cord (gliomal) cancers in humans, a dose-response relationship has not been established, so a cancer slope factor for lead has not been calculated. Therefore, we were unable to calculate lifetime excess cancer risks for the estimated exposure levels (ATSDR 2006a, 2006c, 1999).

Exposures to Mixtures

Arsenic (Wasserman et al. 2004) and lead (Chiodo et al. 2004) have been linked with children's developmental decrements at or near the lowest levels of exposure having reported health effects.

Although the off-site sampling has been limited and therefore information on offsite contamination is limited, daily, long-term exposures to more than one of these chemicals in soil might have additive effects (ATSDR 2004)[†]. Characterization and remediation of off-site soil contamination could safeguard children potentially exposed to surface soil from developmental decrement.

Cancer

Florida DOH added together the theoretical cancer risks for the highest measured levels on the site, for the adjacent yards and for the alleyway north of the site. Only the soil that EPA removed gave a total that might have slightly increased cancer risk. The increased cancer risk probably would not be statistically discernible because both the increased risk and the number of potentially exposed persons were so small.

	Off-site Residential Properties	**"Other" Properties**	**On-site**
Surface soil	"Moderate" Increase (2 in 1,000) **(this soil has been removed)**	"No Significant" Increase (4 in 1 million)	"No Significant" Increase(4-7 in 1 million)
Subsurface soil	"No Apparent" Increase (3 in 100,000)	"No Significant" Increase (less than 1 in 1 million)	"No Significant" Increase (4 in 1 million) (1 to 2 in 100,000)

Uncertainties

Available information on exposure pathways and chemical levels is incomplete. Resident's total exposures and sensitivities are likely to be different. People may contact chemicals at their jobs, through their hobbies, or from other off-site sources. In addition, scientists' understandings of the causal links between chemical exposures and diseases are incomplete. For these reasons, DOH recommends that persons who feel ill, especially with long-term symptoms, should see their doctors. They should tell their doctors about any concerns they might have about environmental exposures.

Quality Assurance and Quality Control

The completeness and reliability of the referenced environmental data determine the validity of the analyses and conclusions drawn for this health consultation. Florida DOH used existing environmental data. We assume these data are valid: DEP's contractor and the laboratory they used have approved comprehensive quality assurance project plans.

[†] Epidemiological studies of children have indicated that lead and arsenic may interact at environmental levels of exposure to produce adverse neurobehavioral consequences on children (Marlowe et al. 1985; Moon et al. 1985). Studies of populations eating fish contaminated with several chemicals, which individually were below each chemical's health advisory level, showed greater motor slowing, poorer results on certain memory tests and attentions and higher scores on the Confusion Scale of the Profile of Mood States Test, taking into account age, education, and alcohol intake. There appears to be a dose–effect: those who consume fish year round present poorer results than those who consume fish during one season, who have poorer results that those who doe not consume Saint Lawrence Lakes fish. These findings suggest that nervous system alterations are associated with fish eating from the Saint Lawrence Lakes and that current guidelines for fish consumption may be inadequate to prevent adverse effects. Since a large number of neurotoxins are absorbed with the fish, there may be an additive or synergistic effect (Belanger et al. 2006).

Child Health Considerations

ATSDR and Florida DOH recognize the unique vulnerabilities of infants and children demand special emphasis in communities faced with contamination in their environment (ATSDR 2005b). Children are at a greater risk than are adults from certain types of exposures to hazardous substances. Because children are smaller than adults are, their exposures can result in higher doses of chemicals per body weight. If toxic exposures occur during critical growth stages, the developing body systems of children can sustain permanent damage. Probably most importantly, however, children depend on adults for risk identification and risk management decisions, housing decisions, and access to medical care.

The highest levels of lead measured in surface soil (1,600 ppm and 1,200 ppm) exceeded the 400-ppm Florida residential Soil target Cleanup Level for lead. EPA removed the soil containing 1,200-ppm lead and the 1,600-ppm lead soil sample was taken in an alley where children probably would not have daily exposure to it. Therefore, we are not aware of a currently completed exposure pathway. Instead, these levels demonstrate the need for additional soil sampling, especially in the northeastern part of the 1515 West La Salle street property and beyond, if metals soil contamination is found there.

Lead at 1,200 to 1,600 ppm in soil in residential surface soil could present a health risk for children, especially young children who might have daily exposure to it. Environmental exposure to lead has long been recognized as a public health problem particularly among children. Excessive concentration of lead in soil has been shown to increase blood lead levels in young children (ATSDR 1999, 2006). Some of the heath effects of lead exposure on various organ systems are permanent or latent and may appear after exposure has ceased. Signs and symptoms associated with lead toxicity include decreased learning capacity and memory, lowered Intelligence Quotient (IQ), speech and hearing impairments, fatigue and lethargy.

In 1991, the CDC recommended lowering the level for individual intervention to 15 µg/dL and implementing communitywide primary lead poisoning prevention activities in areas where many children had blood lead levels $\geq$ 10 µg/dL (CDC 2005). However, this level, which was originally intended to trigger communitywide prevention activities, has been misinterpreted frequently as a definitive toxicological threshold. CDC maintains that efforts to eliminate lead exposures through primary prevention have the greatest potential for success, and reducing lead exposure will benefit all children, regardless of their current blood lead levels (CDC 2005).

For lead, estimated blood levels more accurately predict health effects than traditional dose estimates. Florida DOH used the EPA's Integrated Exposure Uptake and Biokineteic (IEUBK) model to estimate the potential geometric mean of lead in blood of children, ages 6 months to 7 years (EPA, 1994a), should soil-lead values like the highest levels measured be found on other residential properties. This model also provides a probability estimate that a typical child will have a blood lead level greater than or equal to10 µg/dL. Estimates of greater than 5% are considered unacceptable. Our calculations show that both 1,200 and 1,600 ppm soil lead might cause > 5% probability of exposed children to have blood-leads greater than 10 µg/dL, as recommended by the EPA Office of Solid Waste and Emergency Response (EPA, 1994b).

We evaluated surface soil lead exposures associated with residential use by children using the IEUBK model (EPA 2002). We used the two laboratory values for the soil area known to have lead contamination (for which we had accurate locations) in the model.

1. Children are exposed to soil (how often)? The exposure frequency is ***x*** days per week, ***x*** weeks per year.
2. The default lead concentration of soil at a home not associated with the site is 200 ppm (EPA 2002).
3. IEUBK model default values were used for all variables other than surface soil lead concentration.

The predicted geometric mean blood lead levels and the probability of blood lead levels exceeding the community intervention level of 10 µg/dL for children are shown in the following table:

Table 1: Modeled Geometric Mean Blood Lead Levels

Age (months)	Exposure Scenario					
	Residential Background*		1,200 ppm residential soil		1,600 ppm residential soil	
	Blood Lead** Level (µg/dL)	Probability*** Estimate	Blood Lead** Level (µg/dL)	Probability*** Estimate	Blood Lead** Level (µg/dL)	Probability*** Estimate
6-12	3.8	1.98	11.6	62.44	14.0	76.39
12-24	4.2	3.10	13.4	73.15	16.2	84.68
24-36	3.9	2.25	12.6	68.86	15.3	81.68
36-48	3.7	1.70	12.2	66.28	14.9	80.04
48-60	3.1	0.68	10.2	51.95	12.6	68.73
60-72	2.7	0.3	8.7	38.31	10.7	56.03
72-84	2.5	0.17	7.7	29.12	9.5	46.08

*200 ppm
** Geometric mean as calculated by the IEUBK model
*** Probability of blood lead higher that 10 µg/dL

For the residential background exposure scenario, the blood lead levels for all age groups are below 10 µg/dL. Additionally the probability estimate that a typical child will have a blood lead level greater than or equal to10 µg/dL was below the recommended protection level of five percent for all groups.

