Health Consultation

Evaluation of Surface and Subsurface Soils

ESCAMBIA WOOD TREATING
(SAND CASTLE ACADEMY)

PENSACOLA, ESCAMBIA COUNTY, FLORIDA

EPA FACILITY ID: FLD008168346

MARCH 5, 2007

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

Health Consultation: A Note of Explanation

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

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

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Prepared By:

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

Contents

Foreword

This document summarizes the Florida Department of Health's (DOH) evaluation of subsurface soil and white cover sand sampling results from the Escambia County Health Department's effort at Sand Castle Academy in Escambia County, Florida. The Florida Department of Health evaluates site-related public health issues through the following processes:

- Evaluating exposure: Florida DOH scientists begin by reviewing available information about environmental conditions at the site. The first task is to find out how much contamination is present, where it is on the site, and how human exposures might occur. Usually, the Florida DOH does not collect its own environmental sampling data. The Escambia County Health Department (CHD) provided the information for this Health Consultation.
- Evaluating health effects: If we find evidence that exposures to hazardous substances are occurring or might occur, Florida DOH scientists will determine whether that exposure could be harmful to human health. We focus this report on public health; that is, the health impact on the community as a whole, and base it on existing scientific information.
- Developing recommendations: In this evaluation report, the Florida DOH outlines its conclusions regarding any potential health threat posed by potential contaminants in surface and subsurface soils at Sand Castle Academy. Recommendations are made 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 USEPA and the Florida DEP. If, however, an immediate health threat exists or is imminent, the Florida DOH will issue a public health advisory warning people of the danger, and will work with other agencies to resolve the problem.
- Soliciting community input: The evaluation process is interactive. The Florida DOH starts by soliciting and evaluating information from various government agencies, individuals or organizations responsible for cleaning up the site, and those living in communities near the site. We share any conclusions about the site with the groups and organizations providing the information. Once we prepare an evaluation report, the Florida DOH seeks feedback from the public.

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

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Summary

The Escambia County Health Department (CHD) asked the Florida Department of Health (DOH) to evaluate children's health risk from exposure to contamination in soils at Sand Castle Academy.

In September and November 2006, Escambia CHD contractor, Advanced Environmental Technologies, collected subsurface and white cover sand soil samples from the play area at Sand Castle Academy. They analyzed the soil for arsenic, lead, polycyclic aromatic hydrocarbons, and dioxins.

Children attending this daycare are not at risk. Our evaluation of the maximum levels of chemicals measured in the subsurface soils and white cover sand does not indicate a risk of non-cancer or cancer illness. The Sand Castle Academy site is not a public health hazard.

Site Information – Sand Castle Academy

Sand Castle Academy (SCA), a children's day care facility, is at 4000 North Palafox Street in Pensacola, Escambia County, Florida (Figure 1). The site is approximately 0.84 acres. The two buildings on the property were constructed in 1961 and 1969. Two playground areas enclosed by chain-link fencing are east of the two buildings (Figure 2). White sand, which ranges in depth from zero to 5.5 inches, covers the playground areas. The day care opened in February 2006. As of November 2006, 62 children attend SCA (AET 2006a).

The area west of SCA is mixed residential and commercial. Commercial businesses border SCA to the north and south. The former Rosewood Terrace subdivision borders the site to the east. The former Escambia Treating Company Superfund hazardous waste site is approximately 160 feet south of the site (AET 2006a).

Site Information – Escambia Treating Company Superfund Site

The former Escambia Treating Company, a Superfund hazardous waste site, is approximately 160 feet south of SCA. The Escambia Treating Company wood preserving facility operated on a 26-acre site from 1942 to 1982. They made pressure treated wood products using creosote, pentachlorophenol and possibly chromated copper arsenate. The United States Environmental Protection Agency (EPA) and the Florida Department of Environmental Protection (DEP) conducted assessments at the facility between 1982 and 1992. They found elevated concentrations of pentachlorophenol in groundwater, surface soil, subsurface soil, and sludge. In 1985, EPA removed sludge from three impoundments. In 1998, they removed contaminated wooden sidewalls from two of the impoundments. The sludge and the wooden sidewalls were transported off-site and properly disposed. EPA contractors then excavated approximately 220,000 cubic yards of contaminated soil from the impoundments and stored it in piles on-site. EPA also found dioxins, polycyclic aromatic hydrocarbons (PAHs), arsenic, and lead in the soil at nearby properties. Between 1997 and 2001, EPA relocated 358 families from the nearby Rosewood Terrace subdivision. Since then EPA has also found elevated levels of dioxins, PAHs, arsenic, and lead in the nearby Clarinda Triangle subdivision west of SCA (AET 2006).

Sampling History

The Escambia CHD contracted with Advanced Environmental Technologies, LLC (AET) to test soil in the play area at SCA. In September 2006, AET collected 8 composite subsurface soil samples. AET first scraped away any white sand covering the soil and then collected a sample from zero to 6-inches below ground surface. For each sampling location, AET collected 4 soil aliquots from equidistant sampling points within each grid (Figure 3) and then combined to create a single soil sample. In November 2006, AET collected 4 grab samples of the white sand that covers the play areas (Figure 4). The sand varied from 4 to 6-inches deep. AET analyzed both the white cover sand and subsurface soil for dioxins, arsenic, lead and polycyclic aromatic hydrocarbons (PAHs) (AET 2006a,b).

