ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

Public Health Assessment for

BARKER CHEMICAL COMPANY
INGLIS, LEVY COUNTY, FLORIDA

EPA FACILITY ID: FL0001275627

MAY 8, 2008

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
PUBLIC HEALTH SERVICE
Agency for Toxic Substances and Disease Registry

THE ATSDR PUBLIC HEALTH ASSESSMENT: A NOTE OF EXPLANATION

This Public Health Assessment was prepared by ATSDR pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund) section 104 (i)(6) (42 U.S.C. 9604 (i)(6)), and in accordance with our implementing regulations (42 C.F.R. Part 90). In preparing this document, ATSDR has collected relevant health data, environmental data, and community health concerns from the Environmental Protection Agency (EPA), state and local health and environmental agencies, the community, and potentially responsible parties, where appropriate.

In addition, this document has previously been provided to EPA and the affected states in an initial release, as required by CERCLA section 104 (i)(6)(H) for their information and review. The revised document was released for a 30-day public comment period. Subsequent to the public comment period, ATSDR addressed all public comments and revised or appended the document as appropriate. The public health assessment has now been reissued. This concludes the public health assessment 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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PUBLIC HEALTH ASSESSMENT

BARKER CHEMICAL COMPANY
INGLIS, LEVY COUNTY, FLORIDA

EPA FACILITY ID: FL0001275627

Prepared by:

Florida Department of Health, Environmental Health
Under a cooperative agreement with the
U.S. Department of Health and Human Services
Agency for Toxic Substances and Disease Registry

Contents

Foreword

This document summarizes the Florida Department of Health's health assessment from exposure to the contaminants in the environment around the Barker Chemical Company site. The Florida Department of Health (DOH) evaluates site-related public health issues through the following processes:

- Evaluating exposure: Florida DOH scientists begin by reviewing available information about environmental conditions at the site. The first task is to find out how much contamination is present, where it is on the site, and how human exposures might occur. Usually, the Florida DOH does not collect its own environmental sampling data. The Florida Department of Environmental Protection (DEP) provided the information for this public health assessment.
- Evaluating health effects: If we find evidence that exposures to hazardous substances are occurring or might occur, Florida DOH 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 evaluation report, the Florida DOH outlines its conclusions regarding any potential health threat posed by the Barker Chemical Company site, and offers recommendations for reducing or eliminating human exposure to contaminants. The role of the Florida DOH in dealing with hazardous waste sites is primarily advisory. For that reason, the evaluation report will typically recommend actions for other agencies, including the US Environmental Protection Agency (EPA) and the Florida DEP. If, however, an immediate health threat exists or is imminent, the Florida DOH will issue a public health advisory warning people of the danger, and will work to resolve the problem.
- Soliciting community input: The evaluation process is interactive. The Florida DOH 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 any conclusions about the site with the groups and organizations providing the information. Once we prepare an evaluation report, the Florida DOH seeks feedback from the public.

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

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1.0 Summary and Statement of Issues

1.1 Summary

This report assesses the potential public health impact from exposures to contaminated soil, river sediments, and surface water on and around the former Barker Chemical Company (BCC) site in Inglis, Florida. Because of uncertainties, it does not represent an absolute estimate of risk, but rather an approximation of the possibility of adverse health effects.

In 1904, the BCC began processing low-grade phosphate rock to produce fertilizer. Waste from BCC was distributed around the site and in the Garden Mall Court Subdivision causing contamination in soils, river sediments and surface water. The plant ceased operations in 1925, later the property was converted into residential properties, and homes were built on the land. In 1995, the United States Environmental Protection Agency (USEPA) collected soil samples and discovered extensive arsenic and lead contamination. The USEPA removed contamination from the identified properties. Between 1996 and 2005, the USEPA continued to investigate the soil contamination, as well as surface water, river sediment and groundwater contamination. The USEPA has removed soils from any properties identified with lead or arsenic levels above their residential soil cleanup levels.

The former Barker Chemical Company Site is currently no apparent public health hazard. Exposure to contamination in the soils is mitigated by the USEPA's removal of contaminated surface soils. Levels of contamination in other media are at levels not expected to cause adverse health affects.

1.2 Statement of Issues

In this public health assessment, the Florida DOH evaluates the possibility of past, current and future exposures to chemicals on and around the Former Barker Chemical Company (BCC) site. Specifically, this report evaluates groundwater, soil, sediment, and surface water data collected by the Tetra Tech, a contractor for the United States Environmental Protection Agency (USEPA) in the Garden Mall Court Subdivision (Figure 2). Florida DOH then discusses the likelihood of exposures to cause illnesses and actions needed to protect public health.

In 1995, a resident discovered the contamination around the former BCC site when he took a soil sample to determine why plants would not grow in areas with reddish-colored soils. The analysis of the soil indicated elevated levels of lead and arsenic. Further investigation by the Florida Department of Environmental Protection (FDEP) revealed an extensive area of soils containing high levels of lead and arsenic (FDOH 1996).

In August 1996, the Florida DOH published two reports. The first evaluated possible health effects from exposure to soils sampled during 1995 and 1996. The second report discussed results from arsenic hair and urine testing. The reports concluded current exposures were not likely to cause illness. Because of the lack of information about past exposures, however, the reports could not rule illnesses in the past (ATSDR 1996a, ATSDR 1996b).

During 1996 and 1997, the USEPA conducted removal on 17 parcels that had high levels of arsenic or lead. Most removal actions removed soil down to bedrock or until XRF screening indicated that levels were below EPA time-critical removal levels (Tetra Tech 2005).

In 2003, a resident reported that contamination still existed on his property. In late 2003, the USEPA returned to Inglis and collected samples from eight residences. Removal occurred at seven of these properties in early 2005 (Tetra Tech 2005).

The resident that reported to the USEPA that contamination still existed on his property in 2003, petitioned the ATSDR in 2004 to re-evaluate the soils in the Garden Mall Subdivision. This report is in response to the petition.

2.0 Background

2.1 Site History

The BCC operated a phosphate-based fertilizer manufacturing facility at the site from approximately 1904 to 1931. The plant received low-grade phosphate "hard rock," which had less than 77 percent bone phosphate of lime (BPL). This phosphate was used to produce acid phosphate (now known as "superphosphate"), with available acid phosphate ranging from 14 to 17 percent. The phosphate hard rock was transferred to the facility via an 18-mile railroad from the mines of the Dunnellon Phosphate Company. The former railroad is now Inglis Avenue.

Sulfuric acid, used to create acid phosphate, was also produced at the BCC facility. Because the exact method of sulfuric acid production is not known, and because an old drawing of the plant refers to an acid chamber, we assume they used the changer process. This method of sulfuric acid production involved the use of lead vessels and lead pipes to convey the sulfuric acid. Lead-lined vessels were use to treat phosphate rock with sulfuric acid. BCC imported pyrites, minerals composed of iron sulfide, from Spain, because the rock contained more sulfur. These pyrites also contained arsenic and copper. BCC unloaded the pyrites on a wharf on the Withlacoochee River adjacent to the Pyrites Building.

The Florida Power Corporation (FPC) established a power plant on a portion of the BCC property in 1926, and the BCC facility closed in 1931. Currently the property consists of residential subdivisions, including the Garden Mall subdivision and Ray's subdivision, and the FPC. In March 1995, a resident of the Garden Mall Subdivision expressed concerns about possible soil contamination on his property, prompting the Florida Department of Environmental Protection to collect a series of soil samples from within and around the subdivision. Analytical results from these samples indicated elevated levels of lead and arsenic in the soil. The Florida DEP contracted Professional Service Industries, Inc., to conduct a contamination assessment to evaluate the extent of lead and arsenic contamination in the soil and groundwater at the Garden Mall Subdivision and adjacent FPC property, and surface water and river sediment. The contamination assessment was completed in October 1995. Because of the contamination assessment, FDEP requested that EPA evaluate the site for potential removal action. Following a preliminary site investigation, EPA determined that additional sampling would be required to complete the evaluation.

Under the USEPA's direction, the USEPA Environmental Response Team (ERT) conducted a formal site investigation at the site from December 4 through 13, 1995. The ERT collected 250 surface soil samples from residences in and around the Garden Mall Subdivision and the adjacent Ray's Subdivision. Analytical results for these samples indicated levels of arsenic and lead in surface soil at the BCC site that exceed levels set by the EPA. Based on sample results and other available information, EPA determined that a removal action was necessary to remove the immediate threat of arsenic and lead exposure to human health and the environment.

On March 11, 1996, the USEPA signed an Action Memorandum for a removal action under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The USEPA conducted additional site investigation work from April 15 through 19, 1996. USEPA conducted this investigation to establish the vertical and horizontal extent of lead and arsenic contamination in the soils subdivisions and surrounding area. The USEPA collected 190 surface soil samples and analyzed them for lead and arsenic contamination. Analytical results were used to establish excavation depths and to confirm the overall extent of lead and arsenic contamination in the soil. Removal activities commenced at the site on April 22, 1996, excavating contaminated soil areas, backfilling all excavated areas to former grade, and restoring the site. USEPA completed removal activities at the site on April 2, 1997. They completed site restoration work consisting of replacing topsoil and laying sod or grass seed on April 14, 1997.

In an August 1996 health consultation report, Florida DOH concluded it was possible that exposure to the highest levels of arsenic and lead in surface soils and private wells in Garden Mall Court Subdivision could cause illness. Testing of blood for lead and hair/urine for arsenic, however, found that residents were not actually being exposed to levels likely to cause illness.

In 1999, PSI collected three surface water samples from the Withlacoochee River, which borders the former BCC site to the south. Analysis of the water included antimony, arsenic, lead and mercury. However, none of the samples showed an elevated level of any of the metals.

In August 2003, Florida DEP contacted USEPA about residents who continued to claim that contamination was present on their properties. In October 2003, a contractor for DEP prepared and submitted a remedial action sampling and analysis plan. In December 2003, the EPA contractor collected 46 soil samples in the Garden Mall Subdivision. The USEPA removed soil from properties with high levels of lead and arsenic. In April 2004, a concerned resident petitioned ATSDR to evaluate the possibility of health effects from contamination in the soil.

In late 2005, the USEPA contractor, Tetra Tech, collected more soil samples from the Garden Mall Court Subdivision to determine if further removal was necessary. Results showed that several parcels in the area still had high levels of arsenic and lead. The USEPA removed contaminated soil from these parcels in 2007.

In 2005, the USEPA Science and Ecosystems Support Division (SESD) collected seven samples from the Withlacoochee River. They collected samples from the shoreline at a depth of 3 to 4 feet below the river surface. They analyzed the surface water sample results for antimony, arsenic and lead (Tetra Tech 2005).