For residential soil containing the lead level measured in soil that the EPA removed (1,200 ppm), the predicted blood lead levels for ages 6-60 months were above10 µg/dL. Additionally, the probability estimates that a typical child will have a blood lead level greater than or equal to 10 µg/dL were above the recommended protection level of five percent for all groups. For residential soil containing the lead level measured in the alley (1,600 ppm), the blood lead levels for age groups 6-72 months are above 10 µg/dL. Additionally the probability estimates that a typical child will have a blood lead level greater than or equal to 10 µg/dL were above the recommended protection level of five percent for all groups. Therefore, it can be concluded that children (for all age groups) who are exposed to surface soil containing from 1,200-1,600 ppm lead (daily, for long periods of time) in a residential setting could have elevated blood lead levels.

It is important to note that the IEUBK model should not be relied upon to accurately predict blood lead levels above 30 µg/dL because the model was not empirically validated for these levels. Additionally, the model should not be used for exposure periods of less that three months, or in which a higher exposure occurs less that once per week or varies irregularly.

Comparing studies of persons with elevated blood lead to the modeled levels indicates the effects of chronic lead exposure probably would probably not be readily apparent. These include:

- the processes leading to anemia (decreased ALAD activity, an enzyme necessary for heme synthesis), Roels and Lauwerys 1987, Hernberg and Nikkanen 1970;
- neurological and immunological effects, Altmann et al. 1998, Winneke et al. 1994, Lutz et al. 1999;
- decrease in attention, executive function, visual-motor integration, social behavior /motor skills, IQ, and metabolism, Chiodo et al. 2004, Sanin et al. 2001, Canfield et al. 2003, Angle and McIntire 1978, Angle et al. 1982;
- increased blood pressure, decreased kidney function, impaired mental performance, and premature births, Den Hond et al. 2002, Muntner et al. 200, Gennart et al. 1992.

While it is unlikely children might have daily exposure to alley soil contaminated with lead, lead's presence there underscores the need for better characterizing offsite contamination. As mentioned previously, the EPA removed soil from part of one yard. There are currently no children in this home. The residents at this home had their urine tested for metals, because arsenic and other metals in addition to lead were in the soil, and their results were within normal ranges. If any additional testing shows elevated metals in other residential soil, the EPA or the Florida DEP can institute institutional or engineering controls to prevent future exposures.

In addition to children, other susceptible populations may have different or enhanced responses to toxic chemicals than will most people 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 or alcohol). These factors may limit a susceptible person's ability to detoxify or excrete harmful chemicals or may increase the effects of damage to their organs or systems.

Conclusions

1. The EPA removed soil that could have been a "public health hazard" for residents who had daily exposures lasting longer than one year (such exposures are also known as chronic exposures) from a property near the WLS site in December 2006. One soil sample location in an alley north of the property where soil was removed also had elevated lead in the surface soil.

2. Offsite, soil has not been tested and the extent of soil contamination has not been determined. soil, north and east of the property where the EPA removed soil. For these areas, the public health hazard category is "**indeterminate**".

Recommendations

1. DEP may require deed restrictions, or other engineering or institutional controls to prevent future exposures to offsite occurrences of contaminated soil. While it is unlikely people would have daily exposure to alley soil contaminated with lead; lead's presence there underscores the need for characterizing offsite contamination.

2. DEP should collect additional surface and subsurface soil samples from in the alley north of the WLS property and east of the residential property where EPA performed a soil removal in December 2006. They should analyze these soil samples for metals, including arsenic and lead.

Florida DOH intentionally makes conservative and protective recommendations when we make statements concerning public health based on insufficient data. Until the full extent of soil contamination is determined, people can avoid exposure to soil that may (or may not) have contamination by:
-refraining from mowing or landscaping during dry dusty conditions,
-using safe gardening practices (Appendix C), and
-only growing edible fruits and vegetables using clean soil or compost.

Public Health Action Plan

1. Florida DOH will work with Florida DEP to inform and educate neighborhood residents about the potential for residual chemicals in their neighborhood.

2. Florida DOH is assessing the public health threat from contaminated groundwater and will assess the public health threat from any additional soil or groundwater samples that are collected

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Appendix A—Figures

Figure 1: Location of the West La Salle Street site in Tampa, Hillsborough County

0 0.15 0.3 0.6 0.9 1.2 Miles

Figure 2: 1999 aerial photograph of the site.

