HEALTH CONSULTATION

Mill View Subdivision

Port St. Joe, Gulf County, Florida

EPAID#FLN000407304

Prepared by:
Florida Department of Health,
Bureau of Community Environmental Health
Under Cooperative Agreement with
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 (DOH's) evaluation of additional data for the Mill View subdivision in Port St. Joe, Florida. A site evaluation prepared by the US Environmental Protection Agency's contractor, Weston Solutions, Inc. served as the basis for this report. The Florida DOH also reviewed data supplied by George C. Flowers, Ph.D., a consultant to the law firm representing some community members.

- *Evaluating exposure:* The Florida DOH scientists begin by reviewing additional available information about environmental conditions in the subdivision. These data add to our understanding of how much contamination is present, where it is in the subdivision, and how people's exposures might occur. Usually, the Florida DOH does not collect its own environmental sampling data. We rely on information provided by the Florida Department of Environmental Protection (DEP), the U.S. Environmental Protection Agency (EPA), and other government agencies, private businesses, and the public.
- *Evaluating health effects:* If there is evidence that exposures to hazardous substances are currently occurring or are likely to occur, the Florida DOH scientists will determine whether that exposure could be harmful to human health. Our report focuses on public health; that is, the health impact on the community as a whole, and existing scientific information is its basis.
- *Developing recommendations:* In this health consultation, the Florida DOH outlines its conclusions regarding potential health threats posed by a 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 EPA and the Florida DEP—to take. If, however, a 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. Florida DOH shares any conclusions about the site with the groups and organizations providing the information. Once an evaluation report has been prepared, 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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Summary and Statement of Issues

In this health consultation, the Florida Department of Health (DOH) evaluates the public health threat from chemicals measured by the US Environmental Protection Agency's (EPA) contractor, Weston, in Mill View subdivision soil, groundwater, and surface water samples (Weston 2003). We also evaluate additional soil metals data compiled by George C. Flowers, Ph.D., the consultant working for the community's law firm (Flowers 2004).

In 1938, the St. Joe Paper Company began paper mill operations in Port St. Joe, Florida (Figure 1). The Florida Department of Environmental Protection (DEP) found that from the 1940s to the early 1950s, the St. Joe Paper Company filled a canal and wetlands areas east of the paper mill with paper mill wastes (Figure 2). These wastes included tree bark, boiler ash, small pieces of limestone called "lime grits", and slag. In the mid-1950s, St. Joe Paper Company sold properties, including this filled area, for what became the Mill View Subdivision West (Figure 1).

After reviewing all of the available environmental data, Florida DOH concludes that soil, surface water, sediment, and groundwater in the Mill View subdivision pose no apparent public health hazard. However, the use of waste as fill in the Mill View subdivision has resulted in subsidence. This subsidence has caused structural damage to homes and in some cases has allowed access to insects, birds, rodents and other potential disease vectors. Subsidence has also broken water and wastewater pipelines, and has the potential to break natural gas pipes.

The agencies that conducted site assessments for the western Mill View neighborhood measured arsenic, polychlorinated biphenyls (PCBs), and vanadium in soil slightly above chronic and intermediate minimum risk levels set to protect sensitive populations. They measured lead in soil above the Florida Residential Soil Target Cleanup Level. While these levels are unlikely to cause illness, Mill View residents should follow "good gardening practices" to reduce their potential for exposure to these and other fill material chemicals. Lack of air monitoring data prevents assessment of the health risk from past exposures to airborne contaminants from the former St. Joe paper mill and other nearby industrial sources.

Florida DOH recommends Mill View residents in houses with cracking walls and foundations use flexible piping and connections for water, wastewater, and gas. Residents in houses with cracking walls and foundations should also repair openings to prevent entrance of insects, birds, rodents and other potential disease vectors. Mill View residents should follow "good gardening practices" to reduce possible exposures to fill chemicals.

As we do for all instances where the available information on past exposures is incomplete, the Florida DOH recommends people should see their doctor if they feel ill. This is especially important for people who may have contacted airborne contaminants from the former St. Joe paper mill and other nearby industrial sources. Florida DOH does not have information on the sources of contamination persons in Mill View could have contacted in addition to fill material in their yards.

Purpose

The Florida DOH evaluates the public health significance of hazardous waste sites through a cooperative agreement with the federal Agency for Toxic Substances and Disease Registry (ATSDR) in Atlanta, Georgia. In November 2003, the EPA asked the Florida DOH to review

and comment on their 2002 sampling results in the Preliminary Assessment/Site Inspection Report (Weston 2003). This health consultation report also reviews soil samples collected, analyzed, and evaluated on the community's behalf by a private contractor (Flowers 2004). These data sets augment the sampling information collected by the Florida DEP in 2001 and 2002, especially away from the Chickenhouse Branch fill area.

Background

In 1938, the St. Joe Paper Company began its Gulf of Mexico paper mill operations in Port St. Joe, Florida (Figure 1). From the 1940s to the early 1950s, the St. Joe Paper Company filled the Chickenhouse Branch and wetlands east of the paper mill with paper mill wastes (Figure 2). These wastes included tree bark, boiler ash, "lime grits" (small pieces of limestone) and slag. One Mill View resident reported the St. Joe Paper Company disposed of a large volume of "white liquor" mixed with wood chips in the Chickenhouse Branch wetlands (Tracy Moye, personal communication, 2001). This liquid was most likely a combination of lime mud ($CaCO_3$), grits (non-reactive glass-like material), and dregs (insoluble materials such as unburned carbon, calcium, and iron compounds) mixed with weak, green, and white liquors (Debra Gable 2004, ATSDR engineer and Technical Project Officer, personal communication).

In the mid-1950s, St. Joe Paper Company sold these filled areas for home sites as part of the Mill View Subdivision West (Figure 2). Some Mill View residents reported adding soil to their properties to fill holes, to raise the level of the land before building, and to grow lawns. Recent sampling has shown, however, that clean cover of the waste material is thin or non-existent in some areas. Dr. Flowers sampled soil from 50 fire ant mounds. His work shows that activities of ants and other burrowing animals bring buried materials to the surface in areas of cover (Flowers 2004). In August 2001, the Florida DEP reported five residences had gardens in or near the former Chickenhouse Branch fill area.

During the 1980s, St. Joe Paper Company filled a second wetlands area with limey clay, soil, and wood chips. The building of the second phase of the residential development, Mill View Subdivision East, occurred over part of this second filled area (Figure 2). Subsidence in these two areas has caused cracked walls (Photograph 1) and broken sewer lines in some homes. To avoid an explosion risk, the gas company discontinued service to one home (ATSDR 2001a).

In 1990, the Florida DEP found arsenic and solvents in groundwater beneath the Apalachicola Northern Railroad property, south of Mill View Subdivision West (Figure 1). The Florida DEP identified Chickenhouse Branch fill as a possible source of the arsenic groundwater contamination.

Data from the Florida DEP's investigation of the neighborhood fill material, shallow groundwater, and surface water served as the basis for the Florida DOH's initial health consultation report for this community. DEP analyzed these samples for five metals. In Florida DOH's first health consultation (released October 21, 2001), we recommended additional groundwater and soil testing for additional chemicals related to pulp and paper manufacture (ATSDR 2001).

In 2001 and 2002, the Florida DEP took additional soil and surface and groundwater samples. They analyzed these samples for additional metals, volatile organic compounds, semivolatile organic compounds, and polychlorinated biphenyls. The Florida DOH's second Health Consultation, released in May 2003, evaluated these additional 2001 and 2002 Florida DEP data

(ATSDR 2003). In this latest health consultation, the Florida Department of Health (DOH) evaluates the public health threat from chemicals measured by the US Environmental Protection Agency's (EPA) contractor, Weston, in Mill View subdivision soil, groundwater, and surface water samples (Weston 2003). We also evaluate additional soil metals data compiled by George C. Flowers, Ph.D., the consultant working for the community's law firm (Flowers 2004).

Site Description and History

The two parts of the Mill View subdivision ("the site") cover 520 acres (Figure 2) (Weston 2003). In the western part, the subdivision has 447 acres. The remaining 73 acres are in the newer part of the subdivision known locally as "Lizville," located to the east and separated by an area of undeveloped land.

The northern and central areas of western Mill View (along Avenue F and Battles Street) are within the 100-year flood plain. Areas along Avenue A, B, and C in the south-central part of the subdivision are within the 500-year flood plain.

On October 17, 2001, Florida DOH staff visited the site and talked with residents. Residents were concerned with area flooding. They were also concerned with land subsidence causing shifting of houses, steps, driveways, and carport slabs. Because of severe subsidence and the risk of broken gas lines/explosion, the gas company terminated service to one house. Without gas for heating, cooking, and hot water, this house became uninhabitable.

Demographics

In 2000, about 341 people lived within a 1/2-mile radius of the center of the western part of the site. Approximately 95% were black or African American, 5% percent were white, and one person (less than 1% of the total) was American Indian or Alaskan native. Within a 1.5-mile radius of the center of western Mill View, the total population was about 2,867. About 61% were white, 37% were black or African American, about 1 % were two or more races, about 1% were Hispanic or Latino, and less than 1% were American Indian, and Alaskan Native (LandView®5, 2000 US Census).

Land Use

Land use near the Mill View subdivision includes (Figure 2):

- To the north: undeveloped wooded land, railroad spurs, Arizona Chemical Company, and the Port St. Joe (former) Well Field and Wastewater Treatment Plant,
- To the west: Highway 98, the former paper mill, and St. Joe Bay
- To the southwest: Apalachicola Northern Railroad, Port St. Joe residences, commercial properties, and a marina.
- To the east: undeveloped wooded land.

A north-south rail spur and wetland area separates the Mill View subdivision into two parts. West of this division is a former school. A park, a community garden, and community center with a gymnasium and adult education center now operate on the former school property. While most of the subdivision is residential, businesses, churches, and daycare centers are also present. Many of the yards in the neighborhood are not fenced.

Natural Resource Use

People boat, swim, fish, and harvest shellfish in nearby St. Joe Bay and the Gulf of Mexico. St. Joe Peninsula State Park is across the bay from the town of Port St. Joe. A dredged shipping channel leads from the Gulf of Mexico to the former St. Joe paper mill. The Gulf County Canal north of the Mill View subdivision connects St. Joe Bay to the Intercoastal Waterway.