2.2 Site Description

The BCC site is located south of County Road 40 and west of U.S. Highway 19 in Inglis, Levy County, Florida. The area is relatively flat, with elevations ranging from sea level to 15 feet above mean sea level. The area immediately surrounding the former site is residential. County Road 40 (Inglis Avenue) borders the BCC site to the north. Residential areas are to the east and west. The Withlacoochee River forms the southern boundary. Barker Chemical Company operated a phosphate production facility at this location from about 1904 to 1931. The former

BCC property encompasses approximately 140 acres; 96 acres are residential areas, and the FPC owns the remaining 44 acres. (Tetra Tech 2004)

2.2.1 Demographics – In 2000, about 380 people lived within a 0.5-mile radius of the site. Approximately 98% were white. Other racial/ethnic groups include Asian, Hispanic or Latino (Bureau of the Census, U.S. Department of Commerce 2000).

2.2.2 Land Use - The Barker Chemical Company Site is in the Garden Mall subdivision of the city of Inglis, Levy County, Florida. The site is bounded by the Withlacoochee River on the south and west, by Inglis Avenue on the north, and by a wooded area to the east. The Florida Power Company owns property that was the western portion of the main site. The area on and around the site is residential. About a dozen homes are on the site.

The area within one mile of the site is residential with some commercial businesses. Since pyrite cinder from the plant was used as fill throughout the town, the site study area extends from the Withlacoochee River on the south and west to County Road 40 and US Highway 19 on the north and east (Fig. 2).

2.3 Site Visit

In September 2006, representatives of the FDOH visited the former BCC site. The property where the former BCC was once located has been subdivided into residential parcels and there are currently about a dozen homes on the property.

3.0 Discussion

In this section, Florida DOH reviews the available site information (groundwater, surface water, sediment, and soil). Florida DOH predicts whether, if people were to contact these chemicals, those chemicals could affect their health.

The public health assessment process has inherent uncertainties because:

- The risk assessment process is inexact,
- Information on the site and on actions (and interactions) of chemicals is never complete, and
- Opinions on the implications of known information differ.

All risk assessments, to varying degrees, require the use of assumptions, judgments, and incomplete data. These factors contribute to the uncertainty of the final risk estimates. Important sources of uncertainties include environmental sampling and analysis, exposure parameter estimates, use of modeled data, and present toxicological knowledge (Appendix E). These uncertainties can cause risk to be overestimated or underestimated. The assumptions, interpretations, and recommendations made throughout this public health assessment, however, tend to err on the side of protecting public health and may overestimate the risk. Because of the inherent uncertainties, this public health assessment does not represent an absolute estimate of risk to persons exposed to chemicals at or near the former BCC site.

This public health assessment is a deterministic style risk assessment. For each variable in the risk equation (such as exposure concentration or exposure duration) this assessment selects one value. The result is a single estimate of the risk. In contrast, probabilistic risk assessments use a range of values for each variable. The result of probabilistic risk assessments is a range of risk. Both deterministic and probabilistic style risk assessments are useful in describing the risk.

3.1 Environmental Contamination

The Florida DOH used the following screening guidelines in order of priority to select contaminants of concern:

1. Cancer Risk Evaluation Guide (CREG). A CREG is the contaminant concentration estimated to result in no more than one excess cancer per 1 million persons exposed during a lifetime (i.e., 70 years). ATSDR calculates CREGs from EPA-established cancer slope factors (ATSDR 1992).
2. Environmental Media Evaluation Guide (EMEG). ATSDR derives an EMEG from a Minimal Risk Level (MRL), using standard exposure assumptions (e.g., ingestion of 200 milligrams of soil per day and body weight of 30 kilograms (kg) for children). ATSDR establishes MRLs: levels of daily human exposure to a chemical for a period of 1 year or longer which is likely to be without any appreciable risk of noncancerous illnesses.
3. Maximum Contaminant Levels (MCL). The Florida DEP derives MCLs from U.S. Environmental Protection Agency (EPA) standards or from health data complied from state and federal resources. MCLs are fully enforceable standards and must be equal to or more stringent (i.e., lower) than federal MCLs (such as the EPA's).
4. Health Advisory Levels (HALs). The Florida DEP and the Florida DOH set HALs based on U.S. EPA standards or from health data compiled from state and federal agencies. While not enforceable, the state agencies use HALs to protect human health.

Using the above criteria and Florida DEP soil cleanup target levels (SCTL), the Florida DOH determined arsenic, antimony, arsenic, barium, copper, lead, and mercury to be surface soil contaminants of concern. We selected each chemical because it occurred in the surface soil at levels equal to or greater than the screening guideline (Table 1).

Using the above criteria the FDOH determined arsenic to be a contaminant of concern in surface water (Table 5).

Using the above criteria the FDOH determined antimony, arsenic, lead and mercury to be contaminants of concern in the sediments (Table 7).

Identification of a contaminant of concern in this section of the report does not necessarily mean that exposure to the contaminant will cause illness. To be protective of health, ATSDR screening guidelines are usually set hundreds or thousands of times below levels that actually cause illness. Identification of contaminants of concern helps narrow the focus of the public health assessment to those contaminants that require further evaluation for potential public health risk.

3.1.1 Surface Soil - Multiple investigations have taken place around the former BCC site. Between 1995 and 2005, 109 surface soil samples and 389 subsurface soil samples have been collected. Soil samples collected were analyzed for lead. Florida DOH analyzed soil samples collected in 1995 in a previous health consultation, and therefore were not included in this report. Table 1 summarizes results of soil testing. For the purpose of this report, on-site surface soil quality has been adequately characterized.

3.1.2 Surface Water – In 2005, the USEPA collected seven surface water samples from the Withlacoochee River. They analyzed the samples for antimony, arsenic, and lead. (Tetra Tech 2005) For the purpose of this report, on-site surface water quality has been adequately characterized.

3.1.3 Sediment – In 1999, PSI collected five sediment samples for the expanded site investigation submitted to the EPA. The USEPA collected five sampled in 2000 and Tetra Tech collected three sediment samples. For a 2005 Ecological Risk Assessment, Tetra Tech and the USEPA SESD collected an additional 12 sediment samples. They analyzed all samples for arsenic and lead. They analyzed selected soil samples for total priority pollutant metals, mercury, semi-volatile organic compounds, polychlorinated biphenyls, and pesticides. For the purpose of this report, sediment quality has been adequately characterized.

3.2 Pathways Analyses

Chemical contaminants in the environment can harm people's health, but only if people have contact with those contaminants at a high enough concentration (dose) to cause a health effect. 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, Florida DOH looks at the human exposure pathways. An exposure pathway has five parts. These parts are:

1. a source of contaminants, 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 come in contact with a contaminated medium, like drinking water or soil in a garden,
4. an exposure route like drinking contaminated water from a well or eating contaminated soil on homegrown vegetables, and
5. a population who could be exposed to the contaminants.

Florida DOH eliminates an exposure pathway if at least one of the five parts referenced above is missing and will not occur in the future. Exposure pathways not eliminated are either completed or potential. For completed pathways, all five pathway 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.

3.2.1 Completed Exposure Pathways – The following subsection lists completed human exposure pathways.

3.2.1.1 Surface Soil – Currently off-site soils are a completed pathway for some residents. Exposure might occur by accidental ingestion by nearby residents or by inhalation of contaminated dust.

3.2.1.2 Surface Water – Garden Mall Court residents may have contacted surface water in the river along the former BCC site. Residents who swam or waded in the river may have been exposed via incidental ingestion or dermal absorption.

3.2.1.3 Sediments – Garden Mall Court residents may have contacted sediments in the river along the former BCC site. Residents who swam or waded in the river may have been exposed via incidental ingestion or dermal absorption.

3.2.2 Potential Exposure Pathways – The following subsection lists potential human exposure pathways.

There are no known potential pathways around the former BCC site.

3.2.3 Eliminated Exposure Pathways – The following subsections lists pathways in which one component of the pathway is missing.

3.2.3.1 Ground Water – The Florida DOH does not know of any residents using private or irrigation wells in the Garden Mall Court Subdivision. Therefore, no residents are being exposed to potentially contaminated groundwater.

3.3 Public Health Implications

In the following sections, we discuss exposure levels and possible health effects that might occur in people exposed to the contaminants of concern at the site. We discuss the results of previous indoor air, fruit/vegetable, and beryllium sensitivity testing in the Background section.

3.3.1 Toxicological Evaluation The Florida DOH evaluates exposures by estimating daily doses for children and adults. Kamrin (1988) explains the concept of dose in the following manner:

> . . .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; i.e., 1 ounce for each pound of animal.

This amount per weight is the *dose*. Toxicology uses dose to compare the 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 public health assessment. A milligram is 1/1,000 of a gram; a kilogram is approximately 2 pounds.

To calculate the daily dose of each contaminant, the Florida DOH uses standard assumptions about body weight, ingestion and inhalation rates, duration of exposure (period of time), and other factors needed for dose calculation (ATSDR 2005c, EPA 1997). The Florida DOH uses Risk Assistant, a software model that uses EPA risk assessment guidelines, to calculate estimated ingestion doses and inhalation concentrations (Table 11). We assume that people are exposed daily to the maximum concentration measured.

ATSDR's toxicological profiles on contaminants discuss toxicity from three exposure routes - inhalation, ingestion, and dermal (skin) exposure. For each of these exposure routes, ATSDR also 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). ATSDR Toxicological Profiles also provide information on the environmental transport and regulatory status of contaminants.

To estimate exposure from ingestion of contaminated surface water, Florida DOH used the following assumptions:

1) children 1 - 4 years of age ingest an average of 1 liter of water per day,
2) adults ingest an average of 2 liters per day,
3) children 1 - 4 years of age weigh an average of 15 kg,
4) adults weigh an average of 70 kg.

To estimate exposure from incidental ingestion of contaminated residential soil, Florida DOH used the following assumptions:

1) children 1 - 4 years of age ingest an average of 200 mg of soil per day,
2) adults ingest an average of 100 mg of soil per day,
3) children 1 - 4 years of age weigh an average of 15 kg,
4) adults weigh an average of 70 kg,
5) children and adults ingest contaminated soil at the maximum concentration measured for each contaminant.

3.3.1.1 Surface Soils

Garden Mall Court residents may have been exposed to contaminants in surface soil. Their exposure may have been via incidental ingestion (accidentally swallowing small amounts of soil) or by inhalation (breathing dust created from the contaminated soil).

Antimony

We do not expect incidental ingestion of antimony measured in residential surface soils of Garden Mall Court to cause illness. The highest estimated antimony dose from incidental soil ingestion (0.00006 mg/kg/day) is approximately 65 times lower than the USEPA's chronic oral reference dose (0.0004 mg/kg/day). No observable adverse effect levels (NOAEL) for antimony in animal studies range from 0.262 – 0.35 mg/kg/day (ATSDR 1992).