Discussion

The Florida DOH chooses contaminants that could potentially pose a risk to residents using guidelines set by the Florida DEP and ATSDR. These agencies create "screening guidelines" that are set hundreds to thousands of times below levels that cause illness. After comparing data to screening guidelines, the Florida DOH selects contaminants of concern, chemicals that exceed the guidelines. Identification of a contaminant of concern in this section of the report does not necessarily mean that exposure to the contaminant will cause illness. Further examination of the contaminants detected at or above screening levels provides for an evaluation that will take into account the specific situation at this site and will allow for the most protective evaluation for this site.

The Florida DOH used the following "screening guidelines" (ATSDR 2005c and Florida DEP 2003) in order of priority to select contaminants of concern:

1. Cancer Risk Evaluation Guide (CREG). A CREG is the contaminant concentration estimated to result in no more than 1 excess cancer per 1 million persons exposed during a lifetime (i.e., 70 years). CREGs are calculated from the EPA-established cancer slope factor (ATSDR 1992).
2. Environmental Media Evaluation Guide (EMEG). An EMEG is derived from the ATSDR-established Minimal Risk Level (MRL), using standard exposure assumptions (e.g., ingestion of 200 milligrams of soil per day and body weight of 30 kilograms (kg) for children). 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.
3. Maximum Contaminant Levels (MCL). The Florida Department of Environmental Protection (DEP) derives MCLs from U.S. Environmental Protection Agency (EPA) standards or from health data complied from state and federal resources. MCLs are fully enforceable standards and must be equal to or more stringent (i.e., lower) than federal MCLs (such as the EPA's).
4. Health Advisory Levels (HALs). The Florida DEP and the Florida DOH set HALs based on U.S. EPA standards or from health data compiled from state and federal agencies. While not enforceable, the state agencies use HALs to protect human health.

Using the criteria listed above, the Florida DOH selected arsenic, dioxin and PAHs as contaminants of concern. These chemicals occurred in the soil at levels equal to or greater than

the above "screening guidelines" (Tables 1 and 4). Although the maximum concentration of lead in Sand Castle was below screening guidelines, we included lead as a contaminant of concern because EPA found it in the soil at the nearby Escambia Treating Company site.

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.

In this report, the Florida DOH evaluates children's exposure to contaminants in the white cover sand and subsurface soils via ingestion, inhalation and skin contact. Subsurface soils are the top 6-inches of soil that lies beneath the white cover sand.

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 consultation. A milligram is 1/1,000 of a gram; a kilogram is approximately 2 pounds.

To calculate the daily dose of each contaminant, the Florida DOH uses standard assumptions about body weight, ingestion and inhalation rates, duration of exposure (period of time), and other factors needed for dose calculation (ATSDR 2005c, EPA 1997). We assume that people are exposed daily to the maximum concentration measured at the site. ATSDR's toxicological profiles on contaminants discuss toxicity from three exposure routes - inhalation, ingestion, and dermal (skin) exposure. For each of these exposure routes, ATSDR also groups health effects by duration of exposure. Acute exposures are those of 14 days or less; intermediate exposures are those of 15 - 364 days; and chronic exposures are those of 365 days or more (or an equivalent period for animal exposures). ATSDR Toxicological Profiles also provide information on the environmental transport and regulatory status of contaminants.

To estimate exposure from incidental ingestion of contaminated soil, 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) children 1 - 4 years of age weigh an average of 15 kg,
3) children ingest contaminated soil at the maximum concentration measured for each contaminant,
4) children could potentially be exposed every day of the week for up to 3 years.

Tables 2 and 5 summarize the highest estimated dose from incidental ingestion and the highest estimated inhalation concentration.

Subsurface Soils

For the purposes of this report, we define subsurface soils as soils below the white cover sand in the play area of SCA. Where AET collected subsurface soil samples, the white cover sand was about 1 inch or less deep. Because the white cover sand was thin in some areas, children could be exposed to subsurface soils. However, daily exposure to subsurface soil is not likely, but is used to provide the most conservative estimate of exposure.

Arsenic

Incidental ingestion of arsenic at the highest concentration measured in subsurface soils in the Sand Castle Academy play area is not expected to cause illness in children. We assumed the arsenic was in the more toxic inorganic form. The highest estimated arsenic dose, 0.0002 mg/kg/day, is 10 times lower than the dose in a long-term study in which people exposed to arsenic experienced thickening and darkening of the skin. The "no adverse effect levels" for arsenic in humans range from 0.0004 – 0.1 mg/kg/day (ATSDR 2005a).

Inhalation of dust from the highest arsenic level measured in subsurface soils in the Sand Castle Academy play area is not expected to cause illness in children. The highest estimated arsenic exposure from inhalation, 0.000092 mg/m^3, is hundreds of times lower then the lowest concentration that causes changes in skin pigmentation in humans (ATSDR 2005a).

Humans do not absorb arsenic through their skin very well. It is not likely that dermal (skin contact) exposure to arsenic in subsurface soils will cause illness (ATSDR 2005a).