Because municipal water supplies are available, shallow groundwater under the subdivision is not a current or potential source of drinking water. Prior to 2001, the City of Port St. Joe used four 150-400 feet deep municipal wells on the City's wastewater treatment property. The wells were less than ¼-mile from an unlined sludge lagoon. In 2001, the City of Port St. Joe switched to surface water from the Gulf County Canal.

Community Health Concerns

A long-time resident of Port St. Joe is concerned about rates of cancer, lupus, chronic obstructive pulmonary disease, asthma, heart disease, and diabetes in Gulf County. She is also concerned about relative reproductive health effect rates, birth defect rates, and cleanup of St. Joe Bay (Blackwell 2000, 2001).

The Florida DOH held two public meetings in the community on February 16, 2002 to discuss the findings of their initial health consultation and gather health concerns. Thirty-five residents attended the meetings and reported the following health concerns:

- Heart disease,
- Babies born with cleft palate and hydrocephalus,
- Bone cancer and heart attack,
- Sinus (nasal) infections and headaches,
- Illness and death from exposures to chemicals in the garden soil,
- Cancer, diabetes, high blood pressure, and aching knees,
- Breast cancer, diabetes, diabetes related eye problems, arthritis, and
- Parathyroidism resulting in partial removal of the parathyroid gland

Mill View residents were also concerned about the possible health effects from exposure to arsenic in soil.

Discussion of Environmental Contamination

In this report, the Florida DOH reviews analytical data from soil, surface water, and groundwater samples collected November 19-21, 2002 in western Mill View by the EPA's contractor Weston Solutions, Inc. (Weston 2003). The EPA carried out this preliminary assessment/site investigation to address data gaps in the Florida DEP's investigations. In this report, the Florida DOH also reviews analytical data from soil samples collected by George C. Flowers, Ph.D., a consultant for the community's law firm of Levin, Papantonio, Thomas, Mitchell, Echsner, and Proctor, PA (Flowers 2004).

We evaluated the available data by considering the following factors:

1. Concentrations of contaminants found on the site. The Florida DOH eliminates contaminants from further consideration only if background concentrations and on-site concentrations are both below standard comparison values established by the ATSDR and the Florida DEP.
2. Field-data quality, laboratory-data quality, and sample design.
3. Community health concerns. These are concerns expressed by members of the nearby community about possible adverse health effects from exposure to site contaminants.
4. Comparisons of the maximum concentrations of contaminants identified at the site to ATSDR standard comparison values for contaminated environmental media for which a completed exposure pathway, or potential exposure pathway, is found to exist at the site. Standard comparison values are specific to the type of environmental media (water, soil, sediment) that is contaminated. We use these standard comparison values to select site contaminants for further evaluation. The Florida DOH does not use these values to predict health effects or to establish clean-up levels. We evaluate the contaminant further when media concentrations are above the ATSDR's standard comparison values. This does not necessarily mean that a contaminant represents a health risk. The Florida DOH does not evaluate site contaminants further if they fall below an ATSDR chemical-specific standard comparison value and consequently are unlikely to be associated with illness. The Florida DOH also evaluates a contaminant further if the community has expressed a specific concern about it.
5. Comparisons of maximum site concentrations found in completed and potential exposure pathways to toxicological information published in ATSDR's chemical-specific Toxicological Profiles (http://www.atsdr.cdc.gov/toxpro2.html#-A-). These chemical-specific profiles summarize information about the toxicity of chemicals from the scientific literature.

The Florida DOH used the following standard comparison values, in order of priority, to select the 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). We calculate CREGs from the EPA-established cancer slope factor (ATSDR 2004).
2. Environmental Media Evaluation Guide (EMEG). We derive an EMEG from the ATSDR-established Minimal Risk Level (MRL), using standard exposure assumptions (e.g., ingestion of 2 liters of water per day and body weight of 70 kg. for adults). Chronic MRLs are estimated 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 (ATSDR 2004).
3. Soil Cleanup Target Levels (SCTLs). In absence of the above criteria, we used Florida DEP soil cleanup target levels (SCTLs) (Florida DEP 1999, 2002a).

Identification of a contaminant of concern in this section of the report does not necessarily mean that exposure to the contaminant is likely to cause illness. Identification of contaminants of concern helps narrow the focus of the public health assessment to those contaminants that pose a potential public health risk to area residents.

The Florida DOH lists the contaminants measured above screening values for each investigation in separate tables, and then lists the highest measured values from all the investigations. Tables

4, 5, and 6 summarize the intervals sampled and the analyses performed by the Florida DEP, the EPA and Dr. Flowers. Table 7 contains the soil concentrations measured by the EPA. Tables 8 and 9 contain the contaminant concentrations measured by Dr. Flowers, and the Florida DEP, respectively. Table10 summarizes the highest levels of chemicals measured above screening values in all of the investigations. The chemicals measured above their screening values include arsenic, barium, copper, dieldrin, dioxin Toxicity Equivalence (TEQs–Table 3), lead, mercury, N-nitroso di-n-propylamine, polycyclic aromatic hydrocarbons (PAH) TEQs (Table 2), polychlorinated biphenyls (PCBs), and vanadium.

The Florida DOH did not differentiate soil depths with the Florida DEP's data or the new data evaluated in this assessment. All the material was brought in and was likely mixed as the material was spread, so there was no reason to treat chemical concentrations as if they were related to one another, or were otherwise stratified as commonly occurs on sites with dumped or spilled hazardous waste.

Soil Samples

Sample Descriptions

In 2002, the Florida DEP collected soil samples in 54 different locations in Mill View: 47 in the western part, and seven in the eastern (newer) part.

In 2003, the EPA collected:

- 24 surface samples (0–6") including one background and two duplicate samples, and
- 24 subsurface samples (12–24"), including one background and two duplicate samples.

EPA's contract lab analyzed these soil samples for target analyte list metals and cyanide, target compound list volatile organic compounds, pesticides, and polychlorinated biphenyls. They analyzed ten surface soil samples for dioxin and furan congeners; MA-01-SS, MA-04-SS, MA-05-SS, MA-08-SS, MA-10-SS, MA-12-SS, MA-17-SS, MA-20-SS, MA-23-SS.

In August and November 2003, George C. Flowers, Ph.D., collected 41 subsurface soil samples (average 10.6 inches deep) and 115 surface soil samples (0 to 2 inches deep) in the Mill View west subdivision. Fifty of these surface soil samples were from ant piles. In January 2004, Dr. Flowers collected 30 background ("control") soil samples from dune fields on St. Joseph Peninsula, beach ridges north of the subdivision, and streets in Port St. Joe (25 samples were 0–2", two were 18–20", two were 12–14", one was 6–8" below land surface). Severn Trent laboratory analyzed these samples for metals. They analyzed:

- the 41 subsurface soil samples for arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver,
- the 115 surface soil samples for arsenic and lead, and
- the 30 control samples for arsenic and lead.

The Florida DOH received data summary tables with Dr. Flowers' report. We were not able to address data quality issues for these data because the report did not list data qualifiers and we did not receive the original laboratory reports.

Soil Sample Results

Florida DEP found arsenic, polycyclic aromatic hydrocarbons, and polychlorinated biphenyls were present above health-based screening levels. The additional studies by EPA's contractor and Dr. Flowers found higher levels of arsenic, barium, copper, dieldrin, TEQ dioxins, lead, mercury, n-nitro di-n-propylamine, and vanadium than the Florida DEP found. Tables 4, 5, and 6 summarize the analyses performed on the different soil samples.

Dr. Flowers work suggests ants bring buried contaminated soil to the surface.

Surface Water Samples

Sample Descriptions:

EPA's contractor, Weston, collected four surface water samples from the perennial drainage pathway that transects the western part of the subdivision (the former location of Chickenhouse Branch). These four samples included one background sample and one duplicate sample. Water travels through an underground culvert, under most of western Mill View. Weston took a sample from a ditch along the southern part of the subdivision and from the natural creek bed north of the subdivision.

Sample Results:

Weston considered the southern ditch surface water a background sample. However, the proximity of the southern ditch to the Apalachicola Northern Railroad Property could explain why their lab measured lead at 28 micrograms per liter (µg/L) in surface water from the southern ditch. Lead was the only chemical measured above its primary drinking water standard (15 µg/L) in all four surface water samples. They did not detect any volatile organic chemicals (VOCs), semivolatile organic chemicals (SVOCs), pesticides, or polychlorinated biphenyls (PCBs) in the surface water.

All surface water samples exceeded the secondary drinking water standard for iron. Surface water from both non-background sample locations also exceeded the secondary standard for manganese, while the background and one other surface water sample exceeded the secondary standard for aluminum. Secondary standards address acceptable taste and odor standards for drinking water. Aluminum, iron, and manganese levels in surface water do not exceed health-based screening levels. In addition, no one in the Mill View subdivision is using the Chickenhouse Branch surface water as a drinking water source.

Groundwater Samples

Sample Descriptions:

EPA's contractor, Weston, collected five groundwater samples from temporary monitoring wells, including one background well.

Sample Results:

Florida DEP found three monitoring wells that contained sodium above the drinking water standard. Use of sodium hydroxide at the St. Joe paper mill could be responsible for the basic (high) pH levels found in some wells. Florida DEP measured lead at 109µg/L in groundwater from one irrigation well; this level is above the drinking water standard (15 µg/L). Florida DEP

found very low levels of dioxins and furans in one groundwater sample; however, the laboratory blank also contained dioxins and furans, indicating laboratory contamination.

Like the Florida DEP, EPA's contractor, Weston, found relatively little groundwater contamination. Weston found elevated sodium, but none above the drinking water standard. Regardless of the source of sodium and lead, no one in the Mill View Subdivision West or East is using either surface water or groundwater as drinking water.

Sediment Samples

Weston collected four sediment samples from the northern and southern ends of the perennial drainage pathway that transects the western part of the subdivision (the former location of Chickenhouse Branch). These samples included one background sample and one duplicate sample. They did not detect any metals, VOCs, SVOCs, pesticides, or PCBs above their screening levels in sediments. They measured environmentally persistent pesticides (chlordane and DDT derivatives) in trace amounts. However, they measured these pesticides at levels less than the health-based screening values.