We do not expect inhalation of dust from the highest levels of antimony in surface soil to cause illness. The highest estimated antimony exposure from inhalation of dust (0.000005 milligrams per cubic meter, mg/m^3) is thousands of times lower than the lowest concentration that cause respiratory issues. NOAELs in animal studies range from 4.2 to 36 mg/m^3 (ATSDR 1992).

Arsenic

We do not expect incidental ingestion of arsenic measured in residential surface soils of the Garden Mall Court Subdivision to cause illness. We assumed the arsenic was in the more toxic inorganic form. The highest estimated arsenic dose from incidental soil ingestion (0.0004 mg/kg/day) is 4.5 times lower than the lowest dose (0.0018 mg/kg/day) that caused pigmentation changes in the skin. No observable adverse effect levels (NOAEL) for arsenic in humans range from 0.0004 – 0.1 mg/kg/day (ATSDR 2005a).

We do not expect inhalation of dust from the highest residential arsenic surface soil concentration measured in the Garden Mall Court Subdivision to cause illness. The highest estimated arsenic exposure from inhalation of dust (0.00003 milligrams per cubic meter, mg/m^3) is approximately 20 times lower than the lowest concentration that cause changes in skin pigmentation or an increased risk of stillbirth. We do not expect skin contact with arsenic measured in residential surface soil to cause illness (ATSDR 2005a).

To evaluate a theoretical cancer risk from incidental ingestion of arsenic, the US EPA developed a cancer slope factor based on a human study where subjects developed skin cancer. We multiply the cancer slope factor by a lifetime average daily dose. We adjust the highest estimated ingestion dose to create the lifetime average daily dose for a 70-year life expectancy. The maximum theoretical excess cancer risk for lifetime exposure of incidental ingestion of arsenic is four additional cancers per 10,000 people, a low increased risk.

To evaluate a theoretical cancer risk from inhalation of arsenic, the US EPA developed an inhalation risk unit, from a human study where subjects developed lung cancer. We multiply the unit risk by an inhalation concentration that we have adjusted for a lifetime of 70 years. The estimated maximum theoretical excess cancer risk for lifetime inhalation of arsenic is four additional cancers per 100,000, which is not a significant increased risk. We base this theoretical calculation on the assumption there is no safe level of exposure to a chemical that causes cancer. However, the theoretical calculated risk is not exact and tends to overestimate the actual risk associated with exposures that may have occurred. While studies link arsenic to skin, lung, bladder and liver cancer, the lowest dose in any human study that caused cancer was 0.05 mg/m^3 (ATSDR 2005a). Given the relatively low level of the estimated dose in comparison to studies that associated arsenic to cancer, and given an intermittent residential exposure environment, it is unlikely that the estimated dust inhalation would result in an increased rate of cancer.

Barium

We do not expect incidental ingestion of barium measured in residential surface soils in the Garden Mall Court community to cause illness. The highest estimated dose (0.0002 mg/kg/day) is thousands of times lower than the lowest dose that caused increased blood pressure in animal studies.

We do not expect inhalation of dust from the highest residential barium surface soil concentration measured in the Garden Mall Court Subdivision to cause illness. The highest estimated air concentration is thousands of times lower than the lowest concentration that cause increased blood pressure, difficulty breathing, and irregular heartbeat in animal studies. We do not expect skin contact with barium measured in surface soil in the Garden Mall Court community to cause illness. Barium is not well absorbed through the skin. Barium is not a carcinogen (cancer-causing chemical). (ATSDR 2005b)

Copper

One-time ingestion of extremely high levels of copper causes nausea, vomiting, and abdominal pain. Too little is known, however, about the toxicity of chronic exposure to low levels of copper to determine the risk of illness for residents in the Garden Mall Court Subdivision (ATSDR 2004).

Lead

Exposure to soils contaminated with highest concentration of lead (6,800 mg/kg) in the Garden Mall Court Subdivision could cause illness in residents. A predictive model estimated blood lead levels ranging from 14.4 – 46.3 micrograms per deciliter (ug/dL) (Table 3). These levels are above levels in human studies shown to cause health affects. Health affects in studies include hypertension, anemia, decreased fertility, and impaired cognitive ability (ATSDR 2005c). However, the likelihood that residents are consistently exposed to the highest level is very small.

To calculate a more realistic blood lead level for residents, the Florida DOH calculated an average level of lead based on all sampling between 1996 and 2005. The average concentration of lead in surface soils in the Garden Mall Court Subdivision was 243.4 mg/kg. A predictive model estimated blood lead levels ranging from 1.4 – 3.0 ug/dL (Table 4), which falls below the current action level set by the Centers for Disease Control.

The CDC has recommended that blood lead levels in children should be below 10 ug/dL. However, no clear threshold has been identified for the harmful effects of lead, such as neurodevelopmental effects in children. Therefore, it is prudent public health policy to reduce blood lead levels in children to the lowest practical level.

Mercury

We do not expect incidental ingestion of mercury measured in residential surface soils of the Garden Mall Court Subdivision to cause non-cancer illness. The highest estimated mercury dose (0.000004 mg/kg/day) is 1500 times lower than the lowest dose that had adverse effects in animal studies (ATSDR 1999).

We do not expect inhalation of dust from the highest residential mercury surface soil concentration measured in the Garden Mall Court Subdivision to cause non-cancer illness. The highest estimated air concentration resulting from surface soil becoming airborne (dust) is well below the ATSDR MRL for chronic inhalation (0.2 mg/m^3). We do not expect skin contact with mercury measured in surface soil near the BCC site to cause illness (ATSDR 1999).

There is not enough information known to determine if residents of the Garden Mall Court Subdivision could be at a higher risk of cancer from inhalation of mercury. No studies provide evidence to show that inhalation of metallic mercury produces cancer in humans. Associations between organic mercury and leukemia were seen in one human study, but the study did not adequately address exposure to other chemicals or adjust for other risk factors of leukemia.

We do not expect ingestion of surface soil from the highest residential mercury surface soil concentration measured in the Garden Mall Court Subdivision to cause cancer illness. The highest estimated dose is well below the levels in animal studies that caused tumors in the kidneys (ATSDR 1999).

3.3.1.2 Surface Water

Sample results showed several detections of antimony, arsenic and lead. Arsenic is the only chemical needing further evaluation since it exceeds screening values (Table 5).

The routes of exposure of concern with surface water would be incidental ingestion of water or dermal contact. If a child or an adult were to spend time swimming in the Withlacoochee River, they could be exposed to the arsenic in the water via ingestion of small amounts of water or the dermal (skin) route. For this exposure, the Florida DOH estimates a resident could possibly be exposed to the water for 2 hours a day, 5 times a week during the summer months and could incidentally ingest as much as 50 milliliters of river water during each event. Due to the prolonged warm weather of Florida, it is possible that residents could have swum in the water between April and October when the high temperature averages above 80 degrees.

Arsenic

We do not expect incidental ingestion of arsenic by residents swimming in the Withlacoochee River to cause non-cancer illness. The highest estimated dose of incidental ingestion of arsenic in river water is 0.000003 mg/kg/day, which is 100 times lower than the ATSDR chronic oral minimum risk level (MRL). ATSDR developed the MRL for chronic oral exposure to arsenic from a human study that looked at the incidence of black foot disease and dermal lesions in farm workers who drank arsenic contaminated water.

To evaluate a theoretical cancer risk from incidental ingestion of arsenic, the US EPA developed a cancer slope factor based on a human study where subjects developed skin cancer. We multiply the cancer slope factor by a lifetime average daily dose. We adjust the highest estimated ingestion dose to create the lifetime average daily dose for a 70-year life expectancy. The maximum theoretical excess cancer risk for lifetime exposure of incidental ingestion of arsenic is two additional cancers per one million people, which is not a significant increased risk. While studies link arsenic to skin, lung, bladder and liver cancer, the lowest dose in any human study that caused cancer was 0.0011 mg/kg/day (ATSDR 2005d). Given the relatively low level of the estimated dose in comparison to studies that associated arsenic to cancer, and given an intermittent residential exposure environment, it is unlikely that the estimated incidental ingestion would result in an increased rate of cancer.

Arsenic is a metal and the skin does not absorb metals well. The estimated average daily dose to arsenic from dermal exposure is 0.000002 mg/kg/day. This dose is significantly lower than the lowest observed adverse effect level (LOAEL) of 6 mg/kg/day associated with gross hyperplasia and ulceration for intermediate length exposure in mice (ATSDR 2005d). Therefore, we do not expect health effects from dermal exposure to arsenic in the river.

3.3.1.3 Sediments

Sample results showed several detections of antimony, arsenic, lead, and mercury in sediment samples taken from the Withlacoochee River (Table 7).

The routes of exposure of concern with sediments would be incidental ingestion of sediment or dermal contact. If a child or an adult were to spend time playing in the Withlacoochee River, they could be exposed to the contamination in the sediments via ingestion of small amounts of disturbed sediment in the water or the dermal (skin) route. For this exposure, the Florida DOH estimates a resident could possibly be exposed to the water for 2 hours a day, 5 times a week during the summer months and could incidentally ingest as much as 100 milligrams of river sediment during each event. Due to the prolonged warm weather of Florida, it is possible that residents could have waded into the water between April and October when the high temperature averages above 80 degrees.

Antimony

We do not expect incidental ingestion of antimony by residents swimming in the Withlacoochee River to cause non-cancer illness. The highest estimated dose of incidental ingestion of arsenic in river sediments is 0.00009 mg/kg/day, which is approximately 3000 times lower than an animal study that showed increased serum cholesterol. (ATSDR 1992)

There is not enough information known to determine the toxicity of antimony via the dermal route of exposure. (ATSDR 1992)

Arsenic

We do not expect incidental ingestion of arsenic by residents swimming in the Withlacoochee River to cause non-cancer illness. The highest estimated dose of incidental ingestion of arsenic in river sediments is 0.0012 mg/kg/day, which is slightly lower than a study on humans that showed increased skin pigmentation. (ATSDR 2005a)

Arsenic is a metal and the skin does not absorb metals well. The estimated average daily dose to arsenic from dermal exposure is 0.004 mg/kg/day. This dose is significantly lower than the lowest observed adverse effect level (LOAEL) of 6 mg/kg/day associated with gross hyperplasia and ulceration for intermediate length exposure in mice (ATSDR 2005a). Therefore, we do not expect health effects from dermal exposure to arsenic in the river.