To evaluate a theoretical cancer risk from incidental ingestion of arsenic, EPA developed a cancer slope factor based on a human study of skin cancer. We multiply the cancer slope factor by a lifetime average daily dose. We adjust the highest estimated ingestion dose to create the lifetime average daily dose for a 70-year life expectancy. The maximum theoretical excess cancer risk for lifetime exposure of incidental ingestion of arsenic is one additional cancer per one hundred thousand people. We consider this a "no apparent increased risk." While studies link arsenic to skin, lung, bladder, and liver cancer, the lowest dose in any human study that caused cancer was 0.0011 mg/kg/day (ATSDR 2005a). Given the relatively low level of the estimated dose in comparison to studies that associated arsenic with cancer, and given an intermittent and short-term exposure, it is unlikely that the estimated incidental ingestion would result in an increased rate of cancer.

To evaluate a theoretical cancer risk from inhalation of arsenic-contaminated dust, EPA developed an inhalation risk unit, from a human study of lung cancer. We multiply the unit risk by an inhalation concentration that we have adjusted for a lifetime of 70 years. The estimated maximum theoretical excess cancer risk for lifetime inhalation of arsenic is one additional cancer per one million people. We consider this as "no significant increased risk." We base this theoretical calculation on the assumption there is no safe level of exposure to a chemical that causes cancer. However, the theoretical calculated risk is not exact and tends to overestimate the actual risk associated with exposures that may have occurred.

Dioxins

Incidental ingestion of dioxins at the highest concentration measured in subsurface soils in the SCA play area is not expected to cause illness in children. The highest estimated dose, $1.6x10^{-9}$ mg/kg/day, is over 100 times lower than the dose ($1.2x10^{-7}$ mg/kg/day) that caused altered social behavior in monkeys (ATSDR 1998).

Although dioxins are likely to enter the body through inhalation and skin contact, not enough information exists to determine the risk of illness (ATSDR 1998).

Lead

The highest concentrations of lead in subsurface soils at SCA are not expected to cause illness. A predictive model estimated blood lead levels ranging from 0.2 to 2.1 micrograms per deciliter (ug/dl) (Table 3). These levels are below the Centers for Disease Control and Prevention action level (10 ug/dL) (ATSDR 2005b).

Lead is not well absorbed through the skin. Therefore, skin contact with lead in subsurface soils at Sand Castle Academy is not expected to cause illness (ATSDR 2005b).

Polycyclic Aromatic Hydrocarbons (PAHs)

Incidental ingestion of PAHs at the highest concentrations measured in subsurface soils of the SCA play area is not expected to cause non-cancer illness. PAHs include dibenzo(a,h)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, etc. The highest estimated PAH dose (0.000035 mg/kg/day Total Equivalency or TEQ) is hundreds of times lower than the lowest dose that had adverse effects in animal studies (ATSDR 1995).

Inhalation of dust from the highest PAH subsurface soil concentration measured in the SCA play area is not expected to cause non-cancer illness. The highest estimated air concentration, 0.000016 mg/m^3, resulting from subsurface soil becoming airborne (dust) is lower than the lowest concentration (0.0001 mg/m^3) that cause decreased lung function, cough, bloody vomit, and chest and throat irritation in a human study (ATSDR 1995).

Although PAHs are absorbed through the skin, contact with the concentrations of PAHs measured in surface soil in the SCA play area is not expected to cause illness (ATSDR 1995).

To estimate a theoretical increased cancer risk from ingestion of PAHs, EPA developed a cancer slope factor from an ingestion study of squamous cell papillomas and carcinomas in mice. We multiply the cancer slope factor by an average daily dose adjusted for a 70-year life expectancy. The estimated maximum theoretical excess cancer risk for lifetime exposure of incidental

ingestion of PAHs is one additional cancer per one hundred thousand people. We consider this as "no apparent increased risk." We base this theoretical calculation on the assumption there is no safe level of exposure to a chemical that causes cancer. However, the theoretical calculated risk is not exact and tends to overestimate the actual risk associated with exposures that may have occurred. Given the relatively low level of the estimated dose of PAHs in comparison to studies that associated PAHs with cancer, and given an intermittent exposure, it is unlikely that the estimated exposure would result in an increased cancer rate.

White Sand Surface Soils

Arsenic

Incidental ingestion of the highest level of arsenic measured in the white cover sand in the Sand Castle Academy play area is not expected to cause illness in children attending the daycare. We assumed the arsenic was in the more toxic inorganic form. The highest estimated arsenic dose, 0.0002 mg/kg/day, is 10 times lower than long-term study in which people exposed to arsenic experienced darkening and thickening of the skin. Studies show no adverse effect levels for arsenic in humans range from 0.0004 – 0.1 mg/kg/day (ATSDR 2005a).

Inhalation of dust from the highest arsenic level measured in white sand surface soils in the Sand Castle Academy play area is not expected to cause illness in children. The highest estimated arsenic exposure from inhalation is 0.000092 mg/m^3. This exposure is hundreds of times lower then the lowest concentration that causes changes in skin pigmentation in humans (ATSDR 2005a).

Humans do not absorb arsenic through their skin very well. It is not likely that dermal (skin contact) exposure to arsenic in white sand surface soils will cause illness (ATSDR 2005a).