Quality Assurance and Quality Control – The Florida DOH used EPA's contractor, Weston, and Severn Trent Laboratory data to prepare this public health assessment. We assumed that these data are valid. The completeness and reliability of the referenced environmental data determine the validity of the analyses and conclusions drawn for this public health assessment. Some of the EPA contract laboratory data had qualifiers; **J** indicates that qualitative analysis was acceptable. **J** also indicates the lab estimated a quantitative value. The Florida DOH evaluated **J**-modified values. **N** indicates presumptive evidence, the chemical was only tentatively identified; its detection cannot be considered a positive indication of its presence and the Florida DOH did not evaluate these values. **U** indicates that the Florida DOH did not detect a chemical; however, the reported value is the lab-derived sample quantitative limit for the constituent in that sample. **JN** indicates that EPA did not have the chemical on the target compound list. **JN** also indicates that the lab tentatively identified a chemical, and estimated its quantity. The lab rejected **R**-values, and the Florida DOH did not use **R**-qualified data. The contract lab confirmed **C** values by gas chromatography or mass spectrometry; both are alternate laboratory instrument methods.

The Severn Trent data were available only in summary data tables; data qualifier values were not included.

Exposure Pathways

Most chemical contaminants in the environment will only harm people through direct exposure. It is essential to determine or estimate the frequency of contact people could have with hazardous substances in their environment in order to assess the public health significance of the contaminants.

Soil in the Mill View Subdivisions is a mixture of paper mill waste, fill, and native soil. Thus, the Florida DOH assessed the potential public health threat from exposure to all soil samples regardless of depth. Mill View residents could have accidentally eaten small amounts of contaminated soil from their hands or from homegrown vegetables. Residents could also have breathed contaminated dust from this soil.

Some of the persons living in the neighborhood could have had past exposure to arsenic, lead PCBs, and vanadium in soil, in addition to other chemicals from airborne emissions. They may also have had exposures to these and other chemicals from working at the mill, or from parents who worked at the mill and brought materials home on their clothing. Air and work-related exposure routes might also be attributable to current and past industrial businesses including but not limited to: Allied Chemical, Corp., Amerada-Hess, Amoco S/S, Arizona Chemical Company, Apalachicola Northern Railroad, Combustion Engineering, Inc., Miller Agency, Inc., Raffield Shipbuilders and Dry Dock, Sing Food Store, St. Joseph Land and Development, Co., and St. Joseph Telephone and Telegraph Company. Florida DOH found these sites on an EPA database, so these businesses are either currently located nearby, or were located nearby in the recent past.

Public Health Implications

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 1992, EPA 1997). We assume that people ingest, inhale or have dermal contact daily to/with the maximum concentration measured at the site. ATSDR's toxicological profiles on contaminants separate exposures into three exposure routes - inhalation, ingestion, and dermal (skin) exposure. For each of these exposure routes, ATSDR also groups health effects by duration (period) 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's Toxicological Profiles also provide information on the environmental transport and regulatory status of contaminants.

To estimate exposure from incidental ingestion of contaminated soil, the Florida DOH used the following assumptions (EPA 1997):

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.

Health Risk from Soil

The values given on the page before Table 11 list the exposure parameters used in estimating the daily doses for each exposure scenario. For soil exposures, we estimate the doses for incidental ingestion of soil and inhalation of dusts. In Table 11, we highlight doses that exceed the minimal risk level or MRL. Only arsenic, PCB, and vanadium doses calculated for children exceeded their respective MRLs. Lead is a special case and does not have an MRL. Table 12 compares the doses calculated for *all the chemicals measured above their screening values* and compares our calculated doses (using the highest measured levels) with the lowest doses associated with the health effects in animal and human medical studies (the sensitive doses). In this section, we only discuss the potential health effects of four chemicals: arsenic, lead, vanadium, and PCBs.

Table 12 compares the doses calculated from the highest measured chemical values to Minimum Risk Levels (MRLs). MRLs are conservative estimates of daily human exposure (doses) to a contaminant, below which, noncancerous illnesses are unlikely to occur. ATSDR bases their MRL calculations on animal studies and human medical reports. They use conservative exposure assumptions to calculate MRLs because the goal of the MRL is to protect public health. MRLs may exist for different routes of exposure, such as ingestion and inhalation, or for different lengths of exposure, such as acute (less than 14 days), intermediate (15 to 364 days), and chronic (greater than 365 days). ATSDR has prepared Toxicological Profiles for some chemicals, which provide information on the health effects, environmental transport, human exposure, and regulatory status of chemicals.

In the following paragraphs, the Florida DOH evaluates the doses we calculated for soil contaminants that occurred above their MRLs (and lead). We used the highest measured levels for each chemical and standard exposure assumptions to calculate doses for daily, long-term exposures.

Arsenic—accidentally ingesting contaminated soil or inhaling contaminated dust with the highest measured level of arsenic will not likely cause non-cancer illness. Arsenic levels were measured above the screening value ATSDR sets for children (for non-cancer health effects) at only four sample locations. Accidentally ingesting contaminated soil or inhaling contaminated dust with the highest measured arsenic concentration could increase the theoretically cancer risk by five cases in 100,000. Five cases in 100,000 are between the values ATSDR describes as "low" and "no apparent" increased risk. Because the number of known areas with elevated arsenic levels is small (four), it is possible that people may not be exposed daily, therefore the theoretical increased risk of cancer could be even less.

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 (haemangioendothe-

lioma), 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 cancer cells live only in the outermost or epidermis layer of the skin. Pre-invasive cancer cells can spread along the skin surface and they are unlikely to have spread to the lymph nodes. If left untreated, these cells can develop into an invasive cancer and spread into the lymphatic system.

Lead—estimated blood levels more accurately predict health effects than traditional dose estimates. The Florida DOH used a simple model to estimate blood lead levels and likely health effects for exposures to the highest measured levels of lead in soil (ATSDR 1999). This model takes into account children's and adults' exposures to lead from sources other than soil. The model assumes people's exposures to lead-contaminated soil occur for eight hours per day at the highest measured levels. Estimated blood lead concentrations range from 2.5 to 6.7 micrograms per deciliter (µg/dL) for children (Table 13) and 1.9 to 6.3 µg/dL (Table 14) for adults.

Many studies have documented the effects of lead exposures in people. These effects often occur over a range of levels based on lead measured in test subjects' blood. The following table lists those studies for which the known blood lead ranges overlap the ranges we estimated for exposure to the highest measured level of lead in Mill View. However, the model is based on conservative assumptions and may not represent actual exposure. Information about the assumptions used as a basis for the model can be found in Tables 13 and 14 in Appendix B.

Table 1: Possible Health Effects at Blood Lead Levels of 1.9 to 6.7 µg/dL

Children's Blood Lead Levels (µg/dL)	Adults' Blood Lead Levels (µg/dL)	Possible Health Effects
No threshold	**3 - 56**	Decreased aminolevulinic acid dehydratase (ALAD) enzyme activity. ALAD is necessary for hemoglobin synthesis. A large decrease in ALAD activity can lead to anemia.
1 - 17	—	Alterations in visual evoked potentials[1].
6.5	—	(Average value at 24 months of age) - Lower cognitive function test scores in children 5 to 10 years of age.
6 - 200	—	Decreased neurobehavioral function; slightly decreased performance on IQ tests and other measures of neuro-psychological function.
—	**5.5 (average)**	Decreased performance on neurobehavioral tests.

µg/dL = micrograms per deciliter Source: ATSDR 1999a

Lead in the bloodstream can interfere with the body's ability to make new red blood cells (ATSDR 1999). Too few red blood cells (anemia) mean the body's uptake of energy from food and oxygen from air is less efficient. Medical studies show the processes leading to anemia occur at all levels of lead exposure: there is no known threshold for this effect. There also may be no threshold for adverse neurological effects with children's exposure to lead which may affect

1The visual evoked potential measures the electrical response of the brain's primary visual cortex to a visual stimulus.

intelligence, balance, hearing, attention deficit/hyper-activity disorder, and alterations in visual evoked potentials as described in Table 1 (ATSDR 2002). However, as with arsenic, children and adults in Mill View may not have accidentally eaten soil every day, and the highest levels measured may be out of the ordinary (the various investigations measured lead levels above 400 mg/kg in only three out of 307 samples or less than 1%).

Vanadium—accidentally ingesting contaminated soil or inhaling contaminated dust with the highest measured level of vanadium will not likely cause non-cancer illness. The child ingestion dose is 15 times less than the No Observed Adverse Effect Level in a rat study associating mild bleeding in the kidneys (renal hemorrhagic foci) with exposure to sodium metavanadate for three months. Animal studies and human medical case studies are insufficient for evaluating the carcinogenicity of vanadium (ATSDR 1992b).

Polychlorinated Biphenyls (PCBs)—Laboratories measure PCBs as concentrations of various mixtures. Two different laboratories measured the PCB mixtures known as "Arochlor-1260" in the western fill area. Accidentally ingesting contaminated soil or inhaling contaminated dust with the highest measured concentration of Arochlor-1260 will not likely cause non-cancer illness (ATSDR 2000b). The child ingestion dose is 55 times less than the dose associated with elevated and separated toenails and immune system effects in animal studies of primates given PCBs in their food, for longer than a year. Additionally, children in Mill View may not accidentally eat soil every day and the highest levels measured are out of the ordinary (PCB levels above 0.4 mg/kg [DEP's residential Soil Cleanup Target Level]) were only measured in four out of 88 samples, or about 4.5%).

While accidentally ingesting contaminated soil or inhaling contaminated dust with the highest measured concentration of Arochlor 1260 increases the theoretical cancer risk, the level estimated for ingestion (for children) would be an increase of two theoretical cases in 100,000. ATSDR describes one increased case in 100,000 as "no apparent" increased risk. The level estimated for ingestion (for adults) is an increase of eight theoretical cases in 1 million people, which falls between the levels ATSDR describes as "no apparent" and "insignificant" increased risks. Because the number of known areas with elevated PCB levels is small (four), it is possible that people may not be exposed daily, therefore the theoretical increased risk of cancer could be even less.