Lead

Incidental ingestion of the highest concentration of lead in river sediments by residents swimming in the Withlacoochee River could cause non-cancer illness. A predictive model estimated blood lead levels ranging from 10.0 – 31.5 micrograms per deciliter (ug/dL) (Table 9). These levels are above levels in human studies shown to cause health affects. Health affects in studies include hypertension, colic, anemia, decreased fertility, and impaired cognitive ability (ATSDR 2005c). However, it is unlikely that residents would routinely be exposed to the highest concentrations of lead in river sediments.

To create a more realistic exposure scenario for resident being exposed to lead in river sediments; the Florida DOH calculated the average level of lead in all samples collected between 1997 and 2005. The average concentration of lead in river sediments is 438 mg/kg. A predictive model estimated blood lead levels ranging from 1.8 – 4.3 ug/dl (Table 10), which fall below the current CDC action level.

The CDC has recommended that blood lead levels in children should be below 10 ug/dL. However, no clear threshold has been identified for the harmful effects of lead, such as neurodevelopmental effects in children. Therefore, it is prudent public health policy to reduce blood lead levels in children to the lowest practical level.

Mercury

We do not expect incidental ingestion of sediments containing mercury by residents swimming in the Withlacoochee River to cause non-cancer illness. The highest estimated dose of incidental ingestion of mercury is 0.000004 mg/kg/day, which is 100,000 times lower than an animal study that showed decreased motor performance (ATSDR 1999).

Not enough information is known to determine if dermal exposure to mercury in river sediments could cause health affects of Garden Mall Court Subdivision residents (ATSDR 1999).

3.4 Risk of Illness, Dose Response/Threshold and Uncertainty

Appendix E discusses limitations on estimating the risk of illness, the theory of dose response and the concept of thresholds. It also discusses the sources of uncertainty inherent in public health assessments.

3.5 Health Outcome Data

A health outcome data analysis was not performed for two reasons. First, levels of chemicals measured in the environment at this site are not likely to cause illness. Second, analysis of health outcome data would be impractical in such a sparsely populated area—the population is too small to measure an increase in disease rates.

4.0 Child Health Considerations

ATSDR and the Florida DOH recognize the unique vulnerabilities of infants and children demand special attention. Children are at a greater risk than are adults to certain kinds of exposure to hazardous substances. Because they play outdoors and because they often carry food into contaminated areas, children are more likely to be exposed to contaminants in the environment. Children are shorter than adults, which mean they breathe dust, soil, and heavy vapors closer to the ground. They are also smaller, resulting in higher doses of chemical exposure per body weight. If toxic exposures occur during critical growth stages, the developing body systems of children can sustain permanent damage. Probably most important, however, is that children depend on adults for risk identification and risk management, housing, and access to medical care. Thus, adults should be aware of public health risks in their community, so they can guide their children accordingly.

Other susceptible populations may have different or enhanced responses to toxic 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 or alcohol). These factors may limit that persons' ability to detoxify or excrete harmful chemicals or may increase the effects of damage to their organs or systems.

5.0 Community Health Concerns

In 2004, a resident living on the former BCC site property petitioned ATSDR to write a public health assessment on new data collected in the Garden Mall Subdivision. In the petition, the resident reported he and his son experienced gastrointestinal discomfort, burning of eyes and nasal passages while in the river, change in eyesight, neurological problems, tremor, major weight loss, weakness, cramping, and soreness of the limbs among several other symptoms after working several hours in the Withlacoochee River cleaning his dock. We do not expect the levels of chemicals in both sediments and river water to cause any of the reported symptoms during the short exposure duration experienced by the resident and his son.

In 2005, another concerned resident contacted the Florida DOH about a skin lesion. The resident had visited her doctor who took a biopsy. The lesion was determined to be lichen planus, a rare, recurrent, itchy rash or area of inflammatory eruptions (lesions) of unknown origin characterized by shiny reddish-purple spots on the skin and gray-white ones in the mouth. The cause of lichen planus is unknown. None of the contaminants of concern in the Garden Mall Subdivision soil or water has been shown to be associated with lichen planus.

In 2007, Florida DOH mailed a fact sheet to nearby residents summarizing a draft of this report and asking for comments. This final report addresses those few comments received (Appendix D).

6.0 Conclusions

Estimated blood lead levels from exposure to the average concentration of lead in surface soils and sediments fall below the CDC action level.

We do not expect exposure to other contaminants in the soil, sediments, and surface water to cause health affects in residents living in the Garden Mall Court Subdivision. The former Barker Chemical Company site is no apparent public health hazard.

7.0 Recommendations

Florida Department of Health has no recommendations.

8.0 Public Health Action Plan

<u>Past</u>

- The Florida DOH collected urine and hair samples to sample for arsenic exposure.
- The Levy County Health Department collected blood lead samples.
- The USEPA collected soil samples from properties on the former BCC site.

• The USEPA collected private well samples from residences in 1995.

• The Florida DOH published a health consultation in August 1996.

• The USEPA began removing contaminated soils from properties in the Garden Mall Court Subdivision.

• The USEPA collected sediment and surface water samples from the Withlacoochee River.

• In September 2007, Florida DOH distributed a summary fact sheet to nearby residents asking for their comments on the draft of this public health assessment report.

Future

• Florida DOH will inform the residents of the Garden Mall Court subdivision of the findings of this report and post it on-line at www.myfloridaeh.com/community/superfund/pha.html.