To evaluate a theoretical cancer risk from incidental ingestion of arsenic, EPA developed a cancer slope factor based on a human study of skin cancer. We multiply the cancer slope factor by a lifetime average daily dose. We adjust the highest estimated ingestion dose to create the lifetime average daily dose for a 70-year life expectancy. The maximum theoretical excess cancer risk for lifetime exposure of incidental ingestion of arsenic is one additional cancer per one million people. We consider this "no significant increased risk." While studies link arsenic to skin, lung, bladder, and liver cancer, the lowest dose in any human study that caused cancer was 0.0011 mg/kg/day (ATSDR 2005a). Given the relatively low level of the estimated dose in comparison to studies that associated arsenic with cancer, and given an intermittent and short-term exposure, it is unlikely that the estimated incidental ingestion would result in an increased rate of cancer.

To evaluate a theoretical cancer risk from inhalation of arsenic-contaminated dust, EPA developed an inhalation risk unit, from a human study of lung cancer. We multiply the unit risk by an inhalation concentration adjusted for a lifetime of 70 years. The estimated maximum theoretical excess cancer risk for lifetime inhalation of arsenic is one additional cancer per one million people. We consider this "no significant increased risk." We base this theoretical calculation on the assumption there is no safe level of exposure to a chemical that causes cancer.

However, the theoretical calculated risk is not exact and tends to overestimate the actual risk associated with exposures that may have occurred.

Dioxins

Incidental ingestion of dioxins at the highest concentrations measured in white cover sand on the SCA play area is not expected to cause illness in children. The highest estimated dose, $5.3x10^{-11}$ mg/kg/day, is below the minimum risk level (MRL) established by ATSDR ($1.0x10^{-9}$). The ATSDR MRL is based on a study on a lowest observable adverse effect level seen in a study of monkeys. An MRL is set below levels that caused health affects in studies. Therefore, the levels of dioxins in the SCA white cover sand do not pose a health threat (ATSDR 1998).

Too little is known about the toxicity of dioxins via inhalation to determine the risk of illness if children inhale dioxins in dust. Reliable information on how inhalation of dioxins affects the health of humans is not available (ATSDR 1998).

Not enough information exists to determine the risk of illness from skin contact to dioxins (ATSDR 1998).

Lead

The maximum concentrations of lead in the white cover sand at SCA are not expected to cause illness. A predictive model estimated blood lead levels ranging from 0.2 to 1.4 micrograms per deciliter (ug/dl) (Table 6). These levels are below the Centers for Disease Control action level (10 ug/dL) (ATSDR 2005b).

Lead is not well absorbed through the skin. Therefore, skin contact to lead in white sand surface soils at Sand Castle Academy is not expected to cause illness (ATSDR 2005b).

Polycyclic Aromatic Hydrocarbons (PAHs)

Incidental ingestion of PAHs at the maximum concentration measured in the white cover sand on the SCA play area is not expected to cause non-cancer illness. PAHs include dibenzo(a,h)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, etc. The highest estimated PAH dose (0.000028 mg/kg/day Total Equivalency or TEQ) is hundreds of times lower than the lowest dose that had adverse effects in animal studies (ATSDR 1995).

Inhalation of dust from the highest PAH subsurface soil concentration measured in the SCA play area is not expected to cause non-cancer illness. The highest estimated air concentration, 0.000012 mg/m^3, resulting from surface soil becoming airborne (dust) is ten times lower than the lowest concentration (0.0001 mg/m^3) that cause decreased lung function, cough, bloody vomit, and chest and throat irritation in a human study (ATSDR 1995).

Although PAHs are absorbed through the skin, contact with the concentrations of PAHs measured in surface soil in the SCA play area is not expected to cause illness (ATSDR 1995).

To estimate a theoretical increased cancer risk from ingestion of PAHs, EPA developed a cancer slope factor from an ingestion study of squamous cell papillomas and carcinomas in mice. We multiply the cancer slope factor by an average daily dose adjusted for a 70-year life expectancy.

The estimated maximum theoretical excess cancer risk for lifetime exposure of incidental ingestion of PAHs is nine additional cancers per one million people. We classify this as "no apparent increased risk." We base this theoretical calculation on the assumption there is no safe level of exposure to a chemical that causes cancer. However, the theoretical calculated risk is not exact and tends to overestimate the actual risk associated with exposures that may have occurred. Given the relatively low level of the estimated dose of PAHs in comparison to studies that associated PAHs with cancer, and given an intermittent residential exposure, it is unlikely that the estimated exposure would result in an increased cancer rate.

Child Health Considerations

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

This report specifically considers the health threat to children at the Sand Castle Academy daycare.

Conclusions

1. Exposure to contaminants of concern in either subsurface soils or white cover sand at Sand Castle Academy is not expected to cause health affects. The Sand Castle Academy site is not a public health hazard.

