FLORIDA DEPARTMENT OF HEALTH

Rick Scott
Governor

H. Frank Farmer, Jr., MD, PhD, FACP
State Surgeon General

November 8, 2011

Elizabeth Callaghan, Administrator
Hernando County Health Department
Brooksville, FL 34601

RE: Evaluation of 2011 Harar Avenue Soil Test Results

Dear Ms. Callaghan:

At your request, the Florida Department of Health's Hazardous Waste Site Health Risk Assessment Program (Assessment Program) examined possible health risks associated with incidental ingestion of soil at a residential property on Harar Avenue in Brooksville, Hernando County. The Assessment Program evaluates the public health risk of hazardous waste sites through a cooperative agreement with the federal Agency for Toxic Substances and Disease Registry (ATSDR). This is a state certified report. Although it has not been reviewed and cleared by ATSDR, Florida DOH prepared this report following the same procedures and quality control as ATSDR-approved reports.

In 2010, a resident of Harar Avenue expressed concerns about possible health effects associated with arsenic in the soil on his property. The former S&B Go hazardous waste site is located directly across the street north of his property (Figure 1). In a previous report, the Assessment Program examined 2010 surface soil data in order to quantify the possibility of illness from chronic exposure to the soil at this private property. That report concluded that incidental ingestion of the maximum concentrations of arsenic found in the surface soil from the Harar Avenue property was not likely to harm health [DOH 2011]. This health consultation letter is based on additional soil samples collected on the property in 2011.

Background and Statement of Issues

The S&B Go site was a bulk petroleum fueling facility that operated from 1927 to 2003. The facility had eight aboveground storage tanks (ASTs) containing diesel fuel, kerosene and unleaded gasoline and two underground storage tanks (USTs) holding leaded gasoline and waste oil. Dispensers were on the southwestern and north central portion of the property. All tanks and dispensers have been removed from the site.

In 2004, after two reported discharges, consultants for the Florida Department of Environmental Protection (DEP) identified petroleum hydrocarbon contamination in the soil and groundwater at the S&B Go site [Handex 2004]. In April 2005, DEP's consultant removed 1473 tons of contaminated soil from five locations on the site. Post-excavation testing did not include arsenic analysis but found some petroleum hydrocarbon compounds remained above Florida DEP soil cleanup target levels (SCTLs).

Between 2005 and 2007, consultants for DEP identified two additional petroleum hydrocarbon-contaminated areas on the site. In September 2009, they removed an additional 318 tons of soil from the site. In December 2009, they found soil petroleum hydrocarbon levels had actually increased. They did not analyze for arsenic [ES 2010].

In 2010, a resident on Harar Avenue across the street from S&B Go complained of arsenic-contaminated soil in his yard. In August and December 2010, consultants for DEP collected 22 surface soil (0-6 inches below land surface) and subsurface soil (2 feet below land surface) samples on-site, in the adjacent ditch, and at the Harar Avenue residence. They analyzed the samples for arsenic, chromium, copper, and iron.

In March 2011, consultants for DEP collected 15 soil borings at the S&B Go site, the Harar Avenue property and a private property to the north (to establish arsenic background levels) (Figure 2). From each soil boring, soil samples were collected at 0-6 inches, 6 inches, 2 feet and 5 feet below land surface and analyzed for arsenic [ES 2011].

This health consultation letter estimates the possible health effects associated with the arsenic concentrations found in the 2011 soil sampling at the Harar Avenue property. For the purpose of this assessment, DEP has not fully assessed soil quality on the Harar Avenue property since they did not analyze any of the samples for petroleum hydrocarbons that may be associated with the S&B Go site.

Discussion

At the Harar Avenue residence, incidental ingestion (swallowing) of very small amounts of surface soil is a possible route of exposure (Table 1). Because homes in this neighborhood are connected to municipal water, groundwater is not a potential exposure pathway. In order to determine the risk of illness from soil, the Assessment Program used exposure models and risk factors developed by ATSDR and the United States Environmental Protection Agency (EPA). The Assessment Program estimated exposure to the highest concentrations found in the top layer of soil (0-6 inches below land surface). People typically are <u>only</u> exposed to the top layer of soil. In the future, subsurface soil could also be brought to the surface. Therefore, the Assessment Program also estimated the risk of exposure to the highest concentration found in the subsurface soil (greater than 6 inches - 5 feet below land surface).