In other communities, ATSDR has recommended residents not garden in soils having PCBs greater than 10 milligrams per kilogram (mg/kg) or parts per million (ppm). In soils having between 1 and 10 mg/kg PCBs, the ATSDR recommends "good gardening practices" (the following information was obtained from John Wheeler, ATSDR toxicologist, personal communication 2002). Figure 3 shows the locations, depths, and values of PCBs measured above the MRL. MA-17 contained PCBs at 3.2 and 4.1 mg/kg in duplicate soil samples collected from 6 inches to 1 below the surface. MV-42 contained PCBs at 1.3 mg/kg in a soil sample collected 2 to 3 feet below the surface. MV-6 contained PCBs at 6.9 mg/kg in a soil sample collected from 2.5 to 3.5 feet below the surface. Although these data do not indicate widespread PCB contamination in soil people are likely to come in daily contact with, until more is known about the locations and levels of fill contamination, residents using "good gardening practices" will be taking precautionary measures. Using "good gardening practices" could also reduce community members' potential exposures to other contaminants in the fill material.

Good Gardening Practices:

- ☑ Add clean compost or soil to your garden.
- ☑ Be sure phosphate and pH levels do not fall below recommended values. Your county extension office can help evaluate your soil.
- ☑ Avoid dust. You can do this by using mulches and not gardening in dry soil on windy days.
- ☑ Don't eat and drink while in the garden.
- ☑ Limit intake of homegrown root crops, especially carrots. Root crops, in addition to dirt adhering to them, could take up PCBs under certain conditions. Crops that form above the ground are much less likely to contain PCBs. A layer of cells in roots stops PCBs from being transported into the rest of the plant. Residents can avoid any chemicals in the fill by growing root vegetables in raised beds containing only clean topsoil (not paper mill waste fill).
- ☑ Wash leafy vegetables that grow close to the ground (like collard greens) because contaminated soil can adhere to the large surface areas of such plants. Adding a little vinegar to the wash water will help remove dirt and contamination.

When coming in the house from working in the garden:

- ☑ Remove shoes before entering the house.
- ☑ Wash your hands.
- ☑ Wash dirty clothing.

The Florida DOH recommends Mill View residents follow these "good gardening practices" to reduce contact with contaminated soil but still allow the enjoyment and convenience of homegrown fruits and vegetables.

Health Risk from Surface Water and Groundwater

No one in the Mill View Subdivision West or East is using either the surface water or shallow groundwater beneath the subdivision as a source of drinking water. Nonetheless, the Florida DOH evaluated the Florida DEP and the EPA test results from groundwater and surface water.

In four surface water samples from the ditch south of the subdivision, lead was the only chemical above a primary drinking water standard. Weston (2003) measured lead at 28 micrograms per liter (µg/L). The primary drinking water standard for lead is 15 µg/L. The Florida DEP also found lead in a groundwater sample from an irrigation well at 109 µg/L. This is above the primary drinking water standard of 15 µg/L. Lead in water from this irrigation well is unlikely to accumulate to levels in plants that would cause illness.

Child Health Considerations

The ATSDR and the Florida DOH recognize the unique vulnerabilities of infants and children demand special attention (ATSDR, 1998). Children are at a greater risk than adults are for certain kinds of exposure to hazardous substances. Children tend to receive more exposures to contaminants in the environment because they play outdoors and because they often carry food into contaminated areas. Children are shorter than adults are. Therefore, 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.

In recognition of these concerns, the Florida DOH used chemical screening values that the ATSDR developed for children's exposures in preparing this report. Therefore, these screening values would be protective of any children that might live in the neighborhood.

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 (including cigarette smoke or alcohol). These factors may limit a persons' ability to detoxify or excrete harmful chemicals or may increase the effects of damage to their organs or systems.

Evaluation of Health Concerns and Health Outcome Data

Based on what is currently known, the concentrations of contaminants measured in Mill View soil, surface water, or groundwater are not likely to have caused the illnesses reported by residents. Lack of air monitoring data prevents an assessment of the health risk from inhalation of air pollutants from the former paper mill and other nearby industrial sources.

In 2002, the estimated diabetes rate in Gulf County was statistically higher than the state rate (Dr. Schlottman, personal communication, August 2004). In 2002, the estimated diabetes rate in Gulf County was 11.1 percent (95% confidence intervals 5.7% to 16.5%) and the diabetes rate for the entire state was 7.6 % (95% confidence intervals 6.8% to 8.4%)**.**

Florida DOH compared Gulf County cancer rates with statewide rates. For the entire period cancer data are available (1981 to 2000), both liver and total age-adjusted cancer rates were lower in Gulf County rates for all Florida counties (Appendix C).

Age-adjusted liver cancer rates were:

- 2.4 per 100,000 for Gulf County, and
- 2.9 per 100,000 for Florida.

Age-adjusted rates for all cancers were:

- 436.7 per 100,000 for Gulf County, and
- 464.9 per 100,000 for Florida.

Trends for the 1981-1999 reported cancers show similar values (Appendix C).

Age-adjusted liver cancer rates were:
- 1.8 per 100,000 for Gulf County, and
- 2.60 per 100,000 for Florida.

Age-adjusted rates for all cancers were:
- 429.82 per 100,000 for Gulf County, and
- 456.69 per 100,000 for Florida.

In summary, these Florida Cancer Data System values indicate liver and total cancer age-adjusted rates are lower in Gulf County than all Florida Counties, for the periods of 1981 to 2000, and 1981 to 1999.

Conclusions

The levels of chemicals measured in soil, surface water, sediments, and groundwater in the western Mill View subdivision pose no apparent public health hazard. Specific conclusions follow:

1. Disposal of waste from the former St. Joe paper mill in the Mill View subdivision has caused land subsidence. This subsidence has caused structural damage to homes and in some instances has allowed access to insects, birds, rodents and other potential disease vectors. Subsidence has also broken water, wastewater, and has the potential to break natural gas pipes.

2. Agencies and contractors assessing the soil and fill in the Mill View neighborhood measured arsenic, polychlorinated biphenyls (PCBs), and vanadium above the minimum risk levels and lead above the Florida DEP residential Soil Target Cleanup Level. These levels, however, are not likely to cause noncancer illness. PCBs were measured at levels for which the ATSDR has recommended "good gardening practices" in other communities.

3. Although levels of sodium in shallow groundwater under the Mill View subdivision are above drinking water standards, this groundwater is not a source of drinking water. Use of shallow groundwater to irrigate lawns and gardens is not likely to cause illness.

4. Lack of air monitoring data prevents assessment of the health risk from past exposures to airborne contaminants from the former St. Joe paper mill and other nearby industrial sources.

5. Accidental ingestion of small amounts of soil or drainage ditch sediments in the Mill View subdivision is not likely to cause illness. Likewise, inhalation of dust from soil in the Mill View subdivision is not likely to cause illness.

6. In 2002, the estimated Gulf County rates of diabetes was statistically higher than the state rate. The total age-adjusted cancer rate for the 1981-1999 time period was lower for Gulf County than for all Florida counties.

Recommendations

Florida DOH's recommendations parallel our numbered conclusions:

1. Mill View residents in houses with cracking walls and foundations should use flexible connections for water, wastewater, and gas. Residents in houses with cracking walls and foundations should also repair openings to prevent entrance of insects, birds, rodents and other potential disease vectors.

2. Mill View residents should follow "good gardening practices" to reduce their potential for exposure to arsenic, lead, PCBs, vanadium and other fill chemicals until more is known about the locations and levels of fill contamination. "Good gardening practices" include using clean soil and compost, adjusting soil phosphate and pH levels, suppressing dust formation, avoiding food and drink while gardening, limiting carrots and other root crops, washing leafy vegetables before eating, leaving gardening shoes outside, and washing hands and gardening clothes.

3. Mill View residents should continue to use municipal water for drinking and other household uses and should not use shallow groundwater as a drinking water source.

4. As we do for all instances where the available information on past exposures is incomplete, the Florida DOH recommends people should see their doctor if they feel ill. This is especially important for people who may have contacted airborne contaminants from the former St. Joe paper mill and other nearby industrial sources. Florida DOH does not have information on any other sources of contamination persons in Mill View may have contacted in addition to data on fill material in their yards and limited surface and groundwater data.

Public Health Action Plan

1. The Florida DOH will review any new data on chemicals in soil and groundwater.

2. The Florida DOH will inform and educate nearby residents about its public health findings.

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Appendix A Figures

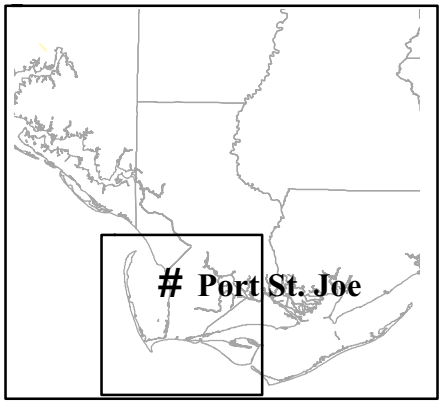

Figure 1: Mill View Subdivision
Location Map
Port St. Joe, Gulf County, Florida

N
W E
S

FLORIDA

Figure 2: 1999 Aerial Photography, Locations Approximate

N
W E
S

0 0.05 0.1 0.2 0.3 0.4
Miles

FLORIDA DEPARTMENT OF HEALTH

Figure 3: Chemicals measured in soil (in mg/kg) that exceeded Minimum Risk Levels, and lead above the DEP Soil Target Cleanup Levels. MA data are from EPA 2002, MV data are from DEP 2002, M and E data are from Flowers.