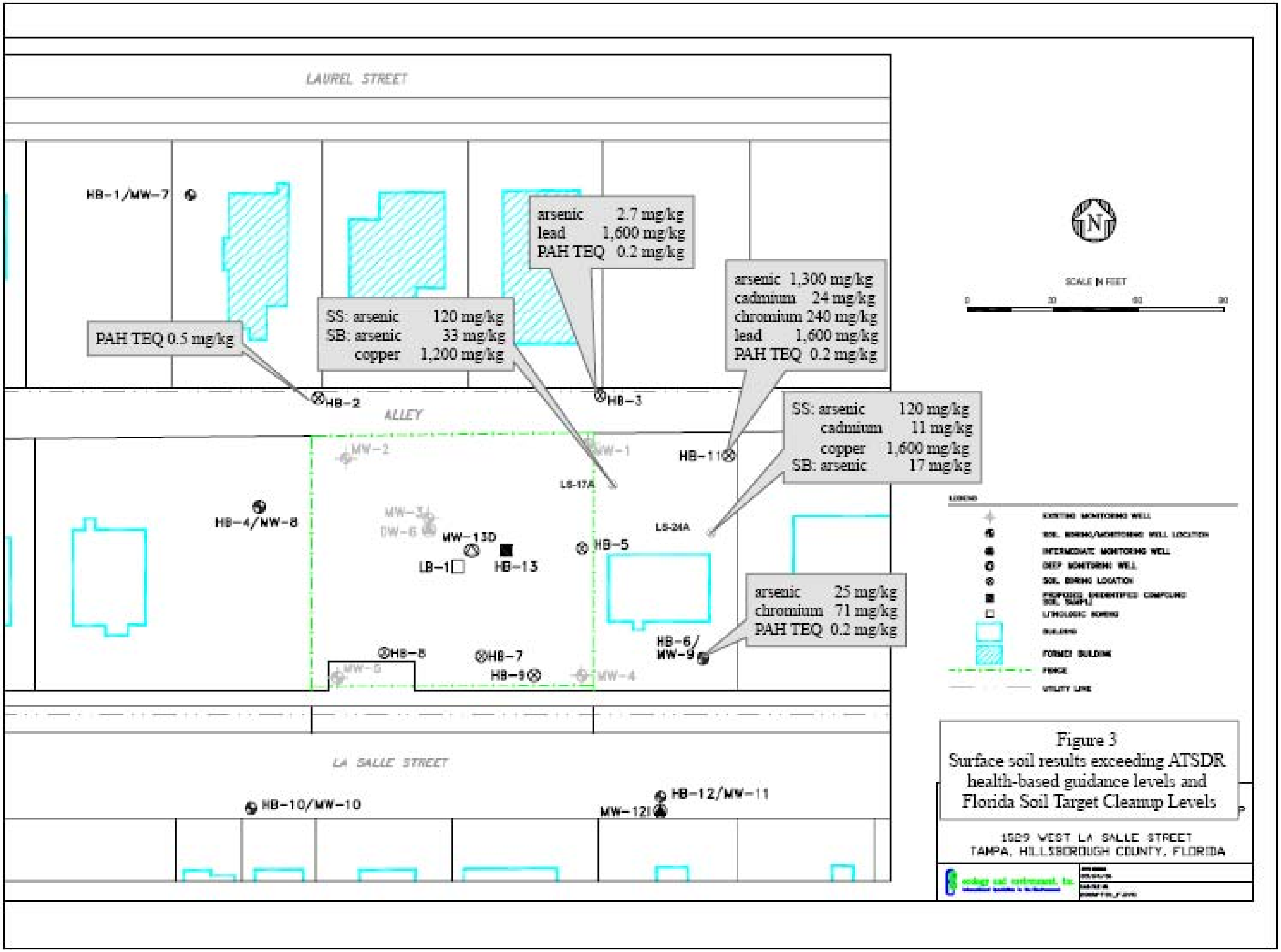

Figure 3
Surface soil results exceeding ATSDR health-based guidance levels and Florida Soil Target Cleanup Levels

Appendix B—Tables

Table 2a. Completed exposure pathways

Pathway Name	Exposure Pathway Elements					Time
	Source	Environmental/ Exposure Media	Point of Exposure	Route of Exposure	Exposed Population and land use	
Contaminated off-site surface soil, dust	Residential soil and soil on other properties	Wastes, surface and subsurface soil	Off-site properties	Incidental ingestion and inhalation	Off-site residents/owners, workers	Past Current Future

Table 2b. Potential exposure pathways

Pathway Name	Exposure Pathway Elements					Time
	Source	Environmental/ Exposure Media	Point of Exposure	Route of Exposure	Exposed Population and land use	
Contaminated off-site subsurface soil, dust	Residential soil and soil on other properties	Wastes, surface and subsurface soil	Off-site properties	Incidental ingestion and inhalation	Off-site residents/owners, workers	Past Current Future

Table 2c. Exposure pathways evaluated in other Health Consultations

Pathway Name	Exposure Pathway Elements					Time
	Source	Environmental/ Exposure Media	Point of Exposure	Route of Exposure	Exposed Population and land use	
Shallow groundwater	Contaminated groundwater on the site	Shallow groundwater	Vapors inside slab homes	Inhalation	Residents who have slab construction homes and live over contaminated shallow groundwater	Past Current Future

Table 3. Maximum concentrations in on-site surface soil (0 to 6 inches below ground surface).

Contaminants of Concern	Screening Value (mg/kg) ATSDR: Children/adults	DEP:	Highest Soil Concentration (mg/kg)	Location of Highest Concentration	Number Soil Samples Above Screening Value ATSDR	DEP
arsenic	20/200 EMEG	2.1 SCTL	NASL/0.28	HB-8	0/4	0/4
cadmium	10/100 EMEG	82 SCTL	19	HB-9	1/4	0/4
chromium	200/2,000 EMEG	210 SCTL	NASL/38	HB-9	0/4	0/4
copper	500/7,000 int. EMEG	150** SCTL	NS	-	-	-
lead		400 SCTL	NASL/20	HB-9	0/4	0/4

EMEG—Environmental Media Evaluation Guide, for long-term daily exposures lasting longer than a year
int.—intermediate exposures are those lasting longer than 2 weeks and less than a year
mg/kg—milligrams per kilogram
SCTL—FDEP's Soil Target Cleanup Level for residential land uses.
NASL-Not above screening levels, value is given along with the sample location, nevertheless.
* Other—sites include lots owned by DOT, road right-of-ways, and the alley north of La Salle Street.
** Direct Exposure value based on acute toxicity considerations.

Table 4. Maximum concentrations in off-site surface soil (0 to 6 inches below ground surface).

Contaminants of Concern	Screening Value (mg/kg) ATSDR: Children/adults	DEP:	Highest Soil Concentration (mg/kg): residences	Highest Soil Concentration (mg/kg): Other*	Location of Highest Concentration: residences	Location of Highest Concentration: Other*	Number Soil Samples Above Screening Value: residences ATSDR	Number Soil Samples Above Screening Value: residences DEP	Number Soil Samples Above Screening Value: Other* ATSDR	Number Soil Samples Above Screening Value: Other* DEP
arsenic	20/200 EMEG	2.1 SCTL	1,300	2.7	HB-11	HB-3 (ALLEY)	4/5	4/5	0/3	1/3
cadmium	10/100 EMEG	82 SCTL	24	NASL/1.1	HB-11	HB-3 (ALLEY)	1/5	0/5	0/3	0/3
chromium	200/2,000 EMEG	210 SCTL	290	NASL/18	HB-11	HB-3 (ALLEY)	1/5	1/5	0/3	0/3
copper	500/7,000 int. EMEG	150** SCTL	1,600	NS	LS24A-SS	-	1/2	2/2	-	-
lead		400 SCTL	1,200	1,600	HB-11	HB-3 (ALLEY)	1/5		1/3	

EMEG—Environmental Media Evaluation Guide, for long-term daily exposures lasting longer than a year
int.—intermediate exposures are those lasting longer than 2 weeks and less than a year
mg/kg—milligrams per kilogram
SCTL—FDEP's Soil Target Cleanup Level for residential land uses.
NASL-Not above screening levels, value is given along with the sample location, nevertheless.
* Other—sites include lots owned by DOT, road right-of-ways, and the alley north of La Salle Street

Table 5. Maximum concentrations in on-site subsurface soil (6 to 24 inches below ground surface).

Contaminants of Concern	Screening Value (mg/kg) ATSDR: Children/adults	DEP:	Highest Soil Concentration (mg/kg)	Location of Highest Concentration	Number Soil Samples Above Screening Value ATSDR	DEP
arsenic	20/200 EMEG	2.1 SCTL	2.8	HB-7	0/5	0/5
cadmium	10/100 EMEG	82 SCTL	NASL/0.96	HB-8	0/5	0/5
chromium	200/2,000 EMEG	210 SCTL	NASL/110	HB-13	0/5	0/5
copper	500/7,000 int. EMEG	150** SCTL	NS	-	-	-
lead		400 SCTL	NASL/67	HB-8	0/5	0/5

EMEG—Environmental Media Evaluation Guide, for long-term daily exposures lasting longer than a year
int.—intermediate exposures are those lasting longer than 2 weeks and less than a year
mg/kg—milligrams per kilogram
SCTL—FDEP's Soil Target Cleanup Level for residential land uses.
NASL-Not above screening levels, value is given along with the sample location, nevertheless.
* Other—sites include lots owned by DOT, road right-of-ways, and the alley north of La Salle Street

Table 6. Maximum concentrations in off-site subsurface soil (6 to 24 inches below ground surface).

