Health Consultation

MILL VIEW SUBDIVISION

PORT ST. JOE, GULF COUNTY, FLORIDA

OCTOBER 31, 2001

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

Certification

This Health Consultation was prepared by the Florida Department of Health under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with approved methodology and procedures existing at the time the health consultation was begun.

Debra Gable
Technical Project Officer,
SPS, SSAB, DHAC
ATSDR

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

for Richard Gillig
Branch Chief,
SSAB, DHAC
ATSDR

HEALTH CONSULTATION

MILL VIEW SUBDIVISION

PORT ST. JOE, GULF COUNTY, FLORIDA

Prepared by:

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

Background and Statement of Issues

In 1938, the St. Joe Paper Company began paper mill operations in Port St. Joe, Florida on the Gulf of Mexico (Figure 1). From the 1940s to the early 1950s, the St. Joe Paper Company filled a wetlands west of the paper mill with paper mill wastes. These wastes included tree bark, boiler ash, "lime grits" and slag. In the mid-1950s St. Joe Paper Company created the 100-acre Mill View subdivision on top of some of the filled area (Figure 2).

In 1990, the Florida Department of Environmental Protection (DEP) found arsenic and solvents in groundwater beneath the nearby Apalachicola Northern Railroad property. In a search for the source of the ground water contamination, the DEP collected 32 soil samples from the Mill View subdivision in June 2001. DEP collected these soil samples from a predetermined grid. They tested these soil samples for five metals: arsenic, cadmium, lead, mercury, and nickel.

DEP reported the results of these soil tests to the Gulf County Health Department which requested a review by the Florida Department of Health (DOH). This health consultation is limited to a review of the June 2001 DEP soil testing in the Mill View subdivision. DOH, through a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR) in Atlanta, Georgia, evaluates the public health significance of hazardous waste sites in Florida. This is the first review of the Mill View subdivision by either DOH or ATSDR.

DEP plans to test additional soil samples from the Mill View subdivision. DEP also plans to test the ground water under the subdivision including existing irrigation wells that residents use to water their home gardens.

Demographics

The majority of residents in the Mill View community are African-American.

Methodology

In June 2001, the DEP collected soil samples from 32 locations in the Mill View subdivision, primarily in the fill area. They used a predetermined grid for the sample locations. At each location they collected soil from the surface to twelve inches deep and at least one deeper interval. DEP observed ash and slag at six locations and "lime grits" in two others (Table 1). DEP analyzed the soil samples for five metals: mercury, lead, arsenic, cadmium, and nickel.

Discussion

Although DEP provided additional data, DOH only evaluated the chemical analyses for the top foot of soil because people do not routinely contact deeper soil. DOH compared these soil test results with health-based screening values to narrow our focus to those contaminants most important to public health.

Analytical Results for Cadmium, Lead, Mercury, and Nickel

The concentrations of cadmium, lead, mercury, and nickel in the Mill View subdivision soil (0-12 inches deep) were all below ATSDR's health-based screening levels and thus are unlikely to cause any illness. The following table shows the screening values DOH used.

Screening Values used for Cadmium, Lead Mercury and Nickel				
Screening Value in milligrams per kilogram (mg/kg)	*Cadmium †*	*Lead ‡*	*Mercury §*	*Nickel **
Adult	**100**	**400**	**3.4**	**1,000**
Child	**10**	**400**	**3.4**	**100**

†Environmental Media Evaluation Guide - ATSDR comparison value for daily exposures to cadmium for longer than one year (ATSDR, 2001).

‡DEP Soil Target Cleanup Level for lead is based on EPA's Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities (#9355.4-12, 1994). This value was calculated with the EPA's Integrated Exposure Uptake Biokinetic Model which takes into account children's likely exposure from more than one source. Research indicates that young children are particularly sensitive to the effects of lead and require specific attention in the development of an STCL for lead. "Thus, an STCL that is protective for young children is expected to be protective for older persons as well" (FDEP, 1999).

§DEP Soil Target Cleanup Level for mercury are calculated for direct contact including ingestion of contaminated soil, dermal contact with the soil and inhalation of chemicals that might volatilize or adhere to dust. The combined impact of exposure to all three routes simultaneously is used to calculate the STCL (FDEP, 1999).