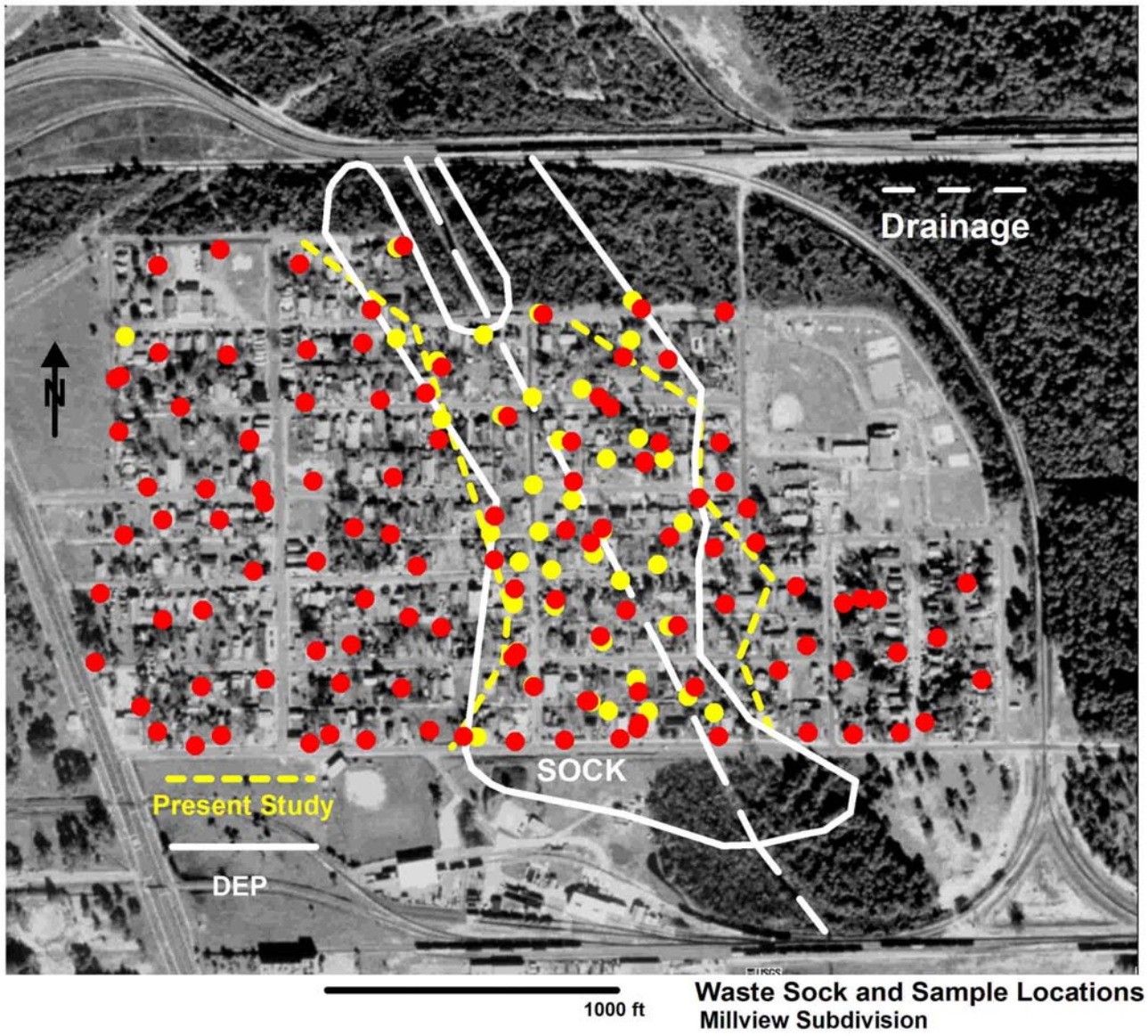

Figure 4: This is Fig 18. in Dr. Flowers' report. Surface (red) and subsurface (yellow) sample stations for soil samples. The sock outline as determined by a former mill employee, is indicated by the yellow dashed line.

Appendix B - Tables

Table 2: TEQs for PAHs

Analytical results are multiplied by the following factors and then added together to obtain one number to be compared with the screening value for Benzo[a]pyrene, the EPA adds half the detection level for all carcinogenic PAHs, if any carcinogenic PAHs are detected.

PAH	Toxicity Equivalency Factor
Dibenz[a,h]anthracene	5
Benzo[a]pyrene	1
Benzo[a]anthracene	0.1
Benzo[b]fluoranthene	0.1
Benzo[k]fluoranthene	0.1
Indeno[1,2,3-c,d]pyrene	0.1
Anthracene	0.01
Benzo[g,h,i]perylene	0.01
Chrysene	0.01
Acenaphthene	0.001
Acenaphthylene	0.001
Fluoranthene	0.001
Fluorene	0.001
Phenanthrene	0.001
Pyrene	0.001

Source: ATSDR 1995.

Table 3: TEQs for Dioxins/Furans

Analytical results are multiplied by the following factors and then added together to obtain one number to be compared with the screening value for 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD), the EPA adds half the detection level for all congeners, if any congeners are detected.

Dioxin/Furan	Toxicity Equivalency Factor
2,3,7,8-TCDD	1
1,2,3,7,8-PeCDD	1
1,2,3,4,7,8-HxCDD	0.1
1,2,3,6,7,8-HxCDD	0.1
1,2,3,7,8,9-HxCDD	0.1
1,2,3,4,6,7,8-HpCDD	0.01
OCDD	0.0001
2,3,7,8-TCDF	0.1
1,2,3,7,8-PeCDF	0.05
2,3,4,7,8-PeCDF	0.5
1,2,3,4,7,8-HxCDF	0.1
1,2,3,6,7,8-HxCDF	0.1
1,2,3,7,8,9-HxCDF	0.1
2,3,4,6,7,8-HxCDF	0.1
1,2,3,4,6,7,8-HpCDF	0.01
1,2,3,4,7,8,9-HpCDF	0.01
OCDF	0.0001

Source: WHO 1998.

Table 4: DEP intervals sampled and analyses performed

Study/Location (MV samples)	Samples analyzed for **As, Cd, Ni, Pb**	Samples analyzed for **Ba, Ca, Fe, K, Mg, Mn, Na and VOCs**	Samples analyzed for **SVOCs (PAHs) and PCBs**	Samples analyzed for **dioxins**
DEP **Surface Soil** inside fill area, ***west***	2, 3, 6, 7, 9, 10, 12, 13, 15, 16, 18, 19, 21, 22, 24, 25, 27, 29, 31, 36, 43	43	Scrape 18, Scrape 42, 43	
DEP **Surface Soil** outside fill area, ***west***	1, 4, 5, 8, 11, 14, 17, 20, 23, 26, 28, 30, 32, 33, 34, 35,			
DEP **Subsurface Soil** inside fill area, ***west***	2, 3, 3, 6, 6, 7, 9, 10, 12, 12, 13, 15, 15, 16, 16, 18, 19, 19, 19A, 21, 22, 24, 25, 25, 27, 29, 31, 36, 36A, 37, 38, 39, 40, 41, 42, 44, 45, 46	19/19A, 36, 36A, 37, 38, 39, 40, 41, 42, 44, 45, 46	3, 6, 9, 12, 13, 15, 16, 19A, 21, 22, 24, 25, 29, 36, 36A, 37, 38, 39, 40, 41, 42, 44, 45, 46,	38, 42, 44
DEP **Subsurface Soil** outside fill area, ***west***	1, 4, 5, 8, 11, 14, 17, 20, 23, 26, 28, 30, 32, 33, 34, 35,		14, 17, 20, 23, 26, 33,	
DEP **Surface soil** inside fill area, ***east***	49	49	49	
DEP **Surface soil** outside fill area, ***east***	48, 50, 51, 52, 53, 54	48, 50, 51, 52, 53, 54	48, 50, 51, 52, 53, 54	48, 50, 52
DEP **Subsurface** soil inside fill area, ***east***				
DEP **Subsurface** soil outside fill area, ***east***	47	47	47	47

SVOCs = semivolatile organic chemicals PAHs = polycyclic aromatic hydrocarbons

PCBs = polychlorinated biphenyls

Source: DEP 2002a

Table 5: EPA's contractor, Weston, intervals sampled and analyses performed

Study/Location (MA samples)	Samples analyzed for **TAL metals** and **cyanide, VOCs, SVOCs (PAHs), pesticides,** and **PCBs**	Samples analyzed for **dioxins**
EPA **Surface Soil**	MA-01-SS (bkg), MA-02 through 024-SS; MA-17-SS and MA-18-SS, had duplicates run	MA-01-SS (bkg), MA-04-22, MA-05-SS, MA-08-SS, MA-10-SS, MA-12-SS, MA-17-SS, MA-20-SS, MA-23-SS
EPA **Subsurface Soil**	MA-01-SB (bkg), MA-02 through 024-SB; MA-17-SB and MA-18-SB, had duplicates run	

SVOCs = semivolatile organic chemicals PAHs = polycyclic aromatic hydrocarbons

PCBs = polychlorinated biphenyls

Source: Weston 2003

Table 6: Dr. Flowers intervals sampled and analyses performed

Study/Location (M samples)	Samples analyzed for **RCRA metals (arsenic, barium, cadmium, chromium, lead, selenium, and silver**) and mercury	Samples analyzed for **arsenic and lead**
Flowers **Surface soil samples**		M138 through M239 Control locations E5 through E22 and C1 through C25
Flowers **Subsurface samples**	M101 through M137 (reported arsenic, lead and mercury) Control locations E1-E4	

Source: Flowers 2004

Table 7. Soil Concentrations for Contaminants of Concern, samples taken by Weston Solutions, Inc. for the EPA

Contaminants of Concern	Screening Value (mg/kg) ATSDR: Child/Adult	DEP:	Highest Soil Concentration (mg/kg)	Location of Highest Concentration	Number Soil Samples Above Screening Value
arsenic	0.5 CREG	2.1 draft SCTL**	19	MA-17-SB	8/46, 5/46
barium	4,000/50,000 RMEG	120 SCTL***	340	MA-17-SB	0/46, 4/46
copper		150 SCTL***	520	MA-17-SB	1/46
dieldrin	0.04 CREG	0.06 SCTL	0.13	MA-17D-SS	1/46, 1/46
dioxin TEQ	0.00005/0.0007 EMEG	0.000007 SCTL	0.000038J	MA-12-SS	0/46, 3/46
lead		400 SCTL	800	MA-17D-SS	1/46
n-nitroso di-n-propylamine	0.1 CREG		0.18J	MA-12-SB	1/46
PAH TEQ	0.1 CREG		0.6	MA-18D-SS/24-SB	6/46
PCBs (Arochlor-1260)	0.4 CREG		4.1	MA-17D-SS	2/46
vanadium	Int. EMEG 200/2,000	51 SCTL	1,100	MA-17-SB	1/46, 2/46

CREG—ATSDR's Cancer Risk Evaluation Guide for 1 excess cancer case in 1 million people (ATSDR 1992a).
Int. EMEG—Environmental Media Evaluation Guide for exposures lasting 15-364 days.
mg/kg—milligrams per kilogram
PAHs—polycyclic aromatic hydrocarbons
PCBs—polychlorinated biphenyls, neither ATSDR nor FDEP has a screening value for Arochlor 1260 alone.
RMEG—ATDR's Reference Dose Environmental Media Evaluation Guide
SCTL—FDEP's Soil Target Cleanup Level for residential land uses.
**DEP's 1x 10^{-6} excess Cancer Risk Evaluation Guide for arsenic is 0.8 mg/kg. DEP is proposing to increase the $1x10^{-6}$ excess cancer risks to 2.1 mg/kg. DEP bases this factor on primate and hog bioavailability studies that give factors of 1/3 and 1/4 for actual bodily uptake of arsenic from ingested sources.
***DEP's direct exposure Residential Soil Target Cleanup Level, based on acute toxicity considerations (for barium, this value is based on soluble barium salts).