Contaminants of Concern	Screening Value (mg/kg) ATSDR: Children/adults	DEP:	Highest Soil Concentration (mg/kg)		Location of Highest Concentration		Number Soil Samples Above Screening Value	
			residences	Other*	residences	Other*	residences	Other*
arsenic	20/200 EMEG	2.1 SCTL	36	NASL/0.8	HB-11	HB-3 (ALLEY)	ATSDR 3/5 DEP 4/5	ATSDR 0/5 DEP 0/5
cadmium	10/100 EMEG	82 SCTL	7	NASL/0.6	HB-11	HB-3 (ALLEY)	ATSDR 0/5 DEP 0/5	ATSDR 0/5 DEP 0/5
chromium	200/2,000 EMEG	210 SCTL	100	NASL/4.1	HB-11	HB-12 (ROW)	ATSDR 0/5 DEP 0/5	ATSDR 0/5 DEP 0/5
copper	500/7,000 int. EMEG	150** SCTL	1,200	NS	LS17B-SB	-	ATSDR 1/2 DEP 2/2	ATSDR - DEP -
lead		400 SCTL	NASL/280	NASL/55	LS17B-SB	HB-3 (ALLEY)	0/5	0/5

EMEG—Environmental Media Evaluation Guide, for long-term daily exposures lasting longer than a year
int.—intermediate exposures are those lasting longer than 2 weeks and less than a year
mg/kg—milligrams per kilogram
SCTL—FDEP's Soil Target Cleanup Level for residential land uses.
ROW—Right-of-way
NASL-Not above screening levels, value is given along with the sample location, nevertheless.
* Other—sites include lots owned by DOT, road right-of-ways, and the alley north of La Salle Street

Table 7a. Estimated doses from exposures to on-site surface soil.

Contaminant of Concern (maximum concentration)	Oral MRL (mg/kg/day)	Soil/dust-Ingestion (mg/kg/day)		Inhalation MRL (mg/m^3)	Soil/dust- Inhalation (mg/m^3)
		Child	Adult		Child and Adult
arsenic	0.0003 Chr	0.000004	0.0000004	-	0.00000002
cadmium	0.0002 Chr.	0.0003	0.00003	-	0.000001
chromium	-	0.0005	0.00005	0.001 Int. (particulates)	0.000002
copper	0.01 Acute & Int.	NS	NS	-	-
lead	-	M	M	-	M

Table 7b. Estimated doses from exposures to on-site subsurface soil.

Contaminant of Concern (maximum concentration)	Oral MRL (mg/kg/day)	Soil/dust-Ingestion (mg/kg/day)		Inhalation MRL (mg/m^3)	Soil/dust- Inhalation (mg/m^3)
		Child	Adult		Child and Adult
arsenic	0.0003 Chr	0.00004	0.000004	-	0.0000002
cadmium	0.0002 Chr.	0.00001	0.000001	-	0.00000006
chromium	-	0.001	0.0002	0.001 Int. (particulates)	0.000006
copper	0.01 Acute & Int.	NS	NS	-	-
lead	-	M	M	-	M

Table 8a. Estimated doses from exposures to off-site residential surface soil.

Contaminant of Concern (maximum concentration)	Oral MRL (mg/kg/day)	Soil/dust-Ingestion (mg/kg/day)		Inhalation MRL (mg/m^3)	Soil/dust- Inhalation (mg/m^3)
		Child	Adult		Child and Adult
arsenic	0.0003 Chr	0.02	0.002	-	0.00007
cadmium	0.0002 Chr.	0.0003	0.00003	-	0.000001
chromium	-	0.004	0.0004	0.001 Int. (particulates)	0.00002
copper	0.01 Acute & Int.	0.02	0.002	-	0.00009
lead	-	M	M	-	M

Table 8b. Estimated doses from exposures to off-site residential subsurface soil.

Contaminant of Concern (maximum concentration)	Oral MRL (mg/kg/day)	Soil/dust-Ingestion (mg/kg/day)		Inhalation MRL (mg/m^3)	Soil/dust- Inhalation (mg/m^3)
		Child	Adult		Child and Adult
arsenic	0.0003 Chr	0.0005	0.00005	-	0.000002
cadmium	0.0002 Chr.	0.00009	0.00001	-	0.00000004
chromium	-	0.001	0.0001	0.001 Int. (particulates)	0.000005
copper	0.01 Acute & Int.	0.02	0.002	-	0.00007
lead	-	M	M	-	M

Table 9a. Estimated doses from exposures to right-of-way, DOT-owned or alley surface soil.

Contaminant of Concern (maximum concentration)	Oral MRL (mg/kg/day)	Soil/dust-Ingestion (mg/kg/day)		Inhalation MRL (mg/m^3)	Soil/dust- Inhalation (mg/m^3)
		Child	Adult		Child and Adult
arsenic	0.0003 Chr	0.00004	0.000004	-	0.0000002
cadmium	0.0002 Chr.	0.00002	0.000002	-	0.00000006
chromium	-	0.0002	0.00003	0.001 Int. (particulates)	0.000001
copper	0.01 Acute & Int.	NS	NS	-	-
lead	-	M	M	-	M

Table 9b. Estimated doses from exposures to right-of-way, city-owned or vacant lot subsurface soil.

Contaminant of Concern (maximum concentration)	Oral MRL (mg/kg/day)	Soil/dust-Ingestion (mg/kg/day)		Inhalation MRL (mg/m^3)	Soil/dust- Inhalation (mg/m^3)
		Child	Adult		Child and Adult
arsenic	0.0003 Chr	0.00001	0.000001	-	0.00000004
cadmium	0.0002 Chr.	0.000008	0.0000009	-	0.00000003
chromium	-	0.00006	0.000006	0.001 Int. (particulates)	0.0000002
copper	0.01 Acute & Int.	NS	NS	-	
lead	-	M	M	-	M

Explanations for abbreviations and footnotes used on Tables 7 through 9.

Acute – Acute exposure length of 0-14 days

Int – Intermediate exposure length of 15- 364 days

Chr – Chronic exposure length of more than 365 days

NS – Not sampled in the initial sampling event.

mg/kg/day – milligram chemical per kilogram body weight per day

mg/m3 – microgram of chemical per cubic meter of air

M – Values were modeled (tables follow)

MRL – Minimum Risk Level: extrapolation of a No Observable Adverse Effect level in a study of exposures, calculated by dividing the study dose by safety factors.

Values used to Estimated Blood Lead Concentrations in Persons Ingesting

Soil (micrograms per deciliter - µg/dl)

Time 8 hrs a day for both	Values for children **Slopes**		Values for adults **Slopes**	
	Low		Low	High
0.33	2.46	0.33	1.59	3.56
0.33	2.46	0.33	1.53	3.56
0.33	0.24	0.33	0.016	0.0195
0.33	0.16	0.33	0.03	0.06
0.33	0.002	0.33	0.002	0.016
0.33	0.004	0.33	0.004	0.004

*Default Value from ATSDR 1999a, Appendix D.
These slopes were for children and adults from ATSDR 1999a, Appendix D.
ATSDR's Regression Analysis with Multiple-uptake Parameters to Estimate Blood Lead from Environmental Exposures (ATSDR 1999a, Appendix D)

Table 10 Estimated Blood Lead Concentrations in Children and Adults Ingesting (0 to 6" foot) Surface Soil and Subsurface Soil (6'-24") (micrograms per deciliter - µg/dl)

Media	**Children**	**Adults**
On-site surface soil	> 0.1	> 0.1
On-site subsurface soil	> 0.1	> 0.1
Off-site residential surface soil	3 - 9	3 - 9
Off-site residential subsurface soil	2 - 3	1 - 3
Off-site non-residential surface soil	4 - 12	3 - 12
Off-site non-residential subsurface soil	1 - 2	0.4 - 1

Table 11. Comparison of doses calculated from highest measured on-site surface soil values to lowest observable adverse effect levels (LOAELs) in animal and human medical studies.