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Appendix A - Figures

Figure 1. Location of former Barker Chemical Company Site

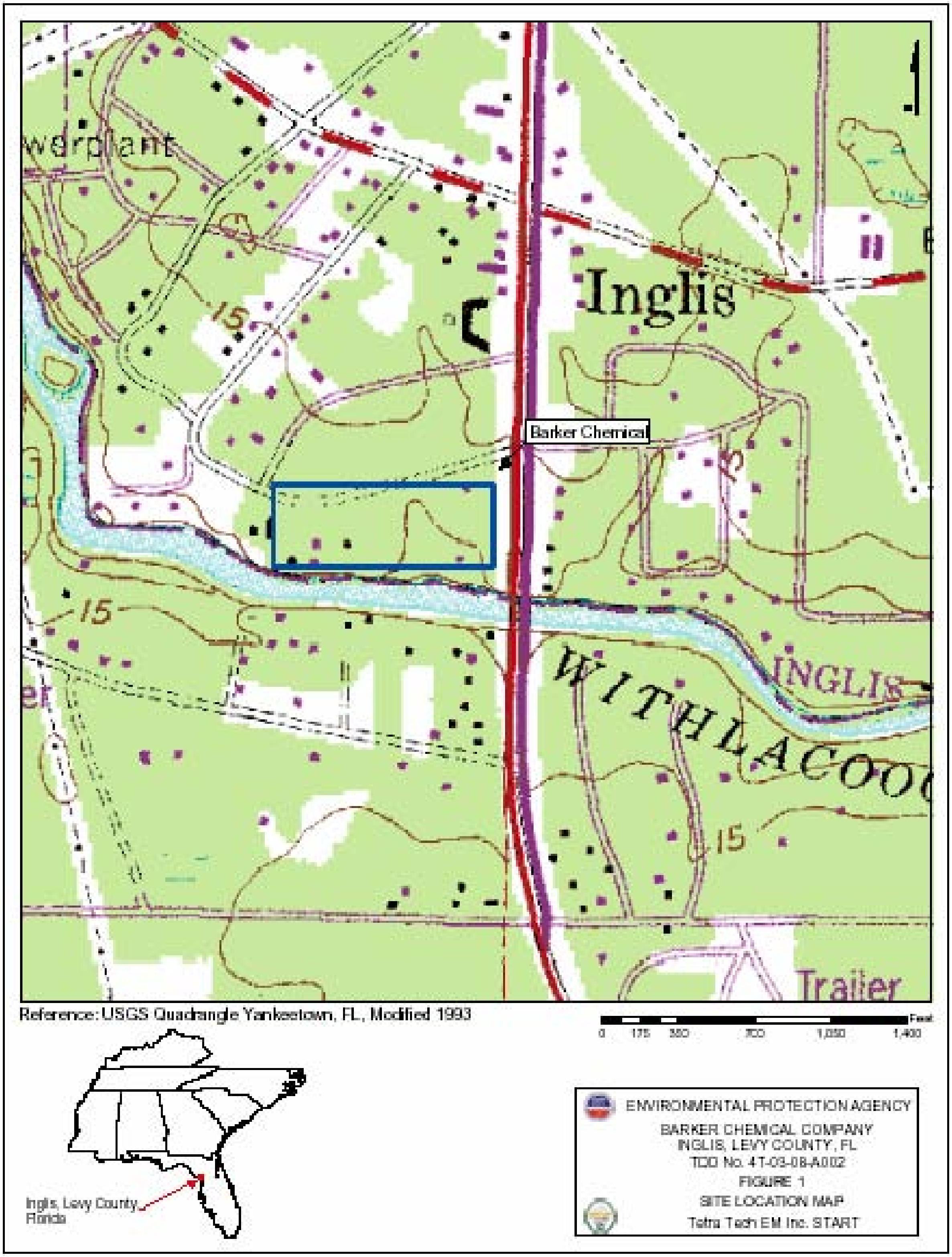


Figure 2. Parcels in Garden Mall Court Subdivision

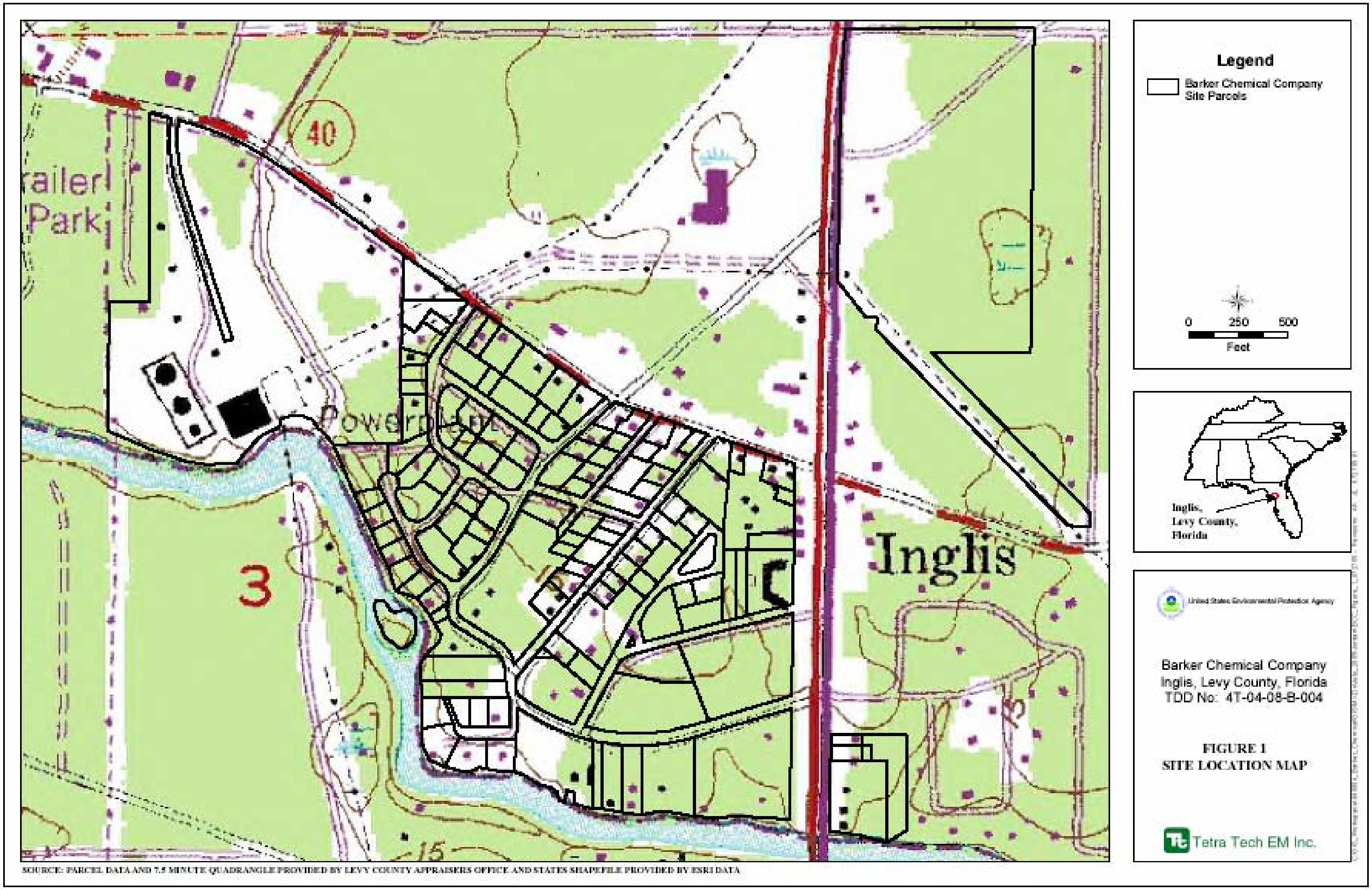


Figure 3. Soil Sample Locations

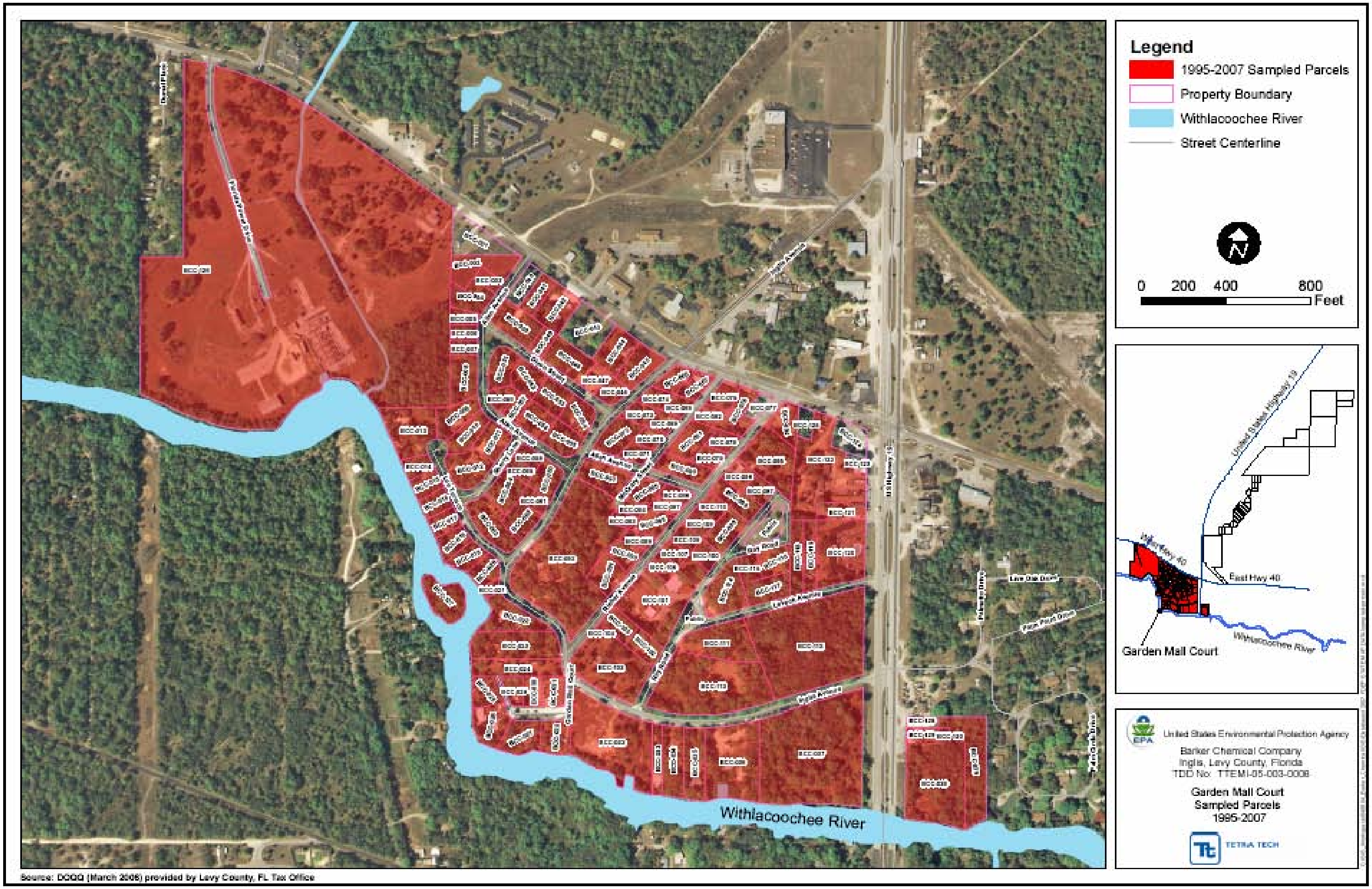


Figure 4. Surface Water Sample Locations

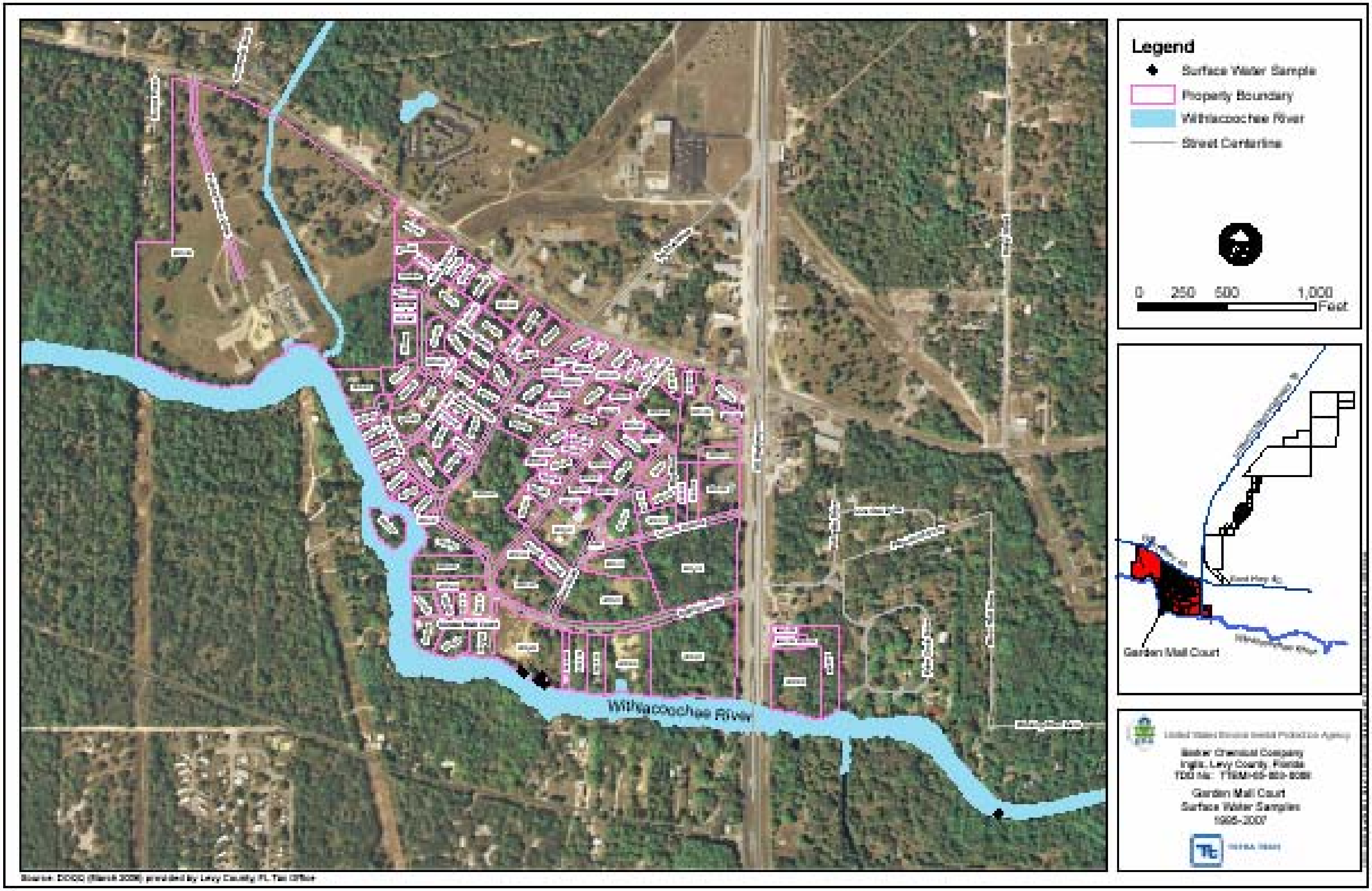
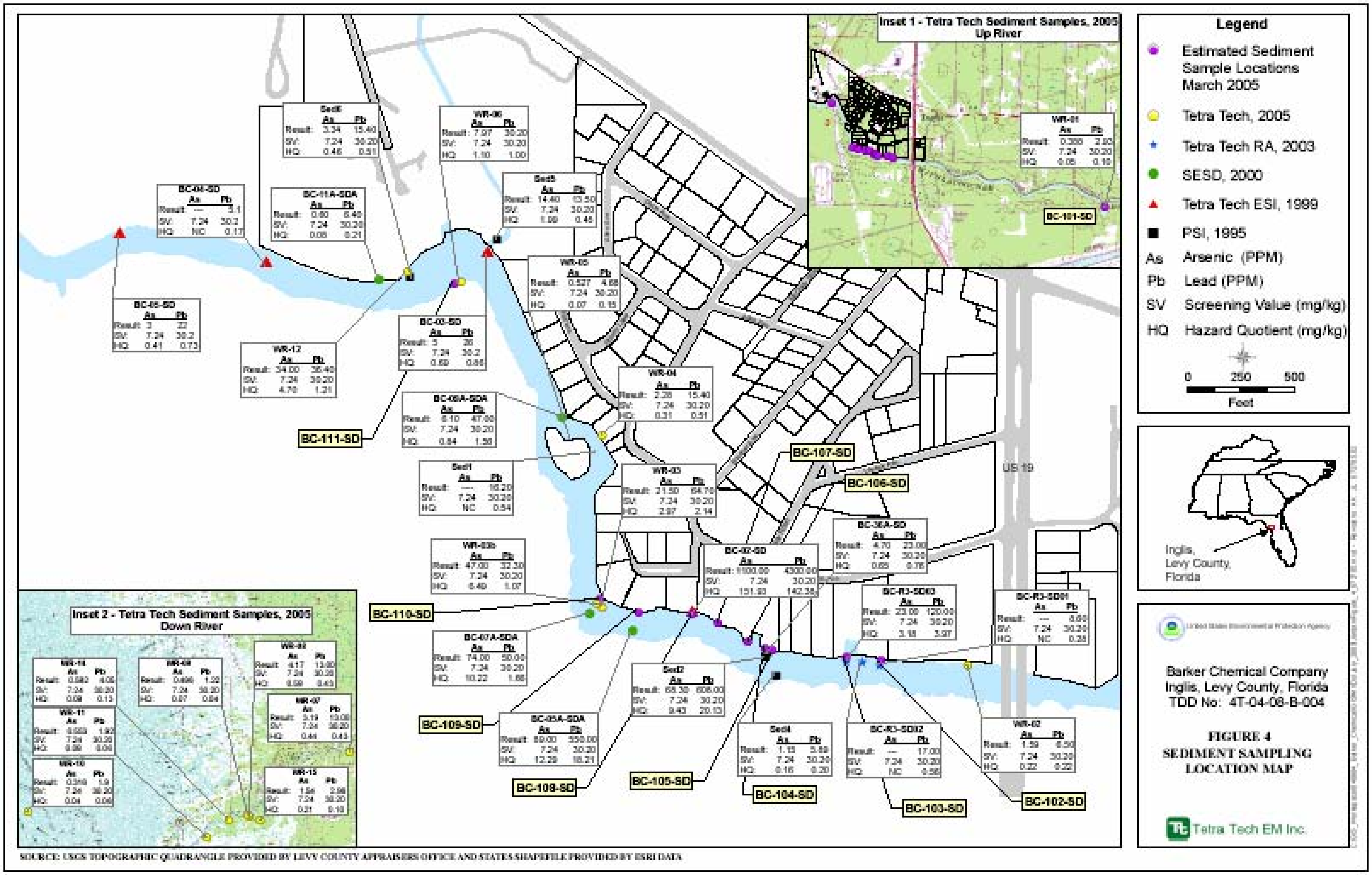