*Reference Dose Media Evaluation Guide - ATSDR comparison value for daily exposures to nickel for longer than one year (ATSDR, 2001).

Analytical Results for Arsenic

The arsenic concentrations in soil (0-12 inches deep) at eight of the 32 locations were above ATSDR's cancer screening value. A one-in one million excess cancer is a governmental risk

management decision of an "acceptable level of risk" (Kamrin, 1988). The federal government makes such risk management decisions to limit people's exposures to toxic chemicals.

Screening Value for Arsenic	
Screening Value in milligrams per kilogram (mg/kg)	***Arsenic*** **
Cancer Risk Evaluation Guide	**0.5**

**ATSDR cancer risk evaluation guide for 1x 10^{-6} excess cancer risk (ATSDR, 2001).

Mill View residents may have accidentally eaten small amounts of contaminated soil that they got on their hands or that could have clung to home-grown vegetables. Residents may also have breathed dust created from this soil. To estimate adults' and children's potential daily exposure rates, DOH assumed exposure to the maximum arsenic soil concentration DEP found, 10.6 mg/kg. Generally an exposure rate (also called a daily dose) is given in milligrams of chemical per kilogram of body weight per day (mg/kg/day). A milligram is one-thousandth of a gram (a raisin or paperclip weighs about one gram). A kilogram is about two pounds. DOH used standard body weights, ingestion rates, inhalation rates, and exposure times (ATSDR 1992a, EPA 1997) in our calculations (Table 3). DOH assumed that adults accidentally ingest 100 milligrams of soil per day (about the weight of postage stamp) and children accidentally ingest 200 milligrams of soil per day.

DOH compared the dose calculated for 10.6 mg/kg arsenic in soil to doses of arsenic known to cause illness in people. DOH found that accidentally ingesting arsenic-contaminated soil (0-12 inches deep) or inhaling arsenic-contaminated dust at this level would not cause any non-cancer illness. Although arsenic is known to cause cancer in people, DOH found that accidentally ingesting arsenic-contaminated soil or inhaling arsenic-contaminated dust at this level would not result in any apparent increased risk of cancer (ATSDR 2000).

DOH has not questioned Mill View subdivision residents about possible occurrences of a rare soil-eating behavior in children called "pica". Pica is a rare condition in which a child intentionally eats as much as 5,000 milligrams of soil per day, or about 25 times as much as a normal child. Five thousand milligrams of soil is about the same weight as five raisins. DOH cannot predict the likelihood of illness from pica behavior without specific information about possible ingestion levels and exposure durations.

DEP has not determined the source of arsenic. Most of the soil depths with higher arsenic levels also had some organic material or some slag (Table 1). Arsenic is present in fuel oil and in pine bark and may have been concentrated in the paper mill wastes.

Rationale for Sampling and Analysis

DEP sampled soils in the Mill View neighborhood for metals because arsenic was found in ANR groundwater monitoring wells to the south. For their June 2001 investigation, DEP located soil

samples using a predetermined grid pattern. DEP's discovery of ash, "lime grits" and slag in the subdivision indicates that other chemicals, in addition to the five metals tested for, could also be present. Future analyses of soil from the Mill View subdivision should include all contaminants

associated with paper mill waste. Since areas with mill wastes may contain elevated levels of contaminants, specific locations indicating the presence of wastes (ash, slag, or "lime grits" at the surface) should be tested. Testing the top three inches of soil is preferable to testing the top twelve inches of soil. Unless they dig, people do not usually come in contact with soil greater than three inches deep.

Buried paper mill wastes could contribute to contamination in irrigation wells in the Mill View subdivision. DEP is planning to test these irrigation wells, some of which are reportedly used to water home vegetable gardens. Again because of DEP's discovery of slag, ashes, and "lime grits", these analyses should include chemicals that might be present in paper mill wastes.

Other sources of exposure

Mill View is in an industrial part of Port St. Joe. Residents may have had past chemical exposures that are not possible to quantify at this time. Such exposures could include inhalation of airborne chemicals from the paper mill to the west, from Arizona Chemical Company to the north, and from Apalachicola Northern Railroad yard to the south.