Chemicals in soil on-site	Doses are in mg/kg/day for ingestion and mg/m3 for inhalation			Soil
	children's dose	adult's dose	children's theoretical increased cancer risk	adult's theoretical increased cancer risk
Arsenic (surface soil)	Ing. 0.000004 Inh. 0.00000002	Ing. 0.0000004 Inh. 0.00000002	Ing.< 1:1,000,000 Inh. < 1:1,000,000	Ing. < 1:1,000,000 Inh. < 1:1,000,000
Arsenic (subsurface soil)	Ing. 0.00004 Inh. 0.0000002	Ing. 0.000004 Inh. 0.0000002	Ing. 2:1,000,000 Inh. < 1:1,000,000	Ing. 3:1,000,000 Inh. < 1:1,000,000
ATSDR 2000a (Update)	Child surface soil ingestion dose (0.000004) is 500 times less than the dose (0.002, Chiou et al. 1997) associated with increased prevalence of cerebrovascular disease and cerebral infarction (an interruption of the blood supply to any part of the brain, resulting in damaged brain tissue). This dose is also 1250 times less than the dose (0.005, Lianfang and Jianzhong 1994) associated with keratosis (a lump or growth on the skin that is the result of overproduction of the protein keratin), hyperkeratosis (a skin condition characterized by thickening and hardening of the skin), depigmentation, cyanosis (bluing) of extremities, palpitation/chest discomfort, fatigue, headache, dizziness, insomnia, nightmares, and numbness. These health effects would be unlikely, even in children with daily, long-term exposures to soil that might cause them to ingest soil incidentally. Adult surface soil ingestion dose (0.0000004) is 5000 times less than the lowest dose referenced (0.002, Chiou et al. 1997), so surface soil exposures would be unlikely to cause adverse non-cancer health effects in adult residents. Child subsurface soil ingestion dose (0.00004) is 50 times less than the lowest dose referenced (0.002, Chiou et al. 1997), so subsurface soil exposures would be unlikely to cause adverse non-cancer health effects in child residents. Adult subsurface soil ingestion dose (0.000004) is 5,000 times less than the lowest dose referenced (0.002, Chiou et al. 1997) so subsurface soil exposures would be unlikely to cause adverse non-cancer health effects in adult residents. Inhalation doses (0.00000002, 0.0000002) are 35,000 and 3,500 times (respectively) less than the amount associated with increased risk of stillbirth in humans (0.0007, Ihrig et al., 1998, As 3^{+}). The exposure levels to arsenic estimated for dust from surface and subsurface soil are unlikely to cause adverse health effects in children or adults. Arsenic associated cancers: From lowest to highest dose cancer effect levels, chronic arsenic exposures in people have been linked to lung cancer, basal and squamous cell skin cancers, liver cancer (haemangioendothelioma), urinary tract cancers (bladder, kidney, ureter and all urethral cancers), and intraepidermal cancers. Intraepidermal is the name for the early pre-invasive form of squamous cell skin cancer. Pre-invasive means that the cancer cells are confined to the outermost layer of skin, the epidermis. At this stage, the cancer cells are unlikely to have spread to the lymph nodes, but they can spread along the skin surface. If left untreated, these cells can develop into an invasive cancer and spread into the lymphatic system.			

Chemicals in soil on-site	Doses are in mg/kg/day for ingestion and mg/m3 for inhalation Soil			
	children's dose	adult's dose	children's theoretical increased cancer risk	adult's theoretical increased cancer risk
Cadmium (surface soil)	Ing. 0.0003 Inh. 0.000001	Ing. 0.00003 Inh. 0.000001	Ing.: No slope. Inh.: <1: 1,000,000	Ing. : No slope. Inh. : <1: 1,000,000
Cadmium (subsurface soil)	Ing. 0.00001 Inh. 0.000006	Ing. 0.000001 Inh. 0.000001	Ing.: No slope. Inh.: <1: 1,000,000	Ing.: No slope. Inh.:. <1: 1,000,000
ATSDR 1999b (Update)	Child surface soil ingestion dose (0.0003) is 26 times less than the dose (0.008) that caused interstitial lesions in kidney tubules in workers (Shiwen et al. 1990) exposed less than 25 years. This same dose (0.008) caused increased blood pressure in rats chronically exposed (lifetime exposure) to cadmium chloride (Perry et al. 1989). If the site were accessible, children's exposures to this level of cadmium in the soil would be unlikely to cause adverse health effects. Adult surface soil ingestion dose (0.00003) is 266 times less than doses showing adverse health effects in workers and animal studies. Adults' exposures to this level in the soil would be unlikely to cause adverse health effects. Child subsurface soil ingestion dose (0.00001) is 800 times less than the dose (0.008) that caused interstitial lesions in kidney tubules in workers (Shiwen et al. 1990) exposed less than 25 years. This same dose caused increased blood pressure in rats chronically exposed (lifetime exposure) to cadmium chloride (Perry et al. 1989). Children's exposures to this level in the soil would be unlikely to cause adverse health effects. Adult subsurface soil ingestion dose (0.000001) is 8,000 times less than doses showing adverse health effects in workers and animal studies. Adults' exposures to this level in the soil would be unlikely to cause adverse health effects. Inhalation doses (0.000001, 0.0000006) are 20,000 and 33,333 times (respectively) less than the cadmium inhalation dose (0.02) associated with 9.2% increased renal proteinuria (Jarup et al. 1988) for workers exposed 30 years, 5 days a week, 8 hours a day to cadmium oxide dust. The exposure levels to cadmium estimated for dust from surface and subsurface soil are unlikely to cause adverse health effects in children or adults. Cadmium associated cancers: Chronic inhalation exposure studies in rats have linked inhalation of cadmium compounds (cadmium oxide, cadmium chloride, and cadmium sulfide with lung cancer, specifically lung bronchioalveolar adenomas, adenocarcinomas and squamous cell carcinomas (various studies ATSDR 1999). Epidemiologic studies of workers linked inhalation of cadmium oxide dust with 50-111 lung cancer deaths per 1000 workers exposed for 45 years.			