Figure 5. Sediment Sample Locations



Appendix B - Tables

Table 1. Surface Soil Contaminants of Concern

Contaminants of Concern	Highest Concentration (mg/kg)	FDEP SCTL Residential (mg/kg)	ATSDR Screening Value (mg/kg)	Number Soil Samples Above Screening Value
Antimony	97	8.7	20 Child RMEG	8/109
Arsenic	630	2.1	0.5 CREG	73/109
Barium	307	120	10000 Child RMEG	5/26
Copper	85000	150	500 Child Int. EMEG	4/26
Lead	6800	400	NA	8/109
Mercury	5.8	3	NA	1/88

mg/kg = milligrams per kilogram
PAHs = polycyclic aromatic hydrocarbons
TRPH = total recoverable petroleum hydrocarbons
CREG = Cancer Risk Evaluation Guide
EMEG - Environmental Media Evaluation Guide
RMEG – Reference Dose (from EPA) Media Evaluation Guide
NA – Not available

Table 2. Estimated Dose from Exposure to Surface Soil

Contaminant of Concern (maximum concentration) (mg/kg)	Oral MRL (mg/kg/day)	Estimated Soil Ingestion Dose (mg/kg/day)		Inhalation MRL (mg/m3)	Estimated Dust-Inhalation (mg/m3)
		Child	Adult		Child and Adult
Antimony	0.0004 Chr.	0.00006	0.00006	None	0.000005
Arsenic	0.0003 Chr.	0.0004	0.0004	None	0.00003
Barium	0.2 Chr.	0.0002	0.0002	None	0.00002
Copper	0.01 Int.	0.05	0.05	None	0.005
Lead	None	NA*	NA*	None	NA*
Mercury	None	0.000003	0.000004	0.2 Chr.	0.0000004

MRL - 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 noncancer health effects over a specified duration of exposure.
mg/kg = milligrams per kilogram
Chr – Chronic exposure length of more than 365 days
mg/kg/day – milligram chemical per kilogram body weight per day
mg/m3 –milligram of chemical per cubic meter of air
*Please see Tables 3 and 4 for Blood Lead Estimates

Table 3. Estimated† Blood Lead Level from Exposure to Garden Mall Court Subdivision Soils With Maximum Lead Levels

Source of lead exposure	**Low estimated concen-tration**	**High estimated concen-tration**	**Exposure Time (fraction of day)***	**Low estimated slope***	**High estimated slope***	**Low estimated blood lead level (ug/dL)**	**High estimated blood lead level (ug/dL)**
Outdoor air *	0.1 µg/m³	0.2 µg/m³	0.33	2.46	3.04	0.08	0.2
Indoor air *	0.3 µg/m³	0.6 µg/m³	0.33	2.46	3.04	0.2	0.6
Food*	5 µg/day	5 µg/day	0.33	0.24	0.24	0.4	0.4
Water*	4 µg/liter	4 µg/liter	0.33	0.16	0.16	0.2	0.2
Soil	6800 mg/kg	6800 mg/kg	0.33	0.002	0.016	4.5	35.9
Dust	6800 mg/kg	6800 mg/kg	0.33	0.004	0.004	9.0	9.0
						14.4	**46.3**

† Estimated using methodology in ATSDR 2005c
ug/dL = micrograms lead per deciliter blood
* Default value from ATSDR 2005c

Table 4. Estimated† Blood Lead Level from Exposure to Garden Mall Court Subdivision Soils With Average Lead Levels

Source of lead exposure	**Low estimated concen-tration ***	**High estimated concen-tration***	**Exposure tme (fraction of day)***	**Low estimated slope***	**High estimated slope***	**Low estimated blood lead level (ug/dL)**	**High estimated blood lead level (ug/dL)**
Outdoor air *	0.1 µg/m^3	0.2 µg/m^3	0.33	2.46	3.04	0.08	0.2
Indoor air*	0.3 µg/m^3	0.6 µg/m^3	0.33	2.46	3.04	0.2	0.6
Food*	5 µg/day	5 µg/day	0.33	0.24	0.24	0.4	0.4
Water*	4 µg/liter	4 µg/liter	0.33	0.16	0.16	0.2	0.2
Soil	243.4 mg/kg	243.4 mg/kg	0.33	0.002	0.016	0.2	1.3
Dust	243.4 mg/kg	243.4 mg/kg	0.33	0.004	0.004	0.3	0.3
						1.4	**3.0**

† Estimated using methodology in ATSDR 2005c
ug/dL = micrograms lead per deciliter blood
* Default value from ATSDR 2005c

Table 5. Contaminants of Concern in Surface Water

Contaminants of Concern	Highest Concentration (ug/L)	MCL/HAL (ug/L)	ATSDR Screening Value child/adult (ug/L)
Antimony	1.24	6	100,000/400,000 (Int. EMEG)
Arsenic	5.58	10	3/10 (Chr. EMEG)
Lead	0.531	15	NA

ug/L= Micrograms per Liter
EMEG = Environmental Media Evaluation Guide
Chr = Chronic exposure length of more than 365 days
Int = Intermediate exposure length of 15 to 364 days
NA = Not Available

Table 6. Estimated Maximum Drinking Dose from Surface Water

Contaminants of Concern (maximum concentration) (ug/L)	Oral MRL (mg/kg/day)	Estimated Drinking Dose* (mg/kg/day)
		Adult
Arsenic	0.0003	0.000003

MRL = 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 noncancer health effects over a specified duration of exposure
Chr = Chronic exposure length of more than 365 days
Int = Intermediate exposure length of 15 to 364 days
Acu = Acute exposure length of less than 14 days
mg/kg/day = milligram chemical per kilogram body weight per day
* = Risk Assistant was used to calculate estimated ingestion dose and estimated inhalation concentration

Table 7. Contaminants of Concern in River Sediments

Contaminants of Concern	Highest Concentration (mg/kg)	Florida DEP Residential SCTL (mg/kg)	ATSDR Screening Value (mg/kg) Child/adult
Antimony	165	8.7	20/300 (Int. RMEG)
Arsenic	2120	8	0.5 CREG
Lead	4560	400	NA
Mercury	0.683	3	NA

mg/kg = milligrams per kilogram
SCTL = Florida DEP Soil Concentration Target Level
PAHs = Polycyclic Aromatic Hydrocarbons
TRPH = Total Recoverable Petroleum Hydrocarbons
CREG = Cancer Risk Evaluation Guide
EMEG = Environmental Media Evaluation Guide
RMEG = Reference Dose (from EPA) Media Evaluation Guide
NA = Not Available
Source: [BBL 2006, DEP 2004, EST 2005, PSI 2005, Tetra Tech 2004, Tetra Tech 2005]

Table 8. Estimated Maximum Dose from Exposure to River Sediments

Contaminant of Concern (maximum concentration) (mg/kg)	Oral MRL (mg/kg/day)	Estimated Maximum Soil Ingestion Dose (mg/kg/day)		Dermal MRL (mg/kg/day)	Estimated Dermal Dose (mg/kg/day)
		Child	Adult		Child and Adult
Antimony	0.0004 EPA RfD			None	0.0003
Arsenic	0.0003 Chr		0.0012	None	0.004
Lead	None	NA*	NA*	None	0.008
Mercury	None	.000009	0.000003	None	0.000001