Children's Health and Other Unusually Susceptile Populations

The unique vulnerabilities of infants and children demand special emphasis in communities faced with the contamination of their environment. Children are at a greater risk than adults from certain kinds of exposure to hazardous substances emitted from waste sites. They are more likely to be exposed because they play outdoors and because they often bring food into contaminated areas. They are shorter than adults, which means they breathe dust, soil, and heavy vapors close to the ground. Children are also smaller, resulting in higher doses of chemical exposure per body weight. In addition, the developing body systems of children can sustain permanent damage if toxic exposures occur during critical growth stages. Most importantly, children depend completely on adults for risk identification and management decisions, housing decisions, and access to medical care. Children are a special consideration in regards to this site because we have observed evidence children live in the Mill View subdivision and children may be more sensitive to metals. Children may absorb metals from the intestine more efficiently than adults and may be more sensitive to the toxicity of metals.

Based on evaluation of measured concentrations of metals collected in soil 0 -12 inches in depth, illnesses in children are unlikely to occur since estimated exposures for children were below levels observed to cause adverse health effects. However, DOH recommends that soil from 0 - 3 inches be collected and analyzed for contaminants associated with paper mill waste. DOH will reevaluate chemical exposures to children at this site if additional information becomes available.

Conclusions

DOH categorizes the Mill View subdivision as an "indeterminate public health hazard" since Mill View residents' exposure to elevated levels of paper mill wastes other than arsenic, cadmium, lead, mercury and nickel has not been determined. The presence of ash, "lime grits" and slag in the subdivision warrants additional testing of soil (0 - 3 inches) in the Mill View subdivision and sampling should be specific to contaminants associated with paper mill waste.

The concentrations of cadmium, lead, mercury, and nickel in the Mill View subdivision soil (0-12 inches deep) were all below health-based screening levels and thus are unlikely to cause illness. Concentrations of arsenic in soil were above health-based screening levels at eight of 32 locations and were considered further. DOH estimated a daily dose of arsenic due to accidental ingestion of soil or inhalation of contaminated dust for the highest level found in surface soil, 10.6 mg/kg. DOH compared this dose to doses of arsenic known to cause illness in people and/or animals. DOH determined that accidentally ingesting arsenic-contaminated soil (0-12 inches deep) or inhaling arsenic-contaminated dust at this level would not cause any non-cancer illness. Although arsenic is known to cause cancer in people, DOH found that accidentally ingesting arsenic-contaminated soil or inhaling arsenic-contaminated dust at this level would not result in any apparent increased risk of cancer.

Mill View is in an industrial part of Port St. Joe. Residents may have past chemical exposures that are not possible to quantify at this time. Such exposures could include inhalation of airborne chemicals from the paper mill to the west, from Arizona Chemical Company to the north, and from Apalachicola Northern Railroad yard to the south.

DOH recognizes DEP's efforts on behalf of the Mill View residents and agrees with DEP's decision to conduct additional sampling in the subdivision. DOH has the following specific conclusions regarding these additional tests:

1. Buried paper mill wastes could contribute to contamination in irrigation wells in the Mill View subdivision. These irrigation wells, used to water home vegetable gardens, have not been tested but should be. Groundwater analyses should include all chemicals associated with paper mill wastes

2. For their June 2001 investigation, DEP located soil samples using a predetermined grid pattern. When collecting soil samples, DEP discovered ash and other paper mill wastes in the fill. Since areas with mill wastes may contain elevated levels of contaminants, specific locations indicating the presence of wastes (ash, slag, or "lime grits" at the surface) should

be tested. Testing the top three inches of soil is preferable to testing the top twelve inches of soil.

Recommendations

DOH's recommendations follow our specific conclusions:

1. Test existing irrigation wells in the Mill View subdivision for all chemicals associated with paper mill wastes.

2. Test the soil in the Mill View subdivision where ash, "lime grits", and slag are visible at the surface. Include analyses for all contaminants associated with paper mill waste. Test the top three inches of soil rather than the top twelve inches of soil.

Public Health Action Plan

DOH will continue to assist the Gulf County Health Department by reviewing new environmental data.