Chemicals in soil on-site	Doses are in mg/kg/day for ingestion and mg/m3 for inhalation Soil			
	children's dose	adult's dose	children's theoretical increased cancer risk	adult's theoretical increased cancer risk
Chromium (surface soil)	Ing . 0.0005 Inh . 0.000002	Ing. 0.00005 Inh. 0.000002	Ing. No slope. Inh. 4:1,000,000	Ing. No slope. Inh. 7:1,000,000
Chromium (subsurface soil)	Ing . 0.001 Inh . 0.000006	Ing. 0.0002 Inh. 0.000006	Ing. No slope. Inh. 1:100,000	Ing. No slope. Inh. 2:100,000
ATSDR 2000b	Child surface soil ingestion dose (0.0005) is 80 times less than the dose (0.04, Kaaber and Veien 1977) associated with dermatitis in a person ingesting a single capsule containing potassium dichromate (IV). All the other adverse health effects observed from ingestion of chromium compounds occurred at higher levels of exposure. Children's exposures to this level in the soil would be unlikely to cause adverse health effects. Adult surface soil ingestion dose (0.0003) is 133 times less than the dose (0.04) described for children. Adults' exposures to this level in the soil would be unlikely to cause adverse health effects. Child subsurface soil ingestion dose (0.001) is 40 times less than the dose (0.04, Kaaber and Veien 1977) associated with dermatitis in a person ingesting a single capsule containing potassium dichromate (IV). Children's exposures to this level in the soil would be unlikely to cause adverse health effects. Adult subsurface soil ingestion dose (0.001) is 400 times less than the dose (0.04) described for children. Adults' exposures to this level in the soil would be unlikely to cause adverse health effects. Inhalation doses (0.000002, 0.000006) are 1,000 and 333 times (respectively) less than the dose (0.002) associated with nasal mucosa atrophy (a progressive loss of the mucous lining of the nasal cavity) and mild decreased lung function in workers exposed from 0.2 to 26.3 years (with an average of 2.5 years of occupation) to chromium oxide VI (Lindberg and Hedenstierna, 1983). The exposure levels to chromium estimated for dust from surface and subsurface soil are unlikely to cause adverse non-cancer health effects in children or adults. Chromium associated cancers: Because some chromium VI compounds have been associated with lung cancer in workers and have caused cancer in animals, the Department of Health and Human Services has determined that certain chromium compounds: calcium chromate, chromium trioxide, lead chromate, strontium chromate and zinc chromate are known human carcinogens.			
Lead ATSDR 2006b	(modeled)	See text in Discussion for potential health effects.		

Table 12. Comparison of doses calculated from highest measured <u>off-site residential soil</u> values to lowest observable adverse effect levels (LOAELs) in animal and human medical studies (This soil has been removed).

Chemicals in residential off-site soil	Doses are in mg/kg/day for ingestion and mg/m3 for inhalation Soil			
	children's dose	adult's dose	children's theoretical increased cancer risk	adult's theoretical increased cancer risk
Arsenic (surface soil)	Ing. **0.02** Inh. 0.00007	Ing. **0.002** Inh. 0.00007	Ing. 1:1,000 Inh. 5:100,000	Ing. 1:1,000 Inh.8:100,000
Arsenic (subsurface soil)	Ing. 0.0005 Inh. 0.000002	Ing. 0.00005 Inh. 0.000002	Ing. 3:100,000 Inh. 1:1,000,000	Ing. 3:100,000 Inh. 1:1,000,000
ATSDR 2000a (Update)	<u>Child surface soil ingestion dose</u> (0.02) is 10 times **greater than** the dose (0.002, Chiou et al. 1997) associated with increased prevalence of cerebrovascular disease and cerebral infarction (an interruption of the blood supply to any part of the brain, resulting in damaged brain tissue). This dose is also 4 times **greater than** the dose (0.005, Lianfang and Jianzhong 1994) associated with keratosis (a lump or growth on the skin that is the result of overproduction of the protein keratin), hyperkeratosis (a skin condition characterized by thickening and hardening of the skin), depigmentation, cyanosis (bluing) of extremities, palpitation/chest discomfort, fatigue, headache, dizziness, insomnia, nightmares, and numbness. Therefore, skin, vascular, neurological and circulation problems could occur if child residents had daily, long-term exposures to soil, that might cause them to ingest soil incidentally. <u>Adult surface soil ingestion dose</u> (0.002) **equals** the lowest dose referenced (0.002, Chiou et al. 1997), so cerebrovascular disease and cerebral infarction problems might occur if sensitive adult residents had daily, long-term exposures to soil, that might cause them to incidentally ingest soil. <u>Child subsurface soil ingestion dose</u> (0.0005) is 4 times less than the lowest dose referenced (0.002, Chiou et al. 1997), so surface soil exposures would be unlikely to cause adverse non-cancer health effects in child residents. <u>Adult subsurface soil ingestion dose</u> (0.00005) is 40 time less than the lowest dose referenced (0.002, Chiou et al. 1997) , so surface soil exposures would be unlikely to cause adverse non-cancer health effects in adult residents. <u>Inhalation doses</u> (0.00007, 0.000002) are 10 and 350 times (respectively) less than the amount associated with increased risk of stillbirth in humans (0.0007, Ihrig et al., 1998, As 3^{+}) inhaling arsenic. The exposure levels to arsenic estimated for dust from surface and subsurface soil are unlikely to cause adverse health effects in children or adults. <u>Arsenic associated cancers</u>: From lowest to highest dose cancer effect levels, chronic arsenic exposures in people have been linked to lung cancer, basal and squamous cell skin cancers, liver cancer (haemangioendothelioma), urinary tract cancers (bladder, kidney, ureter and all urethral cancers), and intraepidermal cancers. Intraepidermal is the name for the early pre-invasive form of squamous cell skin cancer. Pre-invasive means that the cancer cells are confined to the outermost layer of skin, the epidermis. At this stage, the cancer cells are unlikely to have spread to the lymph nodes, but they can spread along the skin surface. If left untreated, these cells can develop into an invasive cancer and spread into the lymphatic system.			

Chemicals in residential off-site soil	Doses are in mg/kg/day for ingestion and mg/m3 for inhalation			Soil
	children's dose	adult's dose	children's theoretical increased cancer risk	adult's theoretical increased cancer risk
Cadmium (surface soil)	Ing. **0.0003** Inh. 0.000001	Ing. 0.00003 Inh. 0.000001	Ing.: No slope. Inh.: <1: 1,000,000	Ing. : No slope. Inh. : <1: 1,000,000
Cadmium (subsurface soil)	Ing. 0.00009 Inh. 0.00000004	Ing. 0.00001 Inh. 0.00000004	Ing.: No slope. Inh.: <1: 1,000,000	Ing.: No slope. Inh.: <1: 1,000,000
ATSDR 1999b (Update)	Child surface soil ingestion dose (0.0003) is 27 times less than the dose (0.008) that caused interstitial lesions in kidney tubules in workers (Shiwen et al. 1990) exposed less than 25 years. This same dose (0.008) caused increased blood pressure in rats chronically exposed (lifetime exposure) to cadmium chloride (Perry et al. 1989). Children's exposures to this level of cadmium would be unlikely to cause adverse health effects. Adult surface soil ingestion dose (0.00003) is 266 times less than doses showing adverse health effects in workers and animal studies. Adults' exposures to this level would be unlikely to cause adverse health effects. Child subsurface soil ingestion dose (0.00009) is 89 times less than doses showing adverse health effects in workers and animal studies. Children's exposures to this level in the soil would be unlikely to cause adverse health effects. Adult subsurface soil ingestion dose (0.00001) is 800 times less than doses showing adverse health effects in workers and animal studies. Adults' exposures to this level in the soil would be unlikely to cause adverse health effects. Inhalation doses (0.000001, 0.00000007) are 20,000 and 285,714 times (respectively) less than the cadmium inhalation dose (0.02) associated with 9.2% increased renal proteinuria (Jarup et al. 1988) for workers exposed 30 years, 5 days a week, 8 hours a day to cadmium oxide dust. The exposure levels to cadmium estimated for dust from surface and subsurface soil are unlikely to cause adverse health effects in children or adults. Cadmium associated cancers: Chronic inhalation exposure studies in rats have linked inhalation of cadmium compounds (cadmium oxide, cadmium chloride, and cadmium sulfide with lung cancer, specifically lung bronchioalveolar adenomas, adenocarcinomas and squamous cell carcinomas (various studies ATSDR 1999). Epidemiologic studies of workers linked inhalation of cadmium oxide dust with 50-111 lung cancer deaths per 1000 workers exposed for 45 years.			