MRL = 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 noncancer health effects over a specified duration of exposure
mg/kg = milligrams per kilogram
RfD = Reference Dose
Chr = Chronic exposure length of more than 365 days
mg/kg/day = milligram chemical per kilogram body weight per day mg/m3 = milligram of chemical per cubic meter of air
* Please see Table 9 for Blood Lead Level estimates

Table 9. IEUBK Estimated Blood Lead Level from Exposure to River Sediments With Maximum Lead Levels

Source of lead exposure	Low estimated concen-tration *	High estimated concen-tration*	Exposure time (fraction of day)	Low estimated slope*	High estimated slope*	Low estimated blood lead level (ug/dL)	High estimated blood lead level (ug/dL)
Outdoor air*	0.1 μg/m^3	0.2 μg/m^3	0.33	2.46	3.04	0.08	0.2
Indoor air*	0.3 μg/m^3	0.6 μg/m^3	0.33	2.46	3.04	0.2	0.6
Food*	5 μg/day	5 μg/day	0.33	0.24	0.24	0.4	0.4
Water*	4 μg/liter	4 μg/liter	0.33	0.16	0.16	0.2	0.2
Soil	4560 mg/kg	4560 mg/kg	0.33	0.002	0.016	3.0	24.1
Dust	4560 mg/kg	4560 mg/kg	0.33	0.004	0.004	6.0	6.0
						10.0	31.5

† Estimated using methodology in ATSDR 2005c
ug/dL = micrograms lead per deciliter blood
* Default value from ATSDR 2005c

Table 10. IEUBK Estimated Blood Lead Level from Exposure to River Sediments With Average Lead Levels

Source of lead exposure	Low estimated concen-tration *	High estimated concen-tration*	Exposure Time (fraction of day)*	Low estimated slope*	High estimated slope*	Low estimated blood lead level (ug/dL)	High estimated blood lead level (ug/dL)
Outdoor air*	0.1 µg/m^3	0.2 µg/m^3	0.33	2.46	3.04	0.08	0.2
Indoor air*	0.3 µg/m^3	0.6 µg/m^3	0.33	2.46	3.04	0.2	0.6
Food*	5 µg/day	5 µg/day	0.33	0.24	0.24	0.4	0.4
Water*	4 µg/liter	4 µg/liter	0.33	0.16	0.16	0.2	0.2
Soil	438 mg/kg	438 mg/kg	0.33	0.002	0.016	0.3	2.3
Dust	438 mg/kg	438mg/kg	0.33	0.004	0.004	0.6	0.6
						1.8	4.3

[†] Estimated using methodology in ATSDR 2005c
ug/dL = micrograms lead per deciliter blood
* Default value from ATSDR 2005c

Table 11. Model Parameters and Assumptions for Tables 1-9.

Exposure Medium: **Groundwater**
Exposure Point: **On-site tap water**
Scenario Time frame: Future
Land Use Conditions: Residential

Receptor Population: **Residents**
These doses were calculated using Risk Assistant software by Hampshire Research Institute, Version 2.0. The part of this software Florida DOH uses allows us to set custom exposures that we can use for every site with accepted values for groundwater consumption, shower inhalation exposure and dermal exposure parameters (EPA, 1991).
The following doses were calculated using the following values:

Adult body weight-	70 kg
Child body weight-	15 kg
Adult water consumption-	2 liters/day
Child water consumption-	1 liter/day
Adult shower time-	0.2 hours
Adult inhalation rate-	1.6 m^3/hr
Child inhalation rate-	2.0 m^3/hr
Adult skin surface area-	23,000cm2
Child skin surface area-	7,200cm^2

* The air concentration is given in milligrams per cubic meter because the values for inhalation studies in most of the Toxicological Profiles are given in these units. The air concentration is not a dose, therefore it is the same for adults and children.

µg/L = microgram per liter of water
mg/kg/day = milligrams per kilogram body weight per day
mg/^{M3} = milligrams per cubic meter

N.D.- Not detected
N.A.- Not applicable
N.S.- Not significant

Exposure Medium: Soil
Exposure Point: **On-site soil and dust**
Scenario Time frame: Future
Land Use Conditions: Residential

Receptor Population: **Residents**
These doses were calculated using Risk Assistant software and accepted values for soil consumption, dust inhalation exposure and dermal exposure parameters (EPA, 1991).

The following doses were calculated using the following values:

Adult body weight-	70 kg
Child body weight-	15 kg
Adult soil consumption-	100 mg/day
Child soil consumption-	200 mg/day
Adult/Child shower time-	0.2 hours
Adult skin surface area-	23,000cm^2
Child skin surface area-	7,200cm^2

* The air concentration is given in milligrams per cubic meter because the values for inhalation studies in most of the Toxicological Profiles are given in these units. The air concentration is not a dose, therefore it is the same for adults and children.
mg/kg = milligram per kilogram of soil
mg/kg/day = milligrams per kilogram body weight per day

Appendix C - Risk of Illness, Dose Response/Threshold and Uncertainty

RISK OF ILLNESS, DOSE RESPONSE/THRESHOLD, AND UNCERTAINTY IN PUBLIC HEALTH ASSESSMENTS

Risk of Illness

In this public health assessment, the risk of illness is the chance that exposure to a hazardous contaminant is associated with a harmful health effect or illness. The risk of illness is not a measure of cause and effect-only an in-depth health study can identify a cause and effect relationship. Instead, Florida DOH uses the risk of illness to decide if the site needs a follow-up health study and to identify possible associations.

The greater the exposure to a hazardous contaminant (dose), the greater the risk of illness. The amount of a substance required to harm a person's health (toxicity) also determines the risk of illness. Exposure to a hazardous contaminant above a minimum level increases everyone's risk of illness. Only in unusual circumstances, however, do many persons become ill.

Information from human studies provides the strongest evidence that exposure to a hazardous contaminant is related to a particular illness. Some of this evidence comes from doctors reporting an unusual incidence of a specific illness in exposed individuals. More formal studies compare illnesses in people with different levels of exposure. Nevertheless, human information is very limited for most hazardous contaminants, and scientists must frequently depend upon data from animal studies. Hazardous contaminants associated with harmful health effects in humans are often associated with harmful health effects in other animal species. There are limits, however, to relying only on animal studies. For example, scientists have found some hazardous contaminants are associated with cancer in animals, but lack evidence of a similar association in humans. In addition, humans and animals have differing abilities to protect themselves against low levels of contaminants, and most animal studies test only the possible health effects of high exposure levels. Consequently, the possible effects on humans of low-level exposure to hazardous contaminants are uncertain when information comes solely from animal experiments.

Dose Response/Thresholds

The focus of toxicological studies in humans or animals is identification of the relationship between exposure to different doses of a specific contaminant and the chance of having a health effect from each exposure level. This dose-response relationship provides a mathematical formula or graph used to estimate a person's risk of illness. The actual shape of the dose-response curve requires scientific knowledge of how a hazardous substance affects different cells in the human body. There is one important difference between the dose-response curves used to estimate the risk of non-cancer illnesses and those used to estimate the risk of cancer: the existence of a threshold dose. A threshold dose is the highest exposure dose at which there is no risk of illness. The dose-response curves for non-cancer illnesses include a threshold dose that is greater than zero. Scientists include a threshold dose in these models because the human body can adjust to varying amounts of cell damage without illness. The threshold dose differs for different contaminants and different exposure routes. It is estimated from information gathered in human and animal studies. By contrast, the dose-response curves used to estimate the risk of cancer assume no threshold dose (or, in other words, the cancer threshold dose is zero). This assumes a single contaminant molecule could be sufficient to cause a clinical case of cancer. Such an assumption is very conservative; indeed, many scientists also believe a threshold dose greater than zero exists for the development of cancer.

Uncertainty

All risk 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 environmental sampling and analysis, exposure parameter estimates, use of modeled data, and present toxicological knowledge. These uncertainties can cause risk to be overestimated or underestimated. Because of the uncertainties described below, this public health assessment does not represent an absolute estimate of risk to persons exposed to chemicals at or near the former American Beryllium site.

Environmental chemistry analysis errors can arise from random errors in the sampling and analytical processes, resulting in either an over- or underestimation of risk. Increasing the number of samples collected/analyzed and sampling the same locations over several different periods can control these errors to some extent. These actions tend to minimize any uncertainty caused by random sampling errors.

Two areas of uncertainty affect exposure parameter estimates. The first is the exposure-point concentration estimate. The second is the estimate of the total chemical exposures. In this assessment maximum detected concentrations were used as the exposure point concentration. Using the maximum measured value is considered appropriate because one cannot be certain of the peak contaminant concentrations, and cannot statistically predict peak values. Nevertheless, this assumption introduces uncertainty into the risk assessment that could over or underestimate the actual risk of illness. When selecting parameter values to estimate exposure dose, default assumptions and values within the ranges recommended by the ATSDR or the EPA were used. These default assumptions and values are conservative (health protective) and can contribute to the overestimation of risk of illness. Similarly, the maximum exposure period was assumed to have occurred regularly for each selected pathway. Both assumptions are likely to contribute to the overestimation of risk of illness.

There are also data gaps and uncertainties in the design, extrapolation, and interpretation of toxicological experimental studies. Data gaps contribute uncertainty because information is either not available or is addressed qualitatively. Moreover, the available information on the interaction among chemicals found at the site, when present, is qualitative; that is, a description instead of a number-a mathematical formula cannot be applied to estimate the dose. These data gaps can tend to underestimate the actual risk of illness. In addition, there are great uncertainties in extrapolating from high to low doses, and from animal to human populations. Extrapolating from animals to humans is uncertain because of the differences in the uptake, metabolism, distribution, and body organ susceptibility between different species. Human populations are also variable because of differences in genetic makeup, diet, home and occupational environment, activity patterns, and other factors. These uncertainties can result in an over or underestimation of risk of illness. Finally, there are great uncertainties in extrapolating from high doses to low doses, and controversy in interpreting these results. Because the models used to estimate dose-response relationships in experimental studies are conservative, they tend to overestimate the risk. Techniques used to derive acceptable exposure levels account for such variables by using safety factors. Currently, there is much debate in the scientific community about the extent to which the actual risks are overestimated and what the resultant risk estimates really mean.

Appendix D: Response to Public Comment

In September 2007, the Florida Department of Health (DOH) solicited public comment on the draft public health assessment by mailing a 2-page summary, with comment form to area residents. In October, Florida DOH received written comments from two area residents and a phone call from a third. In November, Florida DOH received one set of comments from the Florida Department of Environmental Protection. The following summarizes these comments and responses by Florida DOH.

Comment #1: A few years ago, the Environmental Protection Agency (EPA) took a soil sample from my yard but didn't notify me of the results.