Recommendations

1. The Florida DOH has no recommendations at this time.

Public Health Action Plan

Past

- Escambia County Health Department contractors collected and analyzed samples from subsurface soils and white cover sand in the play area at Sand Castle Academy

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Appendix A. – Figures

Figure 1. Location of Sand Castle Academy in Escambia County

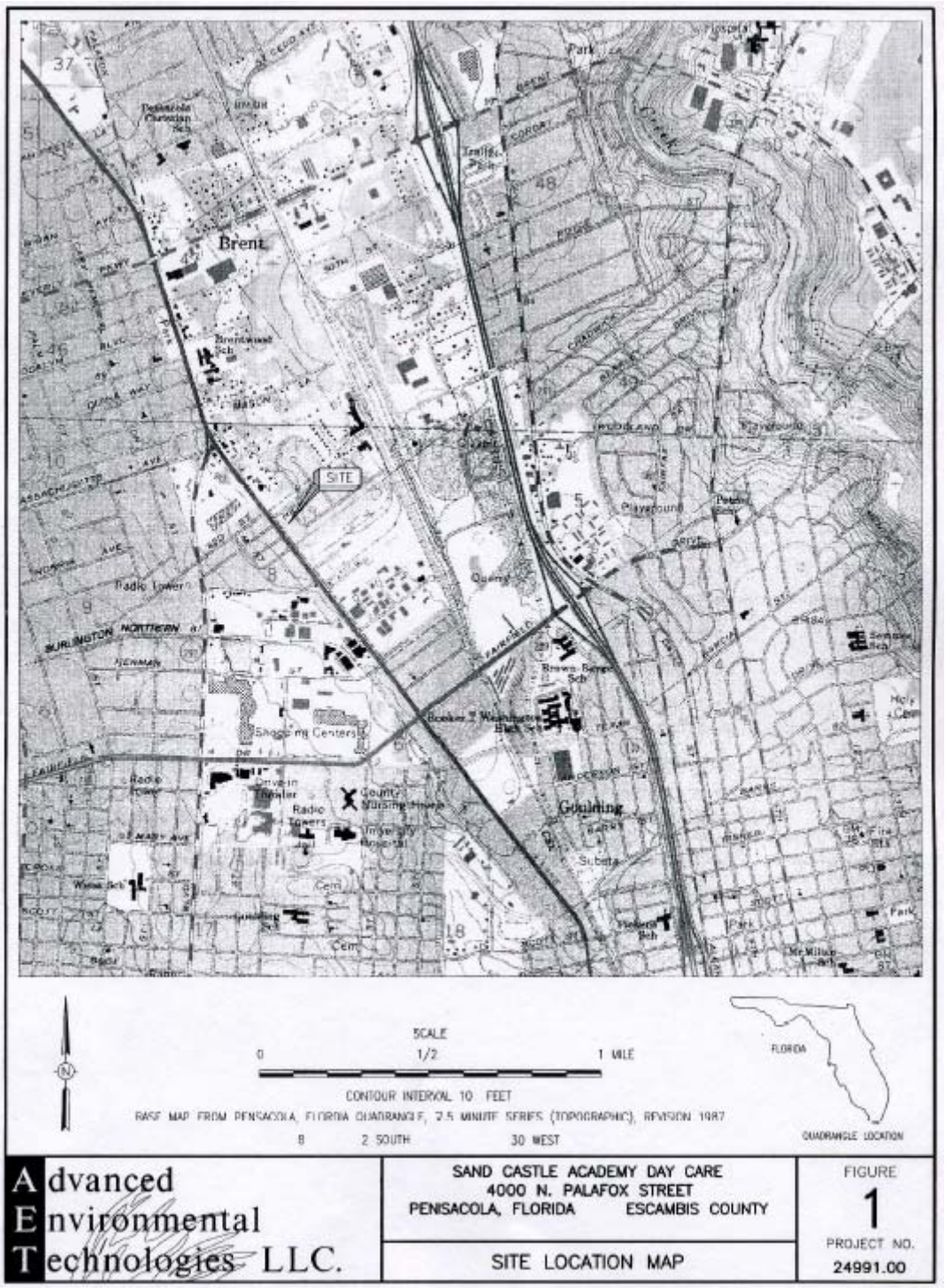


Figure 2. Site Map

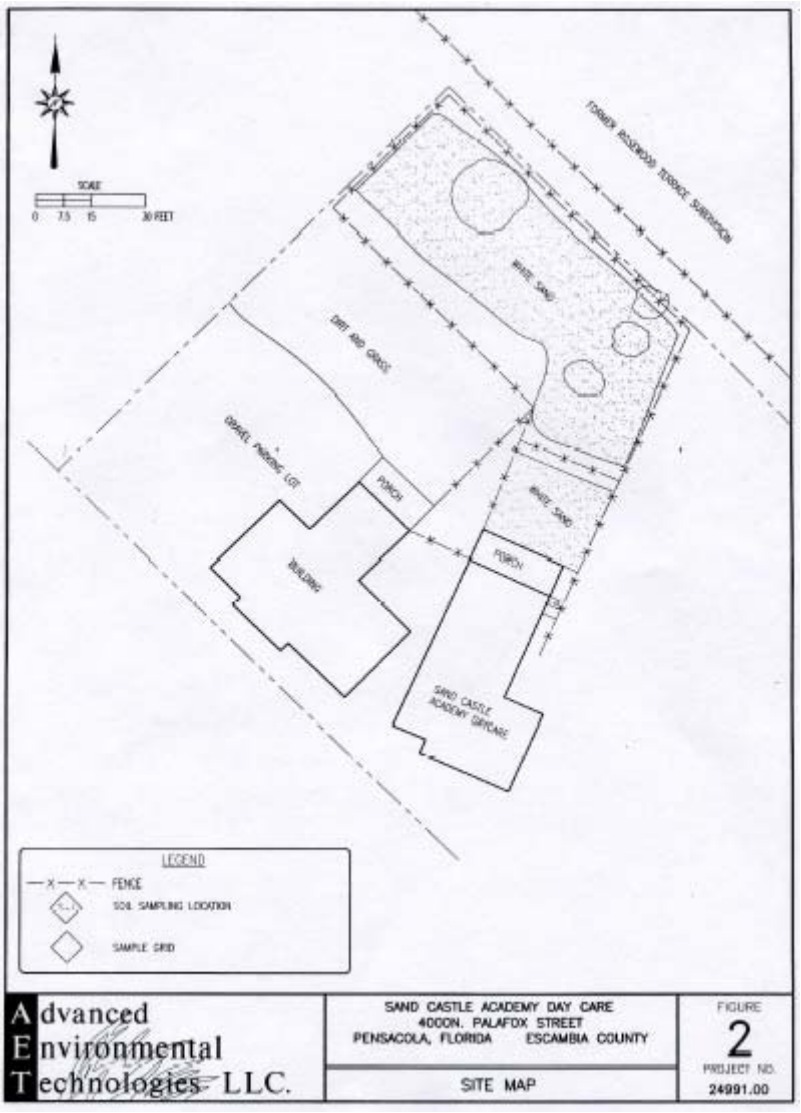


Figure 3. Subsurface Soil Sample Locations

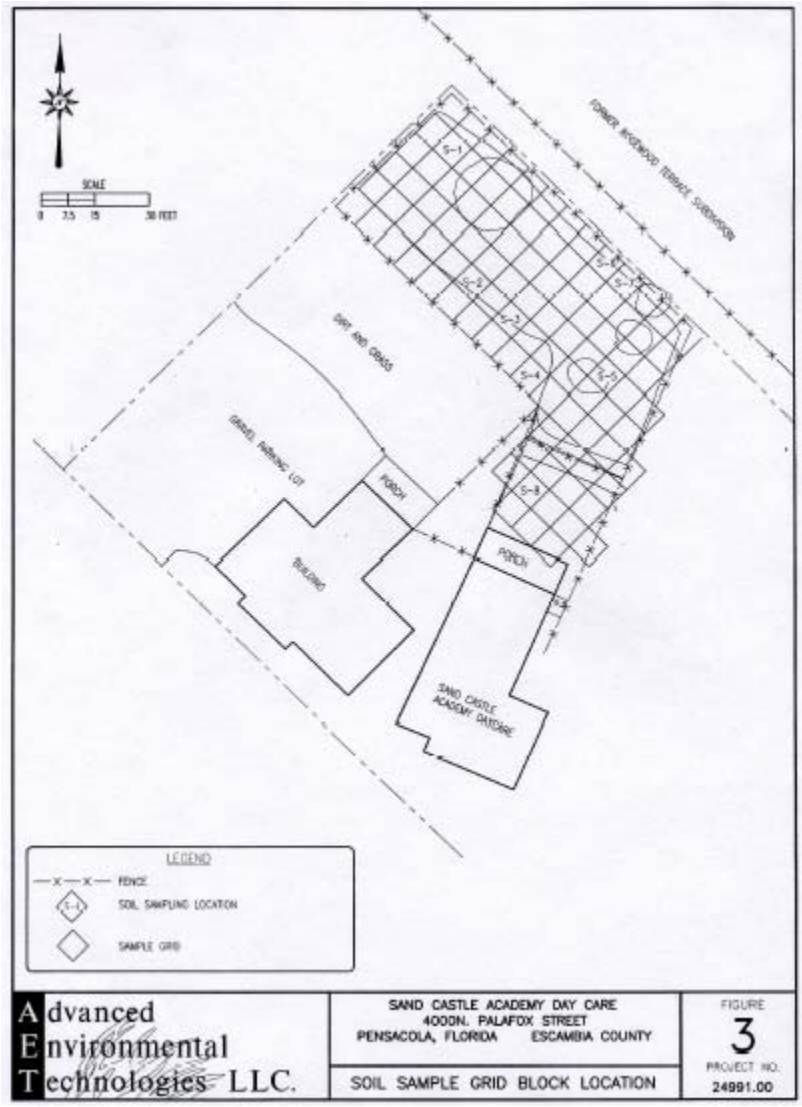
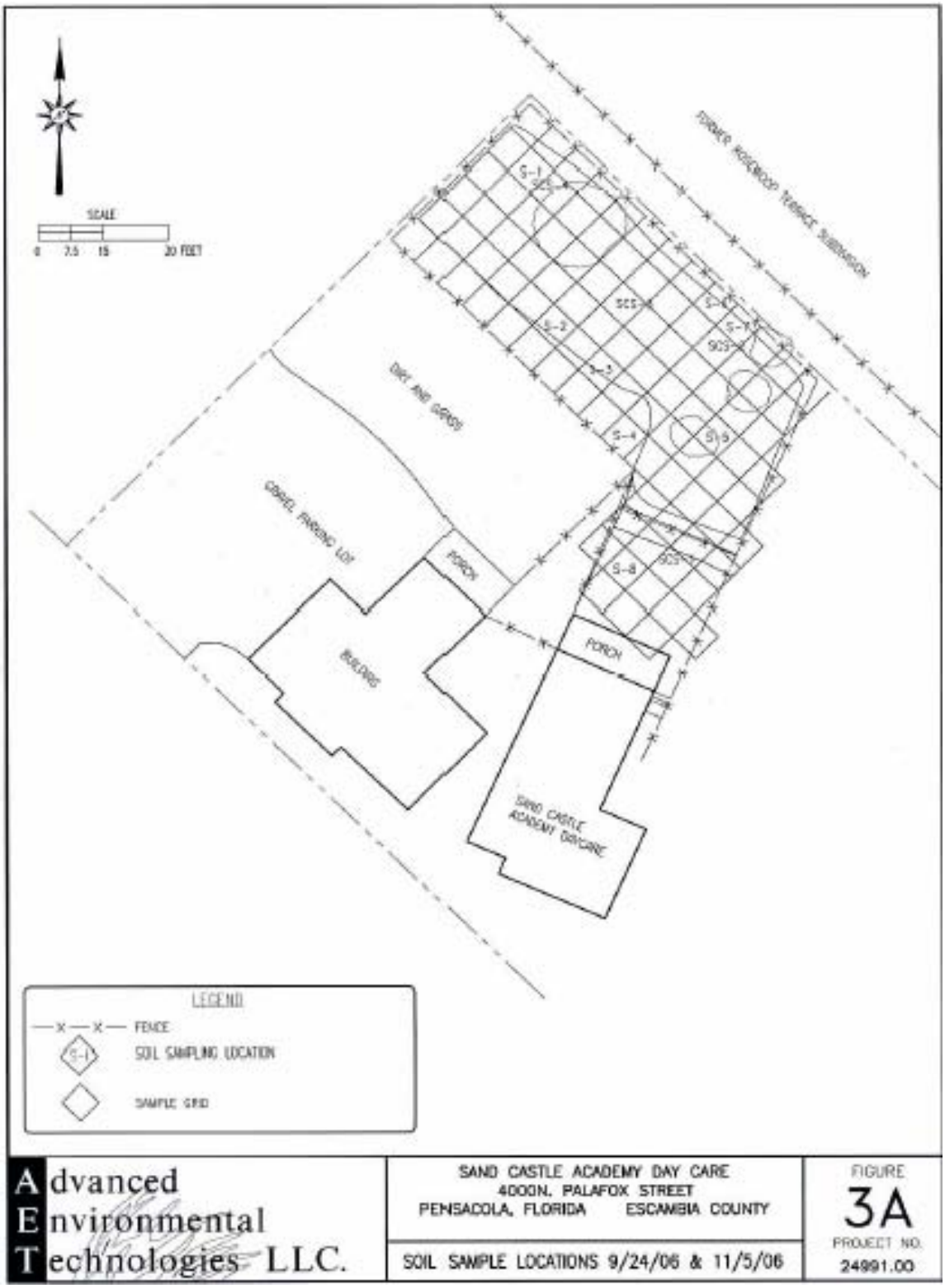