If the concentration of a contaminant in the soil meets or exceeds a health-based comparison value, the sample is considered for further analysis. If a soil contaminant does *not* meet or exceed its appropriate comparison value no further analysis is performed. The sample is assumed to pose no further health risk at that concentration [ATSDR 2005]. For carcinogens, we evaluate the theoretical cancer risk for adults regardless of the contaminant concentration. Even though arsenic is not associated with petroleum contamination, the Assessment Program selected it for further analysis because the levels found were above cancer screening values for soil. The Assessment Program considers the risk of both cancer and non-cancer illness during the assessment process.

Arsenic

Arsenic is a naturally occurring metal that is a common component of the earth's crust. Low levels of arsenic are found throughout the environment. Natural levels of arsenic in soil usually range from 1 to 40 milligrams per kilogram (mg/kg), with a mean of 5 mg/kg [ATSDR 2007.] While arsenic can be released into the environment from natural sources, releases from anthropogenic (man-made) sources are more prevalent. Man-made sources can include metal mining and smelting, wood combustion, coal combustion, waste incineration and pesticide application. To be protective of human health, we assumed that the arsenic found in the surface soils at the Harar Avenue property was in the more toxic inorganic form [ATSDR 2007].

Public Health Implications

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

The Assessment Program evaluates exposures by estimating daily doses for children and adults. The standard assumptions used and the calculations for this assessment are in Appendix A.

We assume that people are exposed daily to the maximum concentration measured. We also make the health protective assumption that 100% of the ingested chemical is absorbed into the body. The percent actually absorbed into the body is likely less.

If concentrations exceed the chemical specific health-based comparison value for non cancer illness, then we estimate an exposure dose. For non-cancer illnesses, we first estimate the health risk for children. Children are smaller and swallow more soil than adults. Thus, their exposure is higher. If children are not at risk, then adults are assumed to not be at risk.

For cancer, we quantify the increased theoretical risk by multiplying the estimated exposure dose by the EPA cancer potency slope factor. This is the highest estimated increased cancer risk. The actual increased cancer risk is likely lower. Because of large uncertainties in the way scientists estimate cancer risks, the actual increased risk of cancer may be as low as zero.

We usually estimate the cancer risk from lifetime (70 years) exposure or over a significant portion of the lifetime (at least 35 years). Most cancer slope factors are derived from animals exposed over their entire lifetime to a carcinogenic chemical. Usually, little is known about the cancer risk in animals from less than lifetime exposures. Estimating the cancer risk for children, or from less than 35 years exposure, may introduce significant uncertainty.

It is important to note, that no arsenic levels found on the Harar property exceeded the non-cancer comparison values. The non-cancer exposure dose was estimated only as a necessary step in completing the later cancer risk calculation (Appendix A).

Surface Soil (0-6 inches below land surface):

The maximum surface soil concentrations for arsenic were below the health-based comparison value for non-cancer illness (Table 2). Therefore, no apparent non-cancer risk is associated with children or adults incidentally ingesting (swallowing) very small amounts of surface soil at the Harar Avenue property.

Because arsenic is a known carcinogen, the Assessment Program also estimated a theoretical increase cancer risk. The exposure dose is multiplied by the chemical specific cancer slope factor in order to estimate the theoretical increase of cancer over a lifetime (70 years) (Appendix A). At the maximum surface soil arsenic concentration (5.5mg/kg), the theoretical increased risk of cancer is one more case of cancer in 100,000 people (Table 3). This estimate is considered a “very low” theoretical increase cancer risk for incidental ingestion. This estimate uses the highest surface soil concentration measured at the Harar property, higher end estimate of incidental surface soil ingestion, and the upper range of the cancer potency. Thus, this is a conservative estimate of the increased cancer risk for exposure to arsenic in the surface soil. The actual increased cancer risk is likely lower and may be as low as zero.