Response: Florida DOH forwarded this comment to the EPA for response.

Comment #2: Can the signs warning of contaminated water on Inglis Avenue opposite River Coast Reality be removed?

Response: Florida DOH does not expect exposure to contaminants in the soil, sediments, and surface water to cause illness in residents living in the Garden Mall Court Subdivision. Florida DOH characterizes the former Barker Chemical Company site as no apparent public health hazard. Florida DOH forwarded this comment to the EPA and asked them to reconsider their sign.

Comment #3: I am disappointed that the report was unable to demonstrate a link between environmental contamination, my illnesses, and my son's illnesses.

Response: At the time they were tested, the levels of chemicals in both sediments and river water are not expected to cause any of the reported symptoms during the short exposure duration experienced by the resident and his son. Contaminant concentrations in the past, however, may have been different.

Comment #4: Page 2 of the report erroneously reports that EPA cleaned up residential soil to Florida DEP standards.

Response: Florida DOH revised Page 2 to state that EPA cleaned up residential soil to EPA standards.

Comment #5: The report contains references to a community in Manatee County.

Response: Florida DOH edited the report to remove references to the community in Manatee County.

Appendix E: Glossary of Environmental Health Terms

Absorption: How a chemical enters a person's blood after the chemical has been swallowed, has come into contact with the skin, or has been breathed in.

Acute Exposure: Contact with a chemical that happens once or only for a limited period of time. ATSDR defines acute exposures as those that might last up to 14 days.

Adverse Health Effect: A change in body function or the structures of cells that can lead to disease or health problems.

ATSDR: The **A**gency for **T**oxic **S**ubstances and **D**isease **R**egistry. ATSDR is a federal health agency in Atlanta, Georgia, that deals with hazardous substance and waste site issues. ATSDR gives people information about harmful chemicals in their environment and tells people how to protect themselves from coming into contact with chemicals.

Background Level: An average or expected amount of a chemical in a specific environment. Or, amounts of chemicals that occur naturally in a specific-environment.

Biota: Used in public health, things that humans would eat B including animals, fish, and plants.

Cancer: A group of diseases that occur when cells in the body become abnormal and grow, or multiply, out of control.

Carcinogen: Any substance shown to cause tumors or cancer in experimental studies.

CERCLA: See **C**omprehensive **E**nvironmental **R**esponse, **C**ompensation, and **L**iability **A**ct.

Chronic Exposure: A contact with a substance or chemical that happens over a long period of time. ATSDR considers exposures of more than one year to be *chronic*.

Completed Exposure Pathway: See **Exposure Pathway**.

Comparison Value: **(CVs)** Concentrations or the amount of substances in air, water, food, and soil that are unlikely, upon exposure, to cause adverse health effects. Comparison values are used by health assessors to select which substances and environmental media (air, water, food and soil) need additional evaluation while health concerns or effects are investigated.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA): **CERCLA** was put into place in 1980. It is also known as **Superfund**. This act concerns releases of hazardous substances into the environment, and the cleanup of these substances and hazardous waste sites. ATSDR was created by this act and is responsible for looking into the health issues related to hazardous waste sites.

Concern: A belief or worry that chemicals in the environment might cause harm to people.

Concentration: How much or the amount of a substance present in a certain amount of soil, water, air, or food.

Contaminant: See **Environmental Contaminant**.

Dermal Contact: A chemical getting onto your skin. (see **Route of Exposure**).

Dose: The amount of a substance to which a person may be exposed, usually on a daily basis. Dose is often explained as "amount of substance(s) per body weight per day".

Dose / Response: The relationship between the amount of exposure (dose) and the change in body function or health that result.

Duration: The amount of time (days, months, years) that a person is exposed to a chemical.

Environmental Contaminant: A substance (chemical) that gets into a system (person, animal, or the environment) in amounts higher than that found in **Background Level**, or what would be expected.

Environmental Media: Usually refers to the air, water, and soil in which chemicals of interest are found. Sometimes refers to the plants and animals that are eaten by humans. **Environmental Media** is the second part of an **Exposure Pathway**.

U.S. Environmental Protection Agency (EPA): The federal agency that develops and enforces environmental laws to protect the environment and the public's health.

Epidemiology: The study of the different factors that determine how often, in how many people, and in which people will disease occur.

Exposure: Coming into contact with a chemical substance.(For the three ways people can come in contact with substances, see **Route of Exposure**.)

Exposure Assessment: The process of finding the ways people come in contact with chemicals, how often and how long they come in contact with chemicals, and the amounts of chemicals with which they come in contact.

Exposure Pathway: A description of the way that a chemical moves from its source (where it began) to where and how people can come into contact with (or get exposed to) the chemical.

ATSDR defines an exposure pathway as having 5 parts:

- Source of Contamination,
- Environmental Media and Transport Mechanism,
- Point of Exposure,
- Route of Exposure, and
- Receptor Population.

When all 5 parts of an exposure pathway are present, it is called a **Completed Exposure Pathway**. Each of these 5 terms is defined in this Glossary.

Frequency: How often a person is exposed to a chemical over time; for example, every day, once a week, twice a month.

Hazardous Waste: Substances that have been released or thrown away into the environment and, under certain conditions, could be harmful to people who come into contact with them.

Health Effect: ATSDR deals only with **Adverse Health Effects** (see definition in this Glossary).

Indeterminate Public Health Hazard: The category is used in Public Health Assessment documents for sites where important information is lacking (missing or has not yet been gathered) about site-related chemical exposures.

Ingestion: Swallowing something, as in eating or drinking. It is a way a chemical can enter your body (See **Route of Exposure**).

Inhalation: Breathing. It is a way a chemical can enter your body (See **Route of Exposure**).

LOAEL: **L**owest **O**bserved **A**dverse **E**ffect **L**evel. The lowest dose of a chemical in a study, or group of studies, that has caused harmful health effects in people or animals.

MRL: **M**inimal **R**isk **L**evel. An estimate of daily human exposure B by a specified route and length of time -- to a dose of chemical that is likely to be without a measurable risk of adverse, noncancerous effects. An MRL should not be used as a predictor of adverse health effects.

NPL: The **N**ational **P**riorities **L**ist. (Which is part of **Superfund**.) A list kept by the U.S. Environmental Protection Agency (EPA) of the most serious, uncontrolled or abandoned hazardous waste sites in the country. An NPL site needs to be cleaned up or is being looked at to see if people can be exposed to chemicals from the site.

NOAEL: **N**o **O**bserved **A**dverse **E**ffect **L**evel. The highest dose of a chemical in a study, or group of studies, that did not cause harmful health effects in people or animals.

No Apparent Public Health Hazard: The category is used in ATSDR's Public Health Assessment documents for sites where exposure to site-related chemicals may have occurred in the past or is still occurring but the exposures are not at levels expected to cause adverse health effects.

No Public Health Hazard: The category is used in ATSDR's Public Health Assessment documents for sites where there is evidence of an absence of exposure to site-related chemicals.

PHA: **P**ublic **H**ealth **A**ssessment. A report or document that looks at chemicals at a hazardous waste site and tells if people could be harmed from coming into contact with those chemicals. The PHA also tells if possible further public health actions are needed.

Plume: A line or column of air or water containing chemicals moving from the source to areas further away. A plume can be a column or clouds of smoke from a chimney or contaminated groundwater sources or contaminated surface water (such as lakes, ponds and streams).

Point of Exposure: The place where someone can come into contact with a contaminated environmental medium (air, water, food or soil). For examples: the area of a playground that has contaminated dirt, a contaminated spring used for drinking water, the location where fruits or vegetables are grown in contaminated soil, or the backyard area where someone might breathe contaminated air.

Population: A group of people living in a certain area; or the number of people in a certain area.

PRP: **P**otentially **R**esponsible **P**arty. A company, government or person that is responsible for causing the pollution at a hazardous waste site. PRP's are expected to help pay for the clean up of a site.

Public Health Assessment(s): See **PHA**.

Public Health Hazard: The category is used in PHAs for sites that have certain physical features or evidence of chronic, site-related chemical exposure that could result in adverse health effects.

Public Health Hazard Criteria: PHA categories given to a site, which tell whether people could be harmed by conditions present at the site. Each are defined in the Glossary. The categories are:

- Urgent Public Health Hazard
- Public Health Hazard
- Indeterminate Public Health Hazard
- No Apparent Public Health Hazard
- No Public Health Hazard

Receptor Population: People who live or work in the path of one or more chemicals, and who could come into contact with them (See **Exposure Pathway**).

Reference Dose (RfD): An estimate, with safety factors (see **safety factor**) built in, of the daily, lifetime exposure of human populations to a possible hazard that is <u>not</u> likely to cause harm to the person.

Route of Exposure: The way a chemical can get into a person's body. There are three exposure routes:

- breathing (also called inhalation),
- eating or drinking (also called ingestion), and
- or getting something on the skin (also called dermal contact).

Safety Factor: Also called **Uncertainty Factor**. When scientists don't have enough information to decide if an exposure will cause harm to people, they use "safety factors" and formulas in place of the information that is not known. These factors and formulas can help determine the amount of a chemical that is <u>not</u> likely to cause harm to people.

SARA: The **S**uperfund **A**mendments and **R**eauthorization **A**ct in 1986 amended CERCLA and expanded the health-related responsibilities of ATSDR. CERCLA and SARA direct ATSDR to look into the health effects from chemical exposures at hazardous waste sites.

Sample Size: The number of people that are needed for a health study.

Sample: A small number of people chosen from a larger population (See **Population**).

Source (of Contamination): The place where a chemical comes from, such as a landfill, pond, creek, incinerator, tank, or drum. Contaminant source is the first part of an **Exposure Pathway**.

Special Populations: People who may be more sensitive to chemical exposures because of certain factors such as age, a disease they already have, occupation, sex, or certain behaviors (like cigarette smoking). Children, pregnant women, and older people are often considered special populations.

Superfund Site: See **NPL**.

Survey: A way to collect information or data from a group of people (**population**). Surveys can be done by phone, mail, or in person. ATSDR cannot do surveys of more than nine people without approval from the U.S. Department of Health and Human Services.

Toxic: Harmful. Any substance or chemical can be toxic at a certain dose (amount). The dose is what determines the potential harm of a chemical and whether it would cause someone to get sick.

Toxicology: The study of the harmful effects of chemicals on humans or animals.

Urgent Public Health Hazard: This category is used in ATSDR's Public Health Assessment documents for sites that have certain physical features or evidence of short-term (less than 1 year), site-related chemical exposure that could result in adverse health effects and require quick intervention to stop people from being exposed.

Certification

The Florida Department of Health (DOH0, Office of Environmental and Occupational Toxicology 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 thc 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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