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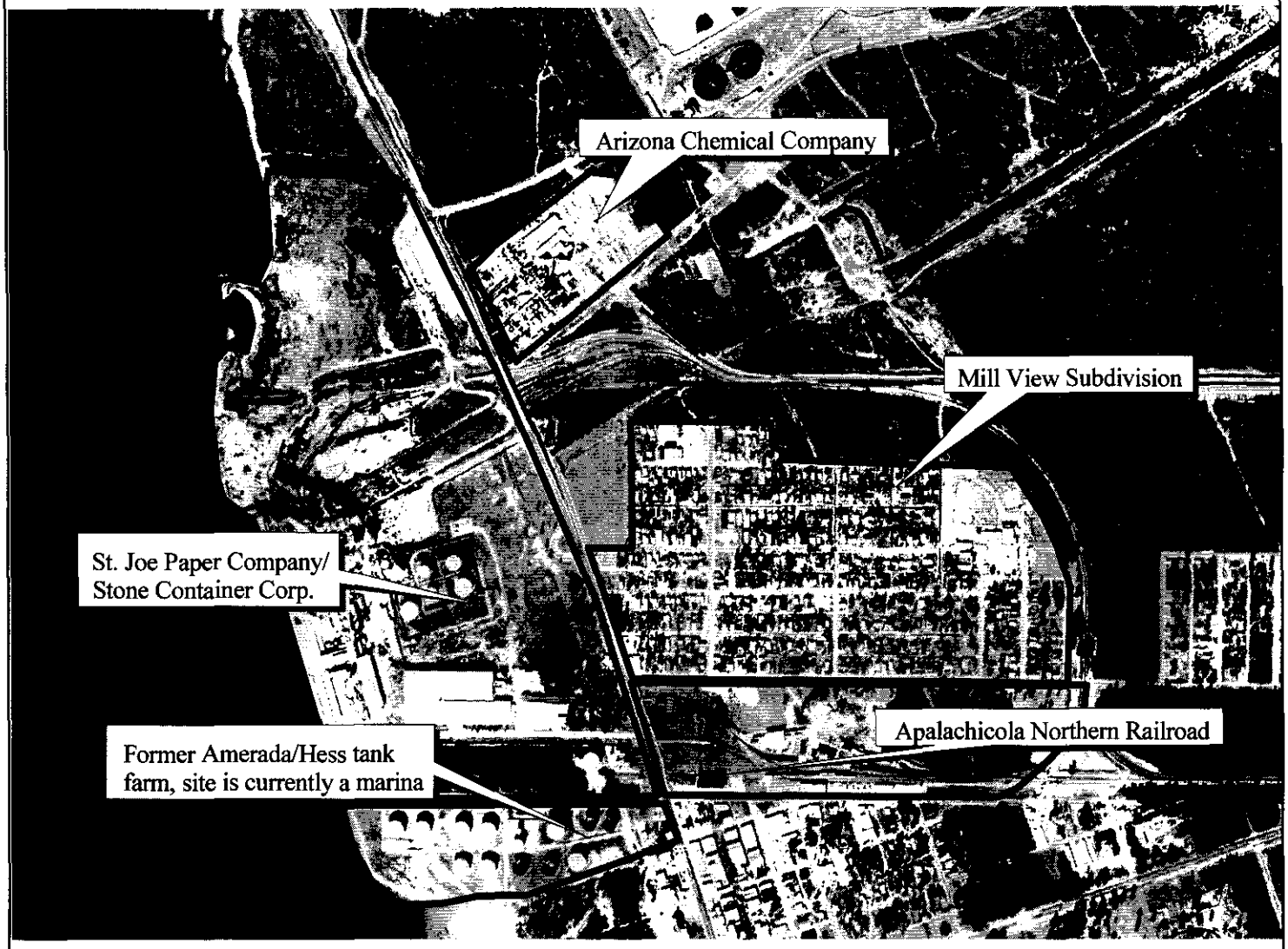
SITE TEAM/AUTHORS

Department of Health Author
Connie Garrett
Bureau of Environmental Epidemiology
Division of Environmental Health
(850) 245-4299

Department of Health Designated Reviewer
Randy Merchant
Bureau of Environmental Epidemiology
Division of Environmental Health

ATSDR Designated Reviewer
Debra Gable
Technical Project Officer
Division of Health Assessment and Consultation
Agency for Toxic Substances and Disease Registry