Subsurface Soil (deeper than 6 inches below land surface):

People are typically exposed to only the top few inches of soil (i.e. surface soil). Exposure to subsurface soil would only occur if future activities brought subsurface soil to the surface.

None of the arsenic concentrations measured in the subsurface soil at the Harar Avenue property exceeded the non-cancer comparison value (Table 2).

At the maximum surface soil arsenic concentration (7.5mg/kg), the theoretical increased risk of cancer is two more cases of cancer in 100,000 people (Table 3). This estimate is considered a “very low” theoretical increase cancer risk for incidental ingestion. This estimate of risk quantifies the results from swallowing (incidental ingestion) very small amounts of the maximum concentrations of subsurface soil over an entire lifetime. This estimate uses the highest soil concentration measured, a higher end estimate of incidental soil ingestion, and the upper range of the cancer potency. Again, it is important to note that these soil concentrations are in the subsurface soil and would have to be brought to the surface before a resident could be exposed. Thus, this is a conservative estimate of the increased cancer risk for exposure to arsenic in subsurface soil. The actual increased cancer risk is likely lower and may be as low as zero.

Conclusions

Based on the available data, incidental ingestion of current levels of arsenic in the soil from the Harar Avenue property is not likely to harm people's health. Because DEP did not test the Harar Avenue property for petroleum hydrocarbons that may be associated with the S&B Go site, the data are inadequate to fully assess the health threat.

Recommendations

DEP should test soil in the ditch adjacent to the Harar Avenue property and on the Harar Avenue property for petroleum hydrocarbons.

Public Health Action Plan

The Assessment Program will evaluate additional surface soil data if they become available.

Please contact me (850-245-4444 extension 2080) with any questions or concerns.

Sincerely,

Elizabeth Tull
Health Assessor

ET/et

CC: Concerned resident
Tara Mitchell DEP Program Manager

REFERENCES:

[ATSDR 2005] Agency for Toxic Substance and Disease Registry. Public Health Assessment Guidance Manual (Update). U.S. Department of Health and Human Services, Atlanta, GA. January 2005.

[ATSDR 2007] Agency for Toxic Substances and Disease Registry. Toxicological Profile for Arsenic. U.S. Department of Health and Human Services, Atlanta, GA. August 2007.

[DOH 2011] Florida Department of Health. Letter to Elizabeth Callaghan, Administrator Hernando County Health Department from Elizabeth Tull concerning evaluation of 2010 Harar Avenue soil test results. Tallahassee, Florida. May 2, 2011.

[ES 2010] Earth Systems Inc. Supplemental Site Assessment Report. December 2010.

[ES 2011] Earth Systems Inc. Supplemental Site Assessment Report. April 2011.

[Handex 2004] Handex. Site Assessment Report S& B Go. September 2004.

Table 1: Potential Human Exposure Pathways at the Harar Avenue Property

POTENTIAL PATHWAY NAME	POTENTIAL EXPOSURE PATHWAY ELEMENTS					TIME
	SOURCE	ENVIRONMENTAL MEDIA	POINT OF EXPOSURE	ROUTE OF EXPOSURE	EXPOSED POPULATION	
Incidental ingestion of surface soil in the yard	Contaminated surface soil	Soil	Soil in the yard	Ingestion	About 5 residents in the house on the property	Current and Future
Incidental ingestion of subsurface soil in the yard	Contaminated subsurface soil	Soil	Soil in the yard	Ingestion	About 5 residents in the house on the property	Future

Table 2: 2011 Maximum Arsenic Concentrations in Harar Avenue Soil

Sample Depth	Maximum Concentration (mg/kg)	Comparison Value* (mg/kg)	Source of Comparison Value	# of samples above comparison value/total # soil samples
0-6 inches (surface)	5.5	20 (non-cancer) 0.5 (cancer)	ATSDR Chronic EMEG	0/14 14/14
Deeper than 6 inches (subsurface)	7.5	20 (non-cancer) 0.5 (cancer)	ATSDR Chronic EMEG	0/14 14/14

mg/kg = milligrams per kilograms
* Comparison values only used to select chemicals for further scrutiny, not to the judge the risk of illness.
Source of data: Earth Systems Inc. 2011
EMEG= Environmental Media Evaluation Guide