Figure 4. White Cover Sand Sample Locations



Appendix B. – Tables

Table 1. Sub-Surface Soil Concentrations for Contaminants of Concern

Contaminants of Concern	Highest Concentration (mg/kg)	Florida DEP Residential Soil "Screening Value" (mg/kg)	ATSDR Soil "Screening Value" (mg/kg)	Number Soil Samples Above DEP Screening Value	Number Soil Samples Above ATSDR Screening Value
Arsenic	15.6	2.1	0.5 CREG	6/12	12/12
Dioxins*	0.000117	0.000007	0.00005 Chr EMEG	5/12	4/12
Lead	111	400	NA	0/12	NA
PAHs*	2.64	8	0.1 CREG	0/12	12/12

mg/kg – milligrams per kilogram
CREG – ATSDR Cancer Risk Evaluation Guide
EMEG – ATSDR Environmental Media Evaluation Guide
RMEG – EPA Reference Dose Media Evaluation Guide
NA – Not available
ND – Chemical not detected above laboratory equipment detection limits
* - Result listed is calculated Toxicity Equivalence (TEQ) (see Appendix C)
Source: [AET 2006a,b]

Table 2. Estimated Dose from Exposure to Sub-Surface Soil

Contaminant of Concern	Oral MRL (mg/kg/day)	Estimated Soil Ingestion Dose (mg/kg/day)		Inhalation MRL (mg/m3)	Estimated Dust-Inhalation (mg/m3)
		Child	Adult		Child and Adult
Arsenic	0.0003 Chr.	0.0002	0.000022	None	0.000092
Dioxins	$1.0x10^{-9}$Chr.	$1.6x10^{-9}$	$1.7x10^{-10}$	None	$6.9x10^{-10}$
Lead	None	NA*	NA*	None	NA*
PAHs	None	0.000035	0.000004	None	0.000016

MRL - Minimal Risk Level. An MRL is an ATSDR estimate of the daily human exposure to a hazardous substance that is likely to be without appreciable risk of adverse noncancer health effects over a specified duration of exposure.
mg/kg = milligrams per kilogram
Chr – Chronic exposure length of more than 365 days
mg/kg/day – milligram chemical per kilogram body weight per day
mg/m3 –milligram of chemical per cubic meter of air
*Please see Tables 3 for Blood Lead Estimates