Figure 1, Mill View Subdivision and Surrounding Industrial Sites



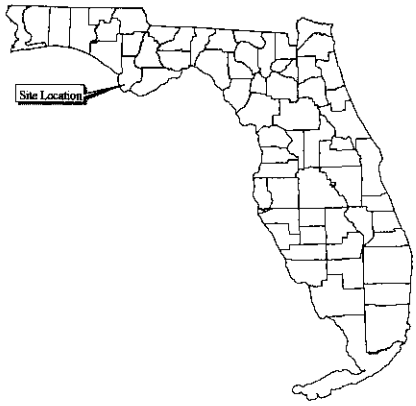


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Figure 2 - Information from DEP

Arsenic in Shallow Soil Interval
Mill View Subdivision
Port St. Joe, Gulf County, Florida

— Former RR Spur Location
— Approximate Extent of Fill Area
- - Current and Previous Ditch Location

FLORIDA

Figure 3
Present and Past Known Garden Locations

● Present

■ Past

0 0.04 0.08 0.12 Miles

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Table 1

Soil Sample Collection Intervals and Descriptions and Arsenic Levels
Mill View Subdivision, Port St. Joe, Gulf County, Florida

Sample Intervals[1] in feet	As mg/kg	Lithologic Description	Approximate Lower Extent of Backfill[2]
MV1 (0-1') MV1 (2-3')	1.1 I 0.8 I	Gray to tan sand, predominantly fine-grained quartz with organic material. Soils become wet ~ 3.5' BLS.	Dense sand encountered approximately 4.8'BLS.
MV2 (0-1') MV2 (2-3')	0.73 I 0.60 I	Gray to tan sand, predominantly fine-grained quartz with organics. What appears to be ash and slag present from 1.5 to 3' BLS. Soils become wet at 3.8' BLS.	Dense sand encountered approximately 5.8' BLS.
MV3 (0-1') MV3 (1.5-2.5') MV3 (7-8') ~20% core recovery	0.6 U 0.76 I 0.6 U	Gray to tan sand, predominantly fine-grained quartz with silt and organics. What appears to be ash and slag present from land surface to 1.5' BLS. Soils become wet at 4.3' BLS. MV3 (7-8') interval mostly organic muck.	Dense sand encountered approximately 15' BLS.
MV4 (0-1') MV4 (3-4')	0.6 U 0.6 U	Dark brown to black sand, fine-grained quartz with silt and organics; grades into light gray to brown sand, lesser organics and silt in (3-4') interval. Soils become wet at 4.3' BLS.	Dense sand encountered approximately 9.8' BLS.
MV5 (0-1') MV5 (3-4')	0.6 U 0.6 U	Sand with pine bark and lime grits. Soils become wet at 4.0' BLS.	Dense sand encountered approximately 2.3' BLS.
MV6 (0-1') MV6 (4-5')	0.59 U 1.9 I	Matrix is predominantly black organic silt with pine bark chips and wood fiber. 2' interval of gray slag at 3.0' BLS. Material wet at 5.0' BLS.	Dense sand encountered approximately 14.0' BLS.
MV7 (0-1'') MV7 (3.5-4.5'')	0.6 U 0.6 U	Primarily decomposing pine bark chips and organic material. Saturation approximately 5.1' BLS.	Dense sand encountered approximately 5.0' BLS.
MV8 (0-1'') MV8 (3.5-4.5'')	0.59 U 1.5 I	Predominantly fine-grained sand. What appears to be lime grits from 3.5 to 3.85' BLS. Material wet 4.3' BLS.	Dense sand encountered approximately 8. 7' BLS.
MV9 (0-1') MV9 (3-4')	0.62 I 1.0 I	Fine-grained sand near surface grading into black organic muck at 3' BLS. Saturated at 4.5' BLS.	Dense sand encountered approximately 7.0' BLS.
MV10 (0-1') MV10 (7-8') ~25% core recovery	0.6 U 5.9	Top 1' interval is primarily light gray to yellow fine-grained quartz sand. Remaining matrix to depth is wood chips with pieces of brick or red terra cotta like material imbedded in matrix. Material wet 5.0' BLS.	Dense sand encountered approximately 15.5' BLS.
MV11 (0-1') MV11 (3-4')	0.6 U 0.6 U	Gray quartz sand with increased presence of organics with depth. Matrix saturated approximately 4.3' BLS.	Dense sand encountered approximately 1.3' BLS.
MV12 (0-1') M V12 (2.5-3.5') MV12 (7.5-8.5') ~25% core recovery	0.6 U 1.7 I 6.3	Interval from (0-1') dry, tan, fine-grained sand with some organics. Intervals below consist primarily of bark and wood chips and decomposed organic matter. Water table at 4.2' BLS.	Dense sand encountered approximately 19.7' BLS.