Table 3: 2011 Estimated Arsenic Dose and Theoretical Cancer Risk from Exposure to Arsenic in Harar Avenue Soil

Sample Depth	Maximum Concentration (mg/kg)	Estimated Ingestion Exposure Dose (mg/kg/day)	Estimated Theoretical Cancer Risk
0-6 inches (surface)	5.5	.000008	1 X 10^{-5} very low increased risk or 1 in 100,000
Deeper than 6 inches (subsurface)	7.5	.00001	2 X 10^{-5} very low increased risk or 2 in 100,000

mg/kg = milligrams per kilograms   mg/kg/day = milligrams per kilogram per day
* Comparison values only used to select chemicals for further scrutiny, not to the judge the risk of illness.
Source of data: Earth Systems Inc. 2011
See Appendix A for calculations.

Figure 1: Area Map

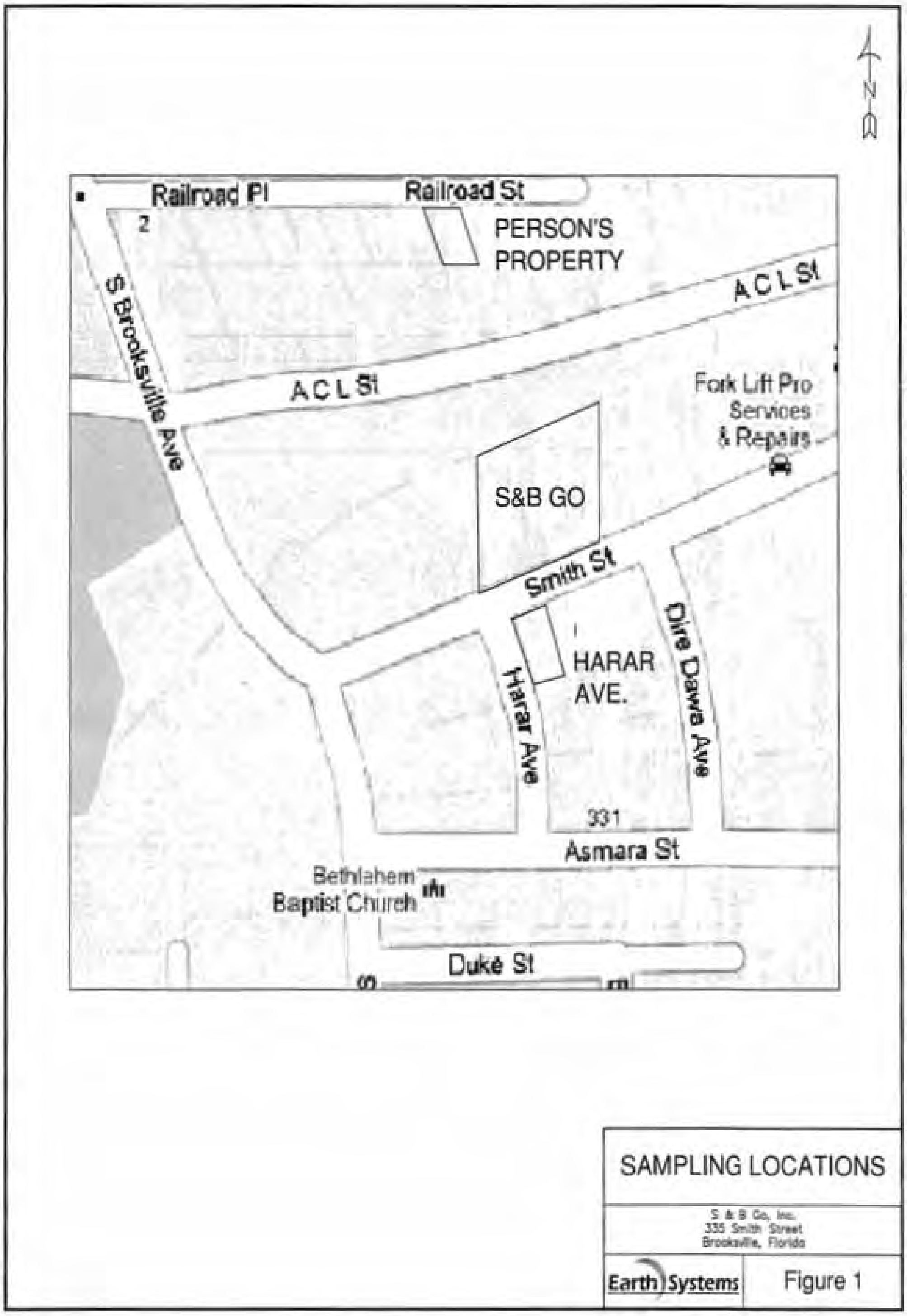
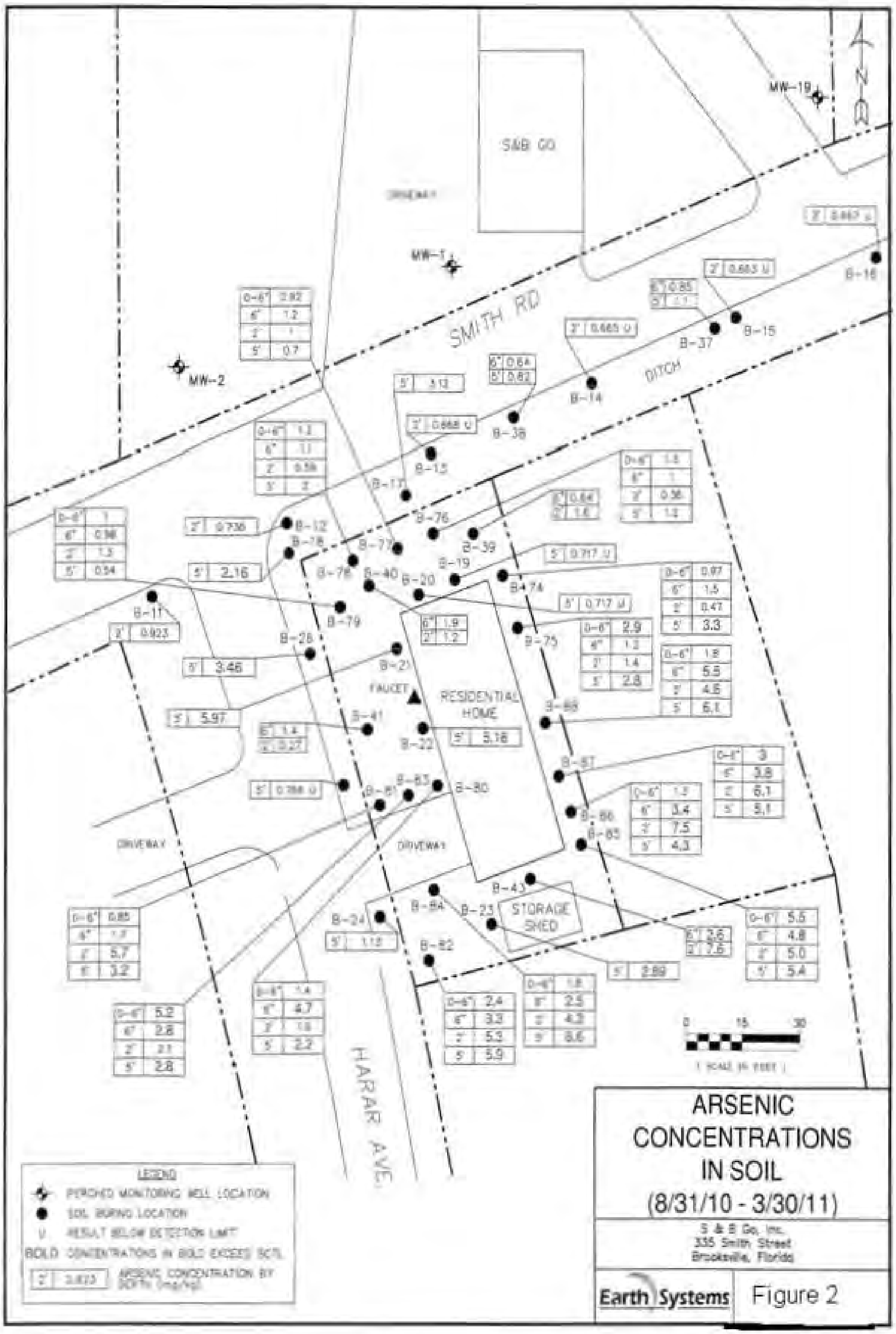