Table 3. Estimated Blood Lead Level for Exposure to Lead in Sub-surface Soils

Media	Conc. *		Time	Slope'		**Low (ug/dL)**	**High (ug/dL)**
	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	15	111	0.33	0.002	0.016	0.0099	0.58608
Dust	15	111	0.33	0.004	0.004	0.0198	0.14652
Total						**0.96162**	**2.14236**
Media	Conc. *		Time	Slope'		**Low (ug/dL)**	**High (ug/dL)**
	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	15	111	0.33	0.002	0.016	0.0099	0.58608
Dust	15	111	0.33	0.004	0.004	0.0198	0.14652
Total						**0.29964**	**1.783815**

All blood lead levels in micrograms per deciliter.

Table created with information from the ATSDR Draft Toxicological Profile for Lead 2005. [ATSDR 2005b]

Table 4. White Cover Sand Concentrations for Contaminants of Concern

Contaminants of Concern	Highest Concentration (mg/kg)	Florida DEP Residential Soil Screening Value (mg/kg)	ATSDR Soil Screening Value (mg/kg)	Number Soil Samples Above DEP Screening Value	Number Soil Samples Above ATSDR Screening Value
Arsenic	1.0	2.1	0.5 CREG	0/4	4/4
Dioxins*	$4.4x10^{-6}$	0.000007	0.00005 Chr EMEG	0/4	0/4
Lead	13.2	400	NA	0/4	NA
PAHs*	2.12	8	0.1 CREG	0/4	12/12

mg/kg = milligrams per kilogram
CREG = ATSDR Cancer Risk Evaluation Guide
EMEG – ATSDR Environmental Media Evaluation Guide
RMEG – EPA Reference Dose Media Evaluation Guide
NA – Not available
* - Result listed is calculated Toxicity Equivalence (TEQ) (see Appendix C)
Source: [AET 2006a,b]

Table 5. Estimated Dose from Exposure to White Cover Sand

Contaminant of Concern	Oral MRL (mg/kg/day)	Estimated Soil Ingestion Dose (mg/kg/day)		Inhalation MRL (mg/m3)	Estimated Dust-Inhalation (mg/m3)
		Child	Adult		Child and Adult
Arsenic	0.0003 Chr.	0.000013	0.000001	None	0.000006
Dioxins	$1.0x10^{-9}$Chr.	$5.3x10^{-11}$	$5.7x10^{-12}$	None	$2.3x10^{-11}$
Lead	None	NA*	NA*	None	NA*
PAHs	None	0.000028	0.000003	None	0.000012

MRL - Minimal Risk Level. An MRL is an ATSDR estimate of the daily human exposure to a hazardous substance that is likely to be without appreciable risk of adverse noncancer health effects over a specified duration of exposure.
mg/kg = milligrams per kilogram
Chr – Chronic exposure length of more than 365 days
mg/kg/day – milligram chemical per kilogram body weight per day
mg/m3 –milligram of chemical per cubic meter of air
*Please see Tables 6 for Blood Lead Estimates

Table 6. Estimated Blood Lead Level for Exposure to Lead in White Cover Sand

Media	Conc. *		Time	Slope'		**Low (ug/dL)**	**High (ug/dL)**
	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	0.99	13.2	0.33	0.002	0.016	0.00065	0.0697
Dust	0.99	13.2	0.33	0.004	0.004	0.00131	0.01742
Total						**0.93388**	**1.49688**
Media	Conc. *		Time	Slope'		**Low (ug/dL)**	**High (ug/dL)**
	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	0.03218
Water*	4	4	0.33	0.03	0.06	0.0396	0.0792
Soil	0.99	13.2	0.33	0.002	0.016	0.00065	0.0697
Dust	0.99	13.2	0.33	0.004	0.004	0.00131	0.01742
Total						**0.2719**	**1.13834**

All blood lead levels in micrograms per deciliter.

Table created with information from the ATSDR Draft Toxicological Profile for Lead 2005. [ATSDR 2005b]

Appendix C - Toxicity Equivalence (TEQ)

TEQs for Polynuclear Aromatic Hydrocarbons (PAHs) and Dioxins/Furans

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

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
Fluoranthene	0.001
Fluorene	0.001
Phenanthrene	0.001
Pyrene	0.001

Source: ATSDR , 1995b.

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), EPA adds ½ 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 TEF.

Glossary of Environmental Health Terms

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Contaminant: See **Environmental Contaminant**.

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

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

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

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

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

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

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

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

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

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

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

ATSDR defines an exposure pathway as having 5 parts:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Plume: A line or column of air or water containing chemicals moving from the source to areas further away. A plume can be a column or clouds of smoke from a chimney

or contaminated underground water sources or contaminated surface water (such as lakes, ponds and streams).

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

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

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

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

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

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

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

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

Reference Dose (RfD): An estimate, with safety factors (see **safety factor**) built in, of the daily, lifetime exposure of human populations to a possible hazard that is 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.

Superfund Site: See **NPL**.

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

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

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

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

CERTIFICATION

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

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

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CAT, SPAB, DHAC, ATSDR