Table 1

Soil Sample Collection Intervals and Descriptions and Arsenic Levels
Mill View Subdivision, Port St. Joe, Gulf County, Florida

Sample Intervals[1]	As	Lithologic Description	Approximate Lower Extent of Backfill[2]
MV13 (0-1') MV13 (3-4')	1.4 I 0.6 U	Dry compacted silt and fine-grained sand grading into a white to gray fine- to medium-grained quartz beach sand. Water table ~4.6'.	Dense sand encountered approximately 0.5' BLS.
MV14 (0-1') MV14 (3-4')	1.1 I 0.6 U	Fine-grained organic sand from land surface to 4' BLS. Trace of silts near top of core. Water table ~4.3' BLS.	Dense sand encountered approximately 1.0' BLS.
MV15 (4-5') ~25% core recovery	0.6 U 0.6 U 0.77 I	Sand with abundant organic material and concrete debris. Deep interval is primarily organic ooze with wood chips and trace amounts of fine-grained sand. Water table ~4.3' BLS.	Dense sand encountered approximately 14.7' BLS.
MV16 (0-1') MV16 (2-3') MV16 (3-4')	1.4 I 0.73 I 1.5 I	First interval is organic sand. The matrix within the second interval contains black fine-grained material (ash?') that glitters. This material then grades into organic muck that contains wood chips. Depth to water about 4.3'.	Dense sand encountered approximately 15.5' BLS.
MV17 (0-1') MV17 (3-4')	0.90 I 0.59 U	Material to depth primarily fine-grained sand with some organics. Depth to water approximately 4'.	Dense sand encountered approximately 8.5' BLS.
MV18 (0-1') MV18 (3-4')	3.0 A 0.6 U	Matrix primarily fine-grained sand and pine bark chips. Water table ~5' BLS.	Dense sand encountered approximately 17.5' BLS.
MV19 (0-1') MV19 (2-3') MV19 (3-4')	10.6 6.2 0.6 U	Organic sand with muck, wood chips, brick debris, and possible slag (2-3'). Depth to water ~4.0'.	Dense sand encountered approximately 5.7' BLS.
MV20 (0-1') MV20 (3-4')	0.59 U 0.6 U	Fine- to medium-grained sand to depth. Water table 3.5' BLS.	Dense sand encountered approximately 4.7' BLS.
MV21 (0-1') MV21 (3-4')	0.6 U 1.8	Organic sand with wood chips and concrete rubble. Water table ~4.5' BLS.	Dense sand encountered approximately 18.5' BLS.
MV22 (0-1') MV22 (3.5-4.5')	0.6 U 0.6 U	Organic sand increasing with organics to depth. Water table 4.8' BLS.	Dense sand encountered approximately 5.8 ' BLS.
MV23 (0-1') MV23 (3.5-4.5')	0.6 U 0.6 U	Light yellow to white fine-grained quartz sand. Water table ~5.6' BLS.	Dense sand encountered approximately 5.0' BLS.
MV24 (0-1') MV24 (3-4')	0.59 U 0.6 U	Fine- to medium-grained sand becoming more organic with depth. Depth to water 4.2' BLS.	Dense sand encountered approximately 5.0' BLS.

Table 1

Soil Sample Collection Intervals and Descriptions and Arsenic Levels
Mill View Subdivision, Port St. Joe, Gulf County, Florida