Table 8. Soil Concentrations for Contaminants of Concern, Dr. Flowers for Levin et al.

Contaminants of Concern	*Screening Value (mg/kg)* *ATSDR:*	*DEP:*	*Highest Soil Concentration (mg/kg)*	*Location of Highest Concentration*	*Number Soil Samples Above Screening Value*
arsenic	0.5 CREG	2.1 *draft SCTL***	53	M149	89/166, 31/166
lead		400 SCTL****	610	E22	3/166
mercury		3 SCTL****	25	M132	1/41

CREG—ATSDR's Cancer Risk Evaluation Guide for 1 excess cancer case in 1 million people (ATSDR 1992a).
mg/kg—milligrams per kilogram
PAHs—polycyclic aromatic hydrocarbons
PCBs—polychlorinated biphenyls, neither ATSDR nor FDEP has a screening value for Arochlor 1260 alone.
RMEG—Reference Dose Environmental Media Evaluation Guide
SCTL—FDEP's Soil Target Cleanup Level for residential land use.
**DEP's 1x 10^{-6} excess Cancer Risk Evaluation Guide for arsenic is 0.8 mg/kg. DEP is proposing to increase the $1x10^{-6}$ excess cancer risks to 2.1 mg/kg. DEP bases this factor on primate and hog bioavailability studies that give factors of 1/3 and 1/4 for actual bodily uptake of arsenic from ingested sources.
***DEP's direct exposure Residential Soil Target Cleanup Level, based on acute toxicity considerations (for barium, this value is based on soluble barium salts).

Arsenic values measured above 20 mg/kg—M211 (33 mg/kg), E14 (43 mg/kg), M202 (47 mg/kg), and M140 (53 mg/kg).
Lead values measured above 400 mg/kg—E14 (470 mg/kg), M235 (560 mg/kg), and E22 (610 mg/kg).

Table 9. Soil Concentrations for Contaminants of Concern, initial data collected by Florida DEP

Contaminants of Concern	*Screening Value (mg/kg)* *ATSDR:*	*DEP:*	*Highest Soil Concentration (mg/kg)*	*Location of Highest Concentration*	*Number Soil Samples Above Screening Value*
arsenic	0.5 CREG	2.1 draft SCTL**	10.6	MV19	38/95, 9/95
barium	4,000/50,000 RMEG	120*** SCTL	304	MV40 3-4’	0/42, 2/42
PAHs	0.1 CREG*		3.5	MV36A	7/42
PCBs	0.4 CREG*		6.9	MV6	2/42

CREG—ATSDR’s Cancer Risk Evaluation Guide for 1 excess cancer case in 1 million people (ATSDR 1992a).
mg/kg—milligrams per kilogram
PAHs—polycyclic aromatic hydrocarbons
PCBs—polychlorinated biphenyls, neither ATSDR nor FDEP has a screening value for Arochlor 1260 alone.
SCTL—FDEP’s Soil Target Cleanup Level for residential land use.
**DEP’s 1x 10^{-6} excess Cancer Risk Evaluation Guide for arsenic is 0.8 mg/kg. DEP is proposing to increase the $1x10^{-6}$ excess cancer risks to 2.1 mg/kg. DEP bases this factor on primate and hog bioavailability studies that give factors of 1/3 and 1/4 for actual bodily uptake of arsenic from ingested sources.
***DEP’s direct exposure Residential Soil Target Cleanup Level, based on acute toxicity considerations (for barium, this value is based on soluble barium salts).

Table 10. Soil Concentrations for Contaminants of Concern, combined studies

Contaminants of Concern	*Screening Value (mg/kg)* *ATSDR:*	*DEP:*	*Highest Soil Concentration (mg/kg)*	*Location of Highest Concentration*	*Number Soil Samples Above Screening Value*
arsenic	0.5 CREG	2.1 *draft SCTL***	53	M149 (Flowers)	135/307, 45/307
barium	4,000/50,000 RMEG	120*** SCTL	340	MA-17-SB (EPA)	0/88, 6/88
copper	2,000 20,000 Int. EME	150*** SCTL	520	MA-17-SB (EPA)	1/46
dieldrin	0.04 CREG	0.06 SCTL	0.13	MA-17D-SS (EPA)	1/46, 1/46
dioxin TEQ	0.00005/0.0007 EMEG	0.000007 SCTL	0.000038J	MA-12-SS (EPA)	0/46, 3/46
lead		400 SCTL	800	MA-17D-SS (EPA)	3/307
mercury		3 SCTL	25	M132 (Flowers)	1/183
n-nitroso di-n-propylamine	0.1 CREG	0.003 SCTL	0.18J	MA-12-SB (EPA)	1/88
PAHs TEQ	0.1 CREG		3.5	MV36A (FDEP)	13/88
PCBs (Arochlor-1260)	(ATSDR—Arochlor mixtures—DEP) 0.4 CREG	0.5 SCTL	6.9	MV6 (FDEP)	4/88
vanadium	Int. EMEG 200/2,000	67*** SCTL	1,100	MA-17-SB (EPA)	1/46, 2/46

CREG—ATSDR's Cancer Risk Evaluation Guide for 1 excess cancer case in 1 million people (ATSDR 1992a).
Int. EMEG—Environmental Media Evaluation Guide for exposures lasting 15-364 days.
mg/kg—milligrams per kilogram
PAHs—polycyclic aromatic hydrocarbons
PCBs—polychlorinated biphenyls, neither ATSDR nor FDEP has a screening value for Arochlor 1260 alone.
RMEG—Reference Dose Environmental Media Evaluation Guide
SCTL—FDEP's Soil Target Cleanup Level for residential land use.
**DEP's 1x 10^{-6} excess Cancer Risk Evaluation Guide for arsenic is 0.8 mg/kg. DEP is proposing to increase the $1x10^{-6}$ excess cancer risks to 2.1 mg/kg. DEP bases this factor on primate and hog bioavailability studies that give factors of 1/3 and 1/4 for actual bodily uptake of arsenic from ingested sources.
***DEP's direct exposure Residential Soil Target Cleanup Level, based on acute toxicity considerations (for barium, this value is based on soluble barium salts).

Model Parameters and Assumptions for Tables 11 and 12

Exposure Medium: **Soil**
Exposure Point: **On-site soil and dust**
Scenario Time frame: Current and 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, 1997).

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
* 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

Table 11. Estimated dose from exposure to on-site surface soil, doses calculated from highest measured levels.

Contaminant of Concern (maximum concentration) (mg/kg)	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 (53)	0.005 Prov. Acute 0.0003 Chr	0.0007	0.00008	-	0.000003
barium (340)	-	0.005	0.0005	-	0.00002
copper (520)	0.02 Acute 0.02Int.	0.007	0.0007	-	0.00003
dieldrin (0.13)	0.0001 Int.	0.000002	0.0000002	-	0.000000007
dioxin TEQ (0.000038)	0.0000002 Acute 0.00000002 Int. 0.000000001 Chr.	0.0000000005	0.00000000005	-	0.000000000002
mercury (25)	-	0.0003	0.00004	-	0.000001
n-nitroso di-n-propylamine (0.18)	0.095 Acute	0.000002	0.0000003	-	0.00000001
PAHs TEQ (3.5)	-	0.00005	0.000005	-	0.0000002
PCBs Arochlor-1260 (6.9 0)	0.00003 Int. 0.00002 Chr.	0.00009	0.00001	-	0.0000004
Vanadium 1100	0. 003 Int.	0.02	0.002	0.0002 Acute	0.00006

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 more than 14 and less than 365 days. **Acute**—Exposure length of less than 14 days. **mg/kg**—milligrams per kilogram **mg/kg/day**—milligram chemical per kilogram body weight per day **PAHs TEQ**—polycyclic aromatic hydrocarbons **mg/m3**—microgram of chemical per cubic meter of air. **MD**—Missing Data to allow calculation of estimate.

Table 12. Comparison of doses calculated from highest measured values to most sensitive effects (effects occurring at the lowest doses in animal and human medical studies). Shaded doses are above sensitive dose or minimum risk level.