Figure 2: Soil Sampling Locations on Harar Avenue Property



Appendix A: Calculations

I). Exposure dose:

Incidental soil ingestion

Non-cancer

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

- children incidentally ingest (swallow) an average of 200 milligrams (mg) of soil per day (about the weight of a postage stamp),
- adults incidentally ingest (swallow) an average of 100 mg of soil per day,
- children weigh an average of 16 kilograms (kg) or about 35 pounds,
- adults weigh an average of 70 kg, or about 155 pounds,
- children and adults incidentally ingest (swallow) contaminated surface soil at the maximum concentration measured for each contaminant
- exposure factor is 1 (reflecting chronic daily exposure of 365 days 24 hours per day)

Abbreviations:

D= exposure dose (mg/kg/day)
C= contaminant concentration (mg/kg)
IR= intake rate of contaminated soil (mg/day)
EF= exposure factor (unit less; in this instance, the EF is 1 because we expect daily exposure)
CF= conversion factor (10^{-6} kg/mg)
BW= body weight
mg= milligram
kg= kilogram
d= day

D= (CxIRxEFxCF)/BW

It is important to note that no arsenic levels were found to exceed non-cancer comparison values. **The non-cancer exposure dose is estimated as a necessary step in completing the later cancer risk calculation.**

***Arsenic* surface soil exposure dose- (0-6 inches below land surface (bls)):**
maximum surface soil concentration = 5.5 mg/kg

D= (5.5 mg/kg x100mg/day x 1 x 10-6 kg/mg)/ 70 kg = .000008 mg/kg/d

***Arsenic* subsurface soil exposure dose- (deeper than 6 inches bls):**
maximum subsurface soil concentration = 7.5 mg/kg

D= (7.5 mg/kg x100mg/day x 1 x 10-6 kg/mg)/ 70 kg = .00001 mg/kg/d

II). Cancer risk

To estimate the theoretical cancer risk from incidental ingestion of contaminated soil, Florida DOH uses the following standard program assumptions:

- An average lifetime is 70 years

To put the cancer risk into perspective, Florida DOH uses the following descriptors for the different numeric cancer risks:

1 in	10 (10^{-1})	"very high" increased risk
1 in	100 (10^{-2})	"high" increased risk
1 in	1,000 (10^{-3})	"moderate" increased risk
1 in	10,000 (10^{-4})	"low" increased risk
1 in	100,000 (10^{-5})	"very low" increased risk
1 in	1,000,000 (10^{-6})	"extremely low" increased risk

ER=CSF x dose

ER= estimated theoretical cancer risk (unit less)
CSF=cancer slope factor from Environmental Protection Agency (EPA)
Dose= estimated exposure dose

Arsenic <u>surface</u> soil (0-6 inches) theoretical cancer risk:

Arsenic ingestion cancer slope factor: 1.5 (mg/kg/d)-1
Arsenic ingestion dose for surface soil: .000008 mg/kg/d
(1.5 $(mg/kg/d)^{-1}$) x .000008 mg/kg/d) = .000012 or approximately 1 x 10^{-5}

This would be interpreted as an increased risk of 1 additional cancer for every 100,000 people.

Arsenic <u>subsurface</u> soil (deeper than 6 inches bls) theoretical cancer risk:

Arsenic ingestion cancer slope factor: 1.5 (mg/kg/d)-1
Arsenic ingestion dose for surface soil: .00001mg/kg/d

(1.5 $(mg/kg/d)^{-1}$) x .00001mg/kg/d) = .000015 or approximately 2 x 10^{-5}

This would be interpreted as an increased risk of 2 additional cancers for each 100,000 people.