Sample Intervals[1] in feet	As	Lithologic Description	Approximate Lower Extent of Backfill[2]
MV25 (0-1') MV25 (3.5-4.5') MV25 (7-8') ~10% core recovery	0.6 U 0.59 U 1.7 I	Light tan, silty sand grading into medium size grain. Deep interval sample primarily organic in nature with trace of fine-grained sand. Depth to water ~5.4'.	Dense sand encountered approximately 19.4' BLS.
MV26 (0-1') MV26 (3.5-4.5')	0.6 U 0.6 U	Fine-grained sand, slightly organic grading into fine- to medium-grained beach sand. Depth to water ~5.0'.	Dense sand encountered approximately 6.0'BLS.
MV27 (0-1') MV27 (3-4')	0.6 U 0.6 U	Fine-grained sand grading into organic sand with abundant pine bark chips and concrete rubble. Water table ~4.2' BLS.	Dense sand encountered approximately 4.7' BLS.
MV28 (0-1') MV28 (3.4-4.5')	0.6 U 1.5 I	Tan to gray fine-grained sand grading into very organic sand with wood chips. Water table ~5.0'.	Dense sand encountered approximately 12.9 'BLS.
MV29 (0-1') MV29 (3.5-4.5')	0.6 U 0.6 U	Dark gray, fine-grained sand grading to dark black, silty organic sand. Water table ~5.0'BLS.	Dense sand encountered approximately 5.1'BLS.
MV30 (0-1 MV30 (4.5-5.5')	0.59 U 0.6 U	Fine- to medium-grained beach sand. Organic layer 5.5' BLS. Water saturated soils at 5.7' BLS.	Dense sand encountered approximately 6.0' BLS.
MV31 (0-1') MV31 (3.5-4.5')	0.59 U 0.6 U	Fine- to medium-grained tan to gray sand. Water table ~5.0' BLS.	Dense sand encountered approximately 1.5BLS.
MV32 (0-1') MV32 (3.5-4.5')	0.59 U 0.6 U	Fine- to medium-grained tan to gray sand. Water table ~5.0' BLS.	Dense sand encountered approximately 0.1'BLS.

[1]Intervals are presented in feet below land surface.
[2]The dense sand contact was defined as when the direct push rate of penetration slowed to less than 10 feet per minute. Description indicates possible fill material.

Table 2. Completed Exposure Pathways

PATHWAY NAME	EXPOSURE PATHWAY ELEMENTS					TIME
	SOURCE	ENVIRONMENTAL MEDIA	POINT OF EXPOSURE	ROUTE OF EXPOSURE	EXPOSED POPULATION	
Surface soil (0-12 inches deep)	Buried paper mill waste: ash, "lime grits", and slag.	Soil	Residential soils in Mill View subdivision	Ingestion	Some residents of the Mill View subdivision.	1950s to present
Dust inhalation	Contaminated surface soil	Dust	Air in Mill View subdivision	Inhalation	Some residents of the Mill View subdivision	1950s to present
Irrigation water/home grown vegetables	Buried paper mill waste: ash, "lime grits", and slag.	Ground water/ home-grown vegetables	Irrigation wells/ home-grown vegetables in Mill View subdivision	Ingestion	Some residents of the Mill View subdivision	1950s to present

Table 3 Calculated dose (mg/kg/day) from residential exposure to soil

Contaminant of Concern (maximum concentration) mg/kg		Oral MRL (mg/kg/day)	Soil- Ingestion (mg/kg/day)		Inhalation MRL	Soil - Inhalation (in ppm conv. from mg/m^3)	
			Child	Adult		Child	Adult
arsenic	10.6	(chronic) 0.0003	0.000141	0.000015	none	5.8×10^{-7}	5.8×10^{-7}

Scenario Time-frame: Future
Land Use Conditions: Residential
Exposure Medium- Soil and Dust
Exposure Point- Inhalation of Ingestion of Soil or Dust
Receptor Population- Residents
These doses were calculated using Risk Assistant Software (Hampshire Research Institute) and accepted values for groundwater consumption, shower inhalation exposure and dermal exposure parameters (EPA, 1991).
MRL - Minimum Risk Level for non-cancer illnesses,
ppm = parts per million,
mg/m^3 = milligrams per cubic meter
$\mu g/L$ = micrograms per liter,
mg/kg/day = milligrams per kilogram per day

The above doses were calculated using the following values:
acute = exposure is 1- 14 days
intermediate = exposure is 15-364 days
chronic = exposure is 365 and longer
Inhalation breathing rate is 0.5 cubic meters per hour

Adult body weight- 70 kg
Adult soil consumption- 100mg
Child body weight- 15 kg
Child water consumption- 200 kg
Soil exposure is 365 events per year, 3 hours per event.

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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