Chemical	Doses are in mg/kg/day			Soil
	children's dose	adult's dose	children's theoretical increased cancer risk	adult's theoretical increased cancer risk
Arsenic	Ing 0.0007 Inh 0.000004	Ing 0.00008 Inh 0.000004	Ing 5:100,000 Inh 2:1,000,000	Ing 5:100,000 Inh 4:1,000,000
ATSDR 2000 (Update)	Child ingestion dose (0.0007) is 31 times less than the Lowest Observable Adverse Effect Level dose (0.022) associated with gastrointestinal irritation, diarrhea, nausea, skin pigmentation changes, and hyperkeratosis (dark raised spots on the skin that are possibly precancerous); persons in this study continuously ingested arsenic in their drinking water. While this level is 1.75 times greater than the (0.0004) No Observable Adverse Effect Level (NOAEL), for these health effects (same study) and 2.3 times greater than the MRL (0.0003) calculated from another NOAEL (0.0008) for adverse skin effects from long-term ingestion of arsenic in drinking water. ATSDR scientists divided this second NOEL dose (0.0008) by 3 to account for human diversity in calculating the MRL. Since the MRL was based on a NOEL, it is unlikely daily exposure at this level would cause noncancer health effects. Adult ingestion dose is 5 times less than the (0.0004) dose referenced for children, we would not expect skin or gastrointestinal health effects for most adults. Inhalation dose (0.000004) is 175 times less than the amount associated with increased risk of stillbirth in humans (0.0007) and 1,750 time less than the dose causing dermatitis (0.007) in humans inhaling arsenic. Dermatitis is skin inflammation that may cause redness, pain, and occasionally itching. 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.			
Barium	Ing 0.005 Inh 0.00002	Ing 0.0005 Inh 0.00002	No slope.	No slope.
ATSDR 1992c TP-91/03	Child ingestion dose (0.005) is 108 times less that the dose (0.54) associated with increased blood pressure in rats exposed 7 days a week for 16 months in their drinking water. However, one person drinking water with barium (0.21 mg/kg/day) for 4 weeks, seven days a week did not experience cardiac effects. Adult ingestion dose is 1,080 times less than the (0.54) sensitive dose health effects described above for children. Inhalation dose Case reports and animal studies for establishing the health effects of barium inhalation exposure are inadequate. Nonetheless, (0.00002) is 3,000 times less than the dose that caused increased blood pressure and cardiac irregularities in guinea pigs exposed for an unspecified period to aerosolized barium chloride solution. Cancer association: Animal studies and human medical case studies are insufficient for evaluating the carcinogenicity of barium via inhalation or ingestion. Animal studies involving dermal exposure to barium hydroxide from tobacco indicates barium hydroxide promotes tumor growth.			

Chemical	Doses are in mg/kg/day			Soil
	children's dose	adult's dose	children's theoretical increased cancer risk	adult's theoretical increased cancer risk
Copper	Ing 0.007 Inh 0.00003	Ing 0.0007 Inh 0.00003	No slope.	No slope.
ATSDR 2003b (Update)	Child ingestion dose (0.007) is 2.4 times less than the Lowest Observed Adverse Effect Level (0.017) for the copper dose causing nausea in a person who drank copper sulfate in water, one time. Adult ingestion dose (0.0007) is 0.0006 mg/kg/day below the (0.0013) No Observed Adverse Effect Level dose referenced for children, so nausea would not be expected. Inhalation dose (0.00003) is 4000 times less than the copper inhalation dose (0.12) associated with decreased lung bactericidal activity and 4,333 times less than the copper inhalation dose (0.13) for decreased average survival time. For both studies, mice were exposed 5 days a week for 1 to 2 weeks, 3 hours a day. Cancer association: Animal studies and occupational epidemiological studies are insufficient for evaluating the carcinogenicity of copper via inhalation or dermal exposure. Animal studies involving ingestion are limited and the significance has not been determined.			
Dieldrin	Ing 0.000002 Inh 0.000000007	Ing 0.0000002 Inh 0.000000007	Ing 1:1,000,000 Inh <1:1,000,000	Ing <1:1,000,000 Inh <1:1,000,000
ATSDR 2002b (Update)	Child ingestion dose (0.000002) is 5,000 times less the No Observed Adverse Effect Level dose (0.01) associated with learning deficits in monkeys exposed 55–109 days, once per day, 5 days a week, in food (50,000 times < learning deficit level). Adult ingestion dose (0.0000002) is 50,000 times less the (0.01) No Observed Adverse Effect Level dose health effects described above for children. Inhalation dose Information ATSDR located regarding the effects dieldrin inhalation exposures in animals was extremely limited. Many studies involved simultaneous inhalation and dermal exposure. In human case reports and occupational studies, doses were not precisely known. Associated cancers: Chronic exposure studies in mice have linked dieldrin ingestion to liver cancer.			

Chemical	Doses are in mg/kg/day Soil			
	children's dose	adult's dose	children's theoretical increased cancer risk	adult's theoretical increased cancer risk
Dioxin TEQ	Ing 0.0000000005 Inh 0.000000000002	Ing Inh 0.000000000002	No slope.	No slope.
ATSDR 1998b (Update)	Child ingestion dose (0.0000000005) is 40,000 times less than the dose (0.00000012) associated with reproductive effects (moderate endometriosis) and altered social behavior in a dioxin rhesus monkey study. The results of oral animal studies suggest that the effects that occur at the lowest levels of dioxin doses are immune, endocrine, and developmental effects. People's ingestion exposures are mainly known from low levels of food contamination. Adult ingestion dose (0.00000000005) is 400,000 times less than the (0.00000012) sensitive dose health effects described above for children. Inhalation of dioxins has not been studied in animals. People's occupational and accidental exposures to dioxin involve primarily inhalation and dermal exposure, but health effects are known primarily from associations with the levels stored in fat. The lowest levels of exposure are associated with hormone changes that can result in changes in sex ratios in children (more females are born). Higher levels are associated with immunosuppression, changes in the liver, abnormal glucose tolerance, and increased risk of diabetes. The highest exposure levels are associated with nervous system effects, chloracne, respiratory effects, and increased risk of cancer. Cancers Statistically significant increases in risks for all cancers were found in workers highly exposed to dioxins with longer latency periods. Although the estimated Standardized Mortality Ratios are low†, they are consistent across studies with the highest dioxin exposures. The evidence linking doses with site-specific cancers is weaker, with some data suggesting a possible relationship between soft-tissue sarcoma, non-Hodgkin's lymphoma, or respiratory cancer.			
Lead ATSDR 1999a	2.5-6.7 µg/dl (modeled)	1.9-6.3 µg/dl (modeled)		

† Standardized Mortality / Morbidity Ratio (SMR) is a widely used method of reporting death or disease which adjusts for differences in age and sex across regions. It is a measure of premature mortality. Instead of giving an adjusted rate, the SMR gives a ratio that is a direct comparison with a standard (e.g. the entire state).

Chemical	Doses are in mg/kg/day			Soil
	children's dose	adult's dose	children's theoretical increased cancer risk	adult's theoretical increased cancer risk
Mercury	Ing 0.0003 Inh 0.000001	Ing 0.00004 Inh 0.000001	No slope.	No slope.
ATSDR 1999b (Update)	Child ingestion dose (0.0003) is 1,866 times less than the dose (0.56) associated with kidney symptoms† in mice exposed for 10 weeks ad. lib. via drinking water. Adult ingestion dose (0.00004) is 14,000 times less than the (0.56) sensitive dose health effects described above for children. Inhalation dose (0.000001) is 14,000 times less than the dose (0.014) associated with impaired performance on neurobehavioral tests in persons exposed 0.7-24 years. Cancer association: Animal studies and human epidemiological studies for evaluating the carcinogenicity of mercury via inhalation or dermal exposure were not located. Animal studies involving ingestion exposure were equivocal.			
N-nitroso di-n-propylamine	Ing 0.04 Inh 0.0002	Ing 0.005 Inh 0.0002	Ing ~8:100,000 Inh <1:1,000,000	Ing ~8:1,000,000 Inh <1:1,000,000
ATSDR 1989	Child ingestion dose (0.04) is 65 times less than the dose (2.6) associated with esophagus and forestomach tumors in rats exposed 300 weeks, 5 days a week, via drinking water. Adult ingestion dose (0.005) is 520 times less than the (2.6) sensitive dose health effects described above for children. Inhalation dose No studies were located regarding the effects in humans or animals following inhalation exposure to N-nitroso di-n-propylamine. Cancer association: Animal studies and human epidemiological studies for evaluating the carcinogenicity of N-nitroso di-n-propylamine via inhalation or dermal exposure were not located. Animal studies involving ingestion exposure indicated forestomach and pulmonary tumors in mice, and esophagus, forestomach, liver, nasal, and esophagus tumors in rats from lowest to highest cancer effect dose.			

† The mouse kidney symptoms were increased granular IgG deposits, slight glomerular endocapillary cell hyperplasia; slight tubular atrophy, inflammation, and fibrosis.

Chemical	Doses are in mg/kg/day			Soil
	children's dose	adult's dose	children's theoretical increased cancer risk	adult's theoretical increased cancer risk
PAHs TEQ	Ing 0.00005 Inh 0.0000002	Ing 0.000005 Inh 0.0000002	Ing 1:100,000 Inh ~6:1,000,000	Ing 2:100,000 Inh ~6:1,000,000
ATSDR 1995 (Update)	Child ingestion dose (0.00005) is 52,000 times less than the dose (2.6) associated with stomach cancer in mice exposed to benzo[a]pyrene ad lib in food for 30 to 197 days. Adult ingestion dose (0.000005) is 520,000 times less than the (2.6) sensitive dose health effects described above for children. Inhalation dose (0.0000002) is 500 times less than the dose (0.0001) associated with reduced lung function, abnormal chest x-ray, cough, bloody vomit, and throat and chest irritation, in persons exposed from 6 months to 6 years. Cancer and occupational studies; Worker exposures to high levels of PAHs show cancers (skin, bladder, lung and gastrointestinal) are the most significant endpoint of PAH toxicity. Long-term worker PAH exposures have been linked with skin and eye irritation, photosensitivity, respiratory irritation (with cough and bronchitis), leukoplakia†, precancerous skin growths enhanced by exposure to sunlight, erythemaΔ, skin burns, acneiform lesions, mild hepatoxicity, and haematuria‡. Also several PAH compounds are immunotoxic, and some suppress selective compounds of the immune system. Workers' dermal exposure studies indicate that although direct contact may be of concern at high exposure levels, they do not suggest that lower levels are likely to cause significant irritation (Goodfellow et al. 2001).			

† Leukoplakia is a common, is a common, potentially pre-cancerous disease of the mouth that involves the formation of white spots on the mucous membranes of the tongue and inside of the mouth. Despite the increased risk associated with having leukoplakia, many people with this condition never get oral cancer
Δ Erythema nodosum is an inflammation of subcutaneous fat tissue.
‡ Haematuria is passage of blood in the urine.