Chemicals in residential off-site soil	Doses are in mg/kg/day for ingestion and mg/m3 for inhalation Soil			
	children's dose	adult's dose	children's theoretical increased cancer risk	adult's theoretical increased cancer risk
Chromium (surface soil)	Ing . 0.004 Inh . 0.00002	Ing. 0.00002 Inh. 0.0004	Ing. No slope. Inh. 3:100,000	Ing. No slope. Inh. 3:100,000
Chromium (subsurface soil)	Ing . 0.001 Inh . 0.000005	Ing. 0.0001 Inh. 0.000005	Ing. No slope. Inh. 1:1,000,000	Ing. No slope. Inh. 2:100,000
ATSDR 2000b	Child surface soil ingestion dose (0.004) is 10 times less than the dose (0.04, Kaaber and Veien 1977) associated with dermatitis in a person ingesting a single capsule containing potassium dichromate (IV). All the other adverse health effects observed from ingestion of chromium compounds occurred at higher levels of exposure. Children's exposures to this level in the soil would be unlikely to cause adverse non-cancer health effects. Adult surface soil ingestion dose (0.0004) is 100 times less than the dose (0.04) described for dermatitis. Adults' exposures to this level in the soil would be unlikely to cause adverse non-cancer health effects. Child subsurface soil ingestion dose (0.001) is 40 times less than the dose (0.04) described for dermatitis. Children's exposures to this level in the soil would be unlikely to cause adverse non-cancer health effects. Adult subsurface soil ingestion dose (0.0001) is 400 times less than the dose (0.04) described for children. Adults' exposures to this level in the soil would be unlikely to cause adverse health effects. Inhalation doses (0.00002, 0.000005) are 100 and 400 times (respectively) less than the dose (0.002) associated with nasal mucosa atrophy (a progressive loss of the mucous lining of the nasal cavity) and mild decreased lung function in workers exposed from 0.2 to 26.3 years (with an average of 2.5 years of occupation) to chromium oxide VI (Lindberg and Hedenstierna, 1983). The exposure levels to chromium estimated for dust from surface and subsurface soil are unlikely to cause adverse non-cancer health effects in children or adults. Chromium associated cancers: Because some chromium VI compounds have been associated with lung cancer in workers and have caused cancer in animals, the Department of Health and Human Services has determined that certain chromium compounds: calcium chromate, chromium trioxide, lead chromate, strontium chromate and zinc chromate are known human carcinogens.			

Chemicals in residential off-site soil	Doses are in mg/kg/day for ingestion and mg/m3 for inhalation			Soil
	children's dose	adult's dose	children's theoretical increased cancer risk	adult's theoretical increased cancer risk
Copper (surface soil)	Ing. 0.02 Inh. 0.00009	Ing. 0.002 Inh. 0.00009	Ing. No slope. Inh. No slope.	Ing. No slope. Inh. No slope.
Copper (subsurface soil)	Ing. 0.02 Inh . 0.00007	Ing. 0.002 Inh. 0.00007	Ing. No slope. Inh. No slope.	Ing. No slope. Inh. No slope.
ATSDR 2004	<u>Child surface and subsurface soil ingestion dose</u> (0.02) is slightly higher than the dose (0.018, Araya et al. 2003) associated with gastrointestinal symptoms in a person drinking copper sulfate in water, once. While copper is an essential nutrient and is readily metabolized by the body, sensitive children might experience similar symptoms. <u>Adult surface and subsurface soil ingestion dose</u> (0.002) is 46 times less than the dose (0.091) described for gastrointestinal symptoms. Adults' exposures to this level in the soil would be unlikely to cause adverse non-cancer health effects. <u>Inhalation doses</u> (0.00007, 0.00009) are 1,714 and 1,333 times less (respectively) than the dose (0.12) associated with alveoli thickening (alveoli are the tiny air sacs in the lungs) and immune system effects (decreased bactericidal activity) in mice exposed for several week (acute effects Drummond et al. 1986). Chronic animal studies showed adverse effects at higher doses. <u>Copper associated cancers:</u> The EPA does not classify copper as a human or animal carcinogen because the available studies are inadequate.			
Lead ATSDR 2006b	(modeled)	See text in Discussion for potential health effects.		

Table 13. Comparison of doses calculated from highest values measured in "other" off-site soil to lowest observable adverse effect levels (LOAELs) in animal and human medical studies.

Chemicals in soil on "other" off-site properties	Doses are in mg/kg/day for ingestion and mg/m3 for inhalation			Soil
	children's dose	adult's dose	children's theoretical increased cancer risk	adult's theoretical increased cancer risk
Arsenic (surface soil)	Ing. 0.00004 Inh. 0.0000002	Ing. 0.000004 Inh. 0.0000002	Ing. 2:1,000,000 Inh. < 1:1,000,000	Ing. 2:1,000,000 Inh. < 1:1,000,000
Arsenic (subsurface soil)	Ing. 0.00001 Inh. 0.00000004	Ing. 0.000001 Inh. 0.00000004	Ing. < 1:1,000,000 Inh. < 1:1,000,000	Ing. < 1:1,000,000 Inh. < 1:1,000,000
ATSDR 2000a (Update) †Other properties include right-of-ways, FDOT-owned land or alleys.	Child surface soil ingestion dose (0.00004) is 50 times less than the dose (0.002, Chiou et al. 1997) associated with increased prevalence of cerebrovascular disease and cerebral infarction (an interruption of the blood supply to any part of the brain, resulting in damaged brain tissue). This dose is also 125 times less than the dose (0.005, Lianfang and Jianzhong 1994) associated with keratosis (a lump or growth on the skin that is the result of overproduction of the protein keratin), hyperkeratosis (a skin condition characterized by thickening and hardening of the skin), depigmentation, cyanosis (bluing) of extremities, palpitation/chest discomfort, fatigue, headache, dizziness, insomnia, nightmares, and numbness. Therefore, skin, vascular, neurological and circulation problems are unlikely to occur if children had incidental daily ingestion exposures to these other off-site properties. Adult surface soil ingestion dose (0.000004) is 500 time less than the lowest dose referenced (0.002, Chiou et al. 1997), so cerebrovascular disease, cerebral infarction problems and skin problems would be unlikely in adults who incidentally ingest "other" off-site soil. Child subsurface soil ingestion dose (0.00001) is 200 times less than the lowest dose referenced (0.002, Chiou et al. 1997), so surface soil exposures would be unlikely to cause adverse non-cancer health effects in daily exposed children. Adult subsurface soil ingestion dose (0.000001) is 2,000 time less than the lowest dose referenced (0.002, Chiou et al. 1997), so surface soil exposures would be unlikely to cause adverse non-cancer health effects in daily exposed adults. Inhalation doses (0.0000002, 0.00000004) are 3,500 and 17,500 times (respectively) less than the amount associated with increased risk of stillbirth in humans (0.0007, Ihrig et al., 1998, $As\ 3^{+}$) inhaling arsenic. The exposure levels to arsenic estimated for dust from surface and subsurface soil are unlikely to cause adverse health effects in children or adults. Arsenic associated cancers: From lowest to highest dose cancer effect levels, chronic arsenic exposures in people have been linked to lung cancer, basal and squamous cell skin cancers, liver cancer (haemangioendothelioma), urinary tract cancers (bladder, kidney, ureter and all urethral cancers), and intraepidermal cancers. Intraepidermal is the name for the early pre-invasive form of squamous cell skin cancer. Pre-invasive means that the cancer cells are confined to the outermost layer of skin, the epidermis. At this stage, the cancer cells are unlikely to have spread to the lymph nodes, but they can spread along the skin surface. If left untreated, these cells can develop into an invasive cancer and spread into the lymphatic system.			

Chemicals in soil on "other" off-site properties	Doses are in mg/kg/day for ingestion and mg/m3 for inhalation			Soil
	children's dose	adult's dose	children's theoretical increased cancer risk	adult's theoretical increased cancer risk
Cadmium (surface soil)	Ing. 0.00002 Inh. 0.0000006	Ing. 0.000002 Inh. 0.0000006	Ing.: No slope. Inh.: <1: 1,000,000	Ing. : No slope. Inh. : <1: 1,000,000
Cadmium (subsurface soil)	Ing. 0.000008 Inh. 0.00000003	Ing. 0.0000009 Inh. 0.00000003	Ing.: No slope. Inh.: <1: 1,000,000	Ing.: No slope. Inh.:. <1: 1,000,000
ATSDR 1999b (Update) †Other properties include right-of-ways, FDOT-owned land or alleys.	Child surface soil ingestion dose (0.00002) is 400 times less than the dose (0.008) that caused interstitial lesions in kidney tubules in workers (Shiwen et al. 1990) exposed less than 25 years. This same dose (0.008) caused increased blood pressure in rats chronically exposed (lifetime exposure) to cadmium chloride (Perry et al. 1989). Children's exposures to this level of cadmium would be unlikely to cause adverse health effects. Adult surface soil ingestion dose (0.000002) is 4,000 times less than doses showing adverse health effects in workers and animal studies. Adults' exposures to this level would be unlikely to cause adverse health effects. Child subsurface soil ingestion dose (0.000008) is 1,000 times less than doses showing adverse health effects in workers and animal studies. Children's exposures to this level in the soil would be unlikely to cause adverse health effects. Adult subsurface soil ingestion dose (0.0000009) is 8,888 times less than doses showing adverse health effects in workers and animal studies. Adults' exposures to this level in the soil would be unlikely to cause adverse health effects. Inhalation doses (0.0000006, 0.00000003) are 33,333 and 666,667 times (respectively) less than the cadmium inhalation dose (0.02) associated with 9.2% increased renal proteinuria (Jarup et al. 1988) for workers exposed 30 years, 5 days a week, 8 hours a day to cadmium oxide dust. The exposure levels to cadmium estimated for dust from surface and subsurface soil are unlikely to cause adverse health effects in children or adults. Cadmium associated cancers: Chronic inhalation exposure studies in rats have linked inhalation of cadmium compounds (cadmium oxide, cadmium chloride, and cadmium sulfide with lung cancer, specifically lung bronchioalveolar adenomas, adenocarcinomas and squamous cell carcinomas (various studies ATSDR 1999). Epidemiologic studies of workers linked inhalation of cadmium oxide dust with 50-111 lung cancer deaths per 1000 workers exposed for 45 years.			

Chemicals in soil on "other" off-site properties	Doses are in mg/kg/day for ingestion and mg/m3 for inhalation			Soil
	children's dose	adult's dose	children's theoretical increased cancer risk	adult's theoretical increased cancer risk
Chromium (surface soil)	Ing . 0.0002 Inh . 0.000001	Ing. 0.00003 Inh. 0.000001	Ing. No slope. Inh. 2:1,000,000	Ing. No slope. Inh. 2:1,000,000
Chromium (subsurface soil)	Ing . 0.00006 Inh . 0.0000002	Ing. 0.000006 Inh. 0.0000002	Ing. No slope. Inh. <1: 1,000,000	Ing. No slope. Inh. <1: 1,000,000
ATSDR 2000b †Other properties include right-of-ways, FDOT-owned land or alleys.	Child surface soil ingestion dose (0.0002) is 200 times less than the dose (0.04, Kaaber and Veien 1977) associated with dermatitis in a person ingesting a single capsule containing potassium dichromate (IV). All the other adverse health effects observed from ingestion of chromium compounds occurred at higher levels of exposure. Children's exposures to this level in the soil would be unlikely to cause adverse non-cancer health effects. Adult surface soil ingestion dose (0.00003) is 1,333 times less than the dose (0.04) described for dermatitis. Adults' exposures to this level in the soil would be unlikely to cause adverse non-cancer health effects. Child subsurface soil ingestion dose (0.00006) is 667 times less than the dose (0.04) described for dermatitis. Children's exposures to this level in the soil would be unlikely to cause adverse non-cancer health effects. Adult subsurface soil ingestion dose (0.000006) is 6,667 times less than the dose (0.04) described for children. Adults' exposures to this level in the soil would be unlikely to cause adverse health effects. Inhalation doses, (0.000001, 0.0000002) are 2,000 and 1,000 times (respectively) less than the dose (0.002) associated with nasal mucosa atrophy (a progressive loss of the mucous lining of the nasal cavity) and mild decreased lung function in workers exposed from 0.2 to 26.3 years (with an average of 2.5 years of occupation) to chromium oxide VI (Lindberg and Hedenstierna, 1983). The exposure levels to chromium estimated for dust from surface and subsurface soil are unlikely to cause adverse non-cancer health effects in children or adults. Chromium associated cancers: Because some chromium VI compounds have been associated with lung cancer in workers and have caused cancer in animals, the Department of Health and Human Services has determined that certain chromium compounds: calcium chromate, chromium trioxide, lead chromate, strontium chromate and zinc chromate are known human carcinogens.			
Lead ATSDR 2006b	(modeled)	See text in Discussion for potential health effects.		

Appendix C—Safe Gardening Card

Safe Gardening Tips

REMEMBER THESE FEW SIMPLE STEPS, IF YOU WANT TO BE SAFE IN THE GARDEN:

PREPARING YOUR GARDEN

- Add clean compost or soil to your garden.
- Be sure phosphate and pH levels do not fall below recommendations.
- Ask your county agriculture extension office to evaluate your soil.

WORKING IN THE GARDEN

- Be sure to wear gloves.
- Don't eat, drink or smoke while in the garden.
- Avoid dust. Use mulch and do not garden in dry soil when it is windy.
- Remove shoes before entering the house.
- Wash your hands and dirty clothing after gardening.

PREPARING FRUITS AND VEGETABLES

- Limit the amount of homegrown root crops you eat, especially carrots.
- Use raised beds of clean topsoil to grow root crops.
- Wash leafy vegetables growing close to the ground (like collards). Add a little vinegar to the wash water to help remove dirt.

FOR MORE INFORMATION see the Florida Department of Health website at: http://www.myfloridaeh.com/hsee/SUPERFUND/index.html. Or call toll-free during business hours at 877-798-2772.

HEALTH DIVISION OF Environmental Health ATSDR

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. Florida DOH followed approved methodologies and procedures existing at the time the health consultation was begun. The Cooperative Agreement Partner completed editorial review.

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

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