Chemical	Doses are in mg/kg/day Soil			
	children's dose	adult's dose	children's theoretical increased cancer risk	adult's theoretical increased cancer risk
PCBs	Ing 0.00009 Inh 0.000003	Ing 0.00001 Inh 0.000003	Ing 2:100,000 Inh. No slope.	Ing 8:1,000,000 Inh. No slope.
ATSDR 2000b (Update)	Child ingestion dose (0.00009) is 55 times less than the dose (0.005) associated with elevated and separated toenails, and immune system effects (reduced IgM and IgG antibody responses to sheep red blood cells) in studies of rhesus monkeys given Arochlor-1254 in capsules for longer than a year. Nonetheless this child ingestion dose is greater than the intermediate oral exposure minimum risk level of 0.00003 set by dividing 0.0075 by an uncertainty factor of 300 (10 for extrapolation from a lowest observed adverse effect level to a no observed adverse effect level, 3 for extrapolation from animals to humans, and 10 for human variability). It is also higher than the chronic oral exposure minimum risk level of 0.00002 set by dividing 0.005 by an uncertainty factor of 300 (10 for extrapolation from a lowest observed adverse effect level to a no observed adverse effect level, 3 for extrapolation from animals to humans, and 10 for human variability). Adult ingestion dose (0.00001) is 500 times less than the (0.005) sensitive dose health effects described above for children. Inhalation dose (0.000003) is 3,000 times less than the dose (0.009) associated with epithelial hyperplasia in the urinary bladder and endocrine symptoms (increased thyroid serum T3 and T4 hormones) in rats exposed 30 days, for 7 days a week 23 hours a day to Arochlor-1242). Associated cancer Chronic oral PCB exposures have been linked with liver cancer in 6 rat studies and thyroid follicular cell adenoma in 3 other rat studies.			
Vanadium	Ing 0.02 Inh 0.00006	Ing 0.002 Inh 0.00006	No slope.	No slope.
ATSDR 1992b TP-91/29	Child ingestion dose (0.02) is 15 times less than the no observed adverse effect level dose (0.3) causing mild bleeding in the kidneys of rats exposed to sodium metavanadate for 3 months. Nonetheless this child ingestion dose is greater than the intermediate oral exposure minimum risk level of 0.003 set by dividing 0.3 by an uncertainty factor of 100 (10 for extrapolation from animals to humans, and 10 for human variability). Adult ingestion dose (0.002) is 150 times less than the (0.3) sensitive dose health effects described above for children. Inhalation dose (0.00006) is 1,000 times less than the dose (0.06) associated with bronchial irritation (mucous formation and coughing) in two persons exposed for 8 hours to vanadium as vanadium pentoxide. The onset of coughing and mucus formation was delayed 7 to 24 hours. Pulmonary function test were normal. Other effects in workers chronically exposed to vanadium dusts included eye irritation, skin rashes, and weight loss. Cancer: Animal studies and human medical case studies are insufficient for evaluating the carcinogenicity of vanadium via inhalation or ingestion.			

Table 13. Estimated Blood Lead Concentrations In Children Ingesting On-Site Surface Soil (micrograms per deciliter - µg/dl)

Media	Conc. *		Time	Slope†		Low	High
	low	high		low	high		
Air (out) *	0.1	0.2	0.33	2.46	3.04	0.08118	0.20064
Air (in) *	0.3	0.6	0.33	2.46	3.04	0.24354	0.60192
Food*	5	5	0.33	0.24	0.24	0.396	0.396
Water*	4	4	0.33	0.16	0.16	0.2112	0.2112
Soil	800	800	0.33	0.002	0.016	0.528	4.224
Dust	800	800	0.33	0.004	0.004	1.056	1.056
Total						**2.51592**	**6.68976**

*Default Value from ATSDR 1999a, Appendix D.
†These slopes were for children 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 14. Estimated Blood Lead Concentrations In Adults Ingesting On-Site Surface Soil (micrograms per deciliter - µg/dl)

Media	Conc. *		Time	Slope†		Low	High
	low	high		low	high		
Air (out) *	0.1	0.2	0.33	1.59	3.56	0.05247	0.23496
Air (in) *	0.3	0.6	0.33	1.53	3.56	0.15147	0.70488
Food*	5	5	0.33	0.016	0.0195	0.0264	0.032175
Water*	4	4	0.33	0.03	0.06	0.0396	0.0792
Soil	800	800	0.33	0.002	0.016	0.528	4.224
Dust	800	800	0.33	0.004	0.004	1.056	1.056
Total						**1.85394**	**6.331215**

*Default Value from ATSDR 1999a, Appendix D.
†These slopes were for 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)

Appendix C—Cancer Study Results

Liver Cancer Incidence Rates per 100,000 population, 1981-2000

	Gulf County		Florida	
Age Group	Number	Age-Specific Rate	Number	Age-Specific Rate
0 to 4	0	-	72	0.4
5 to 9	0	-	14	0.1
10 to 14	0	-	17	0.1
15 to 19	0	-	18	0.1
20 to 24	0	-	36	0.2
25 to 29	0	-	51	0.3
30 to 34	0	-	95	0.5
35 to 39	0	-	162	0.8
40 to 44	1	6.2	235	1.3
45 to 49	0	-	433	2.9
50 to 54	0	-	513	3.8
55 to 59	0	-	613	4.8
60 to 64	3	23.3	933	6.9
65 to 69	2	16.2	1,409	10.1
70 to 74	0	-	1,660	13.2
75 to 79	1	15.1	1,422	14.6
80 to 84	0	-	894	14.8
85 and Up	0	-	708	16.4
TOTAL	7		9,285	
Age-adj Rate		**2.4**		**2.92**

All Cancers Incidence Rates per 100,000 population, 1981-2000

	Gulf County		Florida	
Age Group	Number	Age-Specific Rate	Number	Age-Specific Rate
0 to 4	4	28.0	3,548	20.9
5 to 9	2	12.3	1,961	11.9
10 to 14	4	22.9	2,005	12.2
15 to 19	3	18.1	3,073	18.1
20 to 24	6	41.5	5,276	29.6
25 to 29	7	41.3	10,136	51.8
30 to 34	7	43.6	17,237	87.2
35 to 39	14	87.4	25,542	131.7
40 to 44	26	161.5	37,155	213.0
45 to 49	54	371.8	52,829	358.6
50 to 54	68	485.0	75,075	558.9
55 to 59	99	703.7	110,087	861.3
60 to 64	159	1,234.9	162,546	1,198.2
65 to 69	212	1,719.7	239,844	1,724.0
70 to 74	191	2,036.0	264,015	2,102.8
75 to 79	144	2,174.6	228,090	2,338.9
80 to 84	85	2,035.4	150,878	2,494.1
85 and Up	79	2,854.0	106,295	2,458.5
TOTAL	1,164		1,495,592	
Age-adj Rate		**436.7**		**464.87**

Source: Department of Health
Environmental Epidemiology
Florida Cancer Data System
Age-Adjusted to U.S. 2000 Standard Million

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Incidence Number, Age-Specific and Age-Adjusted Rates for Liver and All Cancers in Florida and Gulf County, 1981-1999

	Liver				All Cancers			
	Gulf		Florida		Gulf		Florida	
	Count	Rate	Count	Rate	Count	Rate	Count	Rate
Age 0 to 4	0	0	64	0.40	4	27.41	3,364	20.76
Age 5 to 9	0	0	15	0.10	2	12.87	1,784	11.65
Age 10 to 14	0	0	15	0.10	1	6.23	1,872	12.43
Age 15 to 19	0	0	18	0.12	3	18.05	2,866	18.40
Age 20 to 24	0	0	35	0.21	6	35.08	4,985	29.62
Age 25 to 29	0	0	47	0.27	6	33.37	9,571	54.03
Age 30 to 34	0	0	86	0.47	8	45.04	16,430	89.93
Age 35 to 39	0	0	149	0.84	11	69.62	24,089	136.08
Age 40 to 44	1	6.51	196	1.22	27	175.64	34,730	216.31
Age 45 to 49	0	0.00	354	2.51	48	356.14	49,093	348.67
Age 50 to 54	0	0.00	421	3.36	63	487.73	69,502	555.48
Age 55 to 59	0	0.00	519	4.32	94	725.70	2,572	854.68
Age 60 to 64	2	17.10	818	6.46	150	1,282.38	52,729	1,207.07
Age 65 to 69	2	17.65	1,222	9.34	193	1,703.29	26,923	1,734.96
Age 70 to 74	0	0	1,416	11.84	177	2,084.31	47,274	2,067.38
Age 75 to 79	0	0	1,226	13.20	135	2,156.55	11,647	2,279.02
Age 80 to 84	0	0	737	12.41	79	1,975.49	38,666	2,335.83
Age 85 & Up	0	0	521	12.45	69	2,470.46	94,668	2,261.36
Total Count	5		7,859		1,076		492,765	
Age-Adjusted Rate		**1.80**		**2.60**		**429.82**		**456.69**

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Appendix D—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.

Additive Effect: A response to a chemical mixture, or combination of substances, that might be expected if the known effects of individual chemicals, seen at specific doses, were added together.

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

Antagonistic Effect: A response to a mixture of chemicals or combination of substances that is **less** than might be expected if the known effects of individual chemicals, seen at specific doses, were added together.

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: A background level is an average or expected amount of a chemical in a specific environment, or an amount of chemical that occurs naturally in a specific environment.

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

CAP: See **C**ommunity **A**ssistance **P**anel**.**

Cancer: A group of diseases, which 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 is a carcinogen.

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**.

Community Assistance Panel (CAP): A group of people from the community and health and environmental agencies who work together on issues and problems at hazardous waste sites.

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. Health assessors use comparison values 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**.

Delayed Health Effect: A disease or injury that happens as a result of exposures that may have occurred far in the past.

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 "an 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: Hazardous wastes are 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).

Intermediate Exposure: Any chemical exposure that has occurred for more 14 days but less than one year (365 days).

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.

Malignancy: See **Cancer**.

MRL: **M**inimal **R**isk **L**evel. An estimate of daily human exposure – 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. (This 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 under 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 that tells 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 not 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 not 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.

Statistics: A branch of the math process of collecting, looking at, and summarizing data or information.

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.

Synergistic Effect: A health effect from an exposure to more than one chemical, where one of the chemicals worsens the effect of another chemical. The combined effects of the chemicals acting together are greater than the effects of the chemicals acting by themselves.

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.

Tumor: Abnormal growth of tissue or cells that have formed a lump or mass.

Uncertainty Factor: See **Safety Factor**.

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 prepared this Mill View Subdivision Health Consultation under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). They prepared it in accordance with the 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, has reviewed this health consultation, and concurs with its findings.

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