Health Consultation

PICAYUNE WOOD TREATING SITE

PICAYUNE, PEARL RIVER COUNTY, MISSISSIPPI

EPA FACILITY ID: MSD065490930

JANUARY 5, 2006

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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HEALTH CONSULTATION

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Prepared by:

U.S. Department of Health and Human Services
Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation
Superfund and Program Assessment Branch

STATEMENT OF ISSUES AND BACKGROUND

Statement of Issues

The Agency for Toxic Substances and Disease Registry (ATSDR) prepared this health consultation to evaluate, based on the information currently available, any known or potential adverse human health hazards related to exposures to contaminants in sediments and surface soils at the Picayune Wood Treating site.

Background

The Picayune Wood Treating site is located at 403 Davis Street in the city of Picayune, Pearl County, Mississippi. The facility operated as a wood preserving plant from 1946 until 1999. The facility utilized a pressurized wood treating process to produce wood products (primarily utility poles and foundation pilings). The main process area included the creosote, pentachlorophenol (PCP), and diesel storage tank area; the oil/water separator tanks; the treatment vessels; and the treatment building (1).

Currently, the site is comprised of abandoned buildings, storage tanks/vats, treated poles, and several pieces of heavy equipment. A surface impoundment measuring approximately 100 feet by 30 feet is located on the eastern portion of the facility. The facility contains 5 drainage ditches, the northernmost of which flows from the biostorage tanks southeast into Mill Creek. The second drainage ditch flows east from the pressure tank area, intersects the first drainage ditch, and flows into Mill Creek. The third drainage ditch originates south of the central processing area and flows south into Mill Creek. The fourth drainage ditch is located near the facility office and intersects the third drainage ditch and flows into Mill Creek. The fifth drainage ditch is located on the western portion of the facility property and flows to the west.

The facility is bounded on the north by a residential, commercial, and industrial area. The facility is bounded on the south by a public park, daycare center, and residences. The facility is bounded on the east by a commercial and industrial area and on the west by an elementary school and residences. Two industries are presently operating on the 30-acre site – a paint blending company located to the north of the site and a chromated copper arsenate (CCA) wood treating operation to the southwest of the site (2).

According to 2000 U.S. Census results, approximately 2,471 people live within a ½ mile distance of the site and 5,661 people live within a 1 mile distance of the site. Of those within a ½ mile distance, 301 are children aged 6 and younger; 321 are adults aged 65 and older; and 562 are females of childbearing aged 15 to 44. Of those within a 1 mile distance of the site, 620 are children aged 6 and younger; 787 are adults aged 65 and older, and 1,229 are females of childbearing aged 15 to 44 (Appendix A).

<u>Past ATSDR Evaluation</u>

In a previous health consultation dated January 13, 2005, ATSDR concluded that repeated exposure to the highest concentration of polyaromatic hydrocarbon (PAHs) and dioxins in sediments from Mill Creek posed a potential health hazard for children. (ATSDR based this conclusion on samples collected from an approximate 3,000 linear foot section of Mill Creek.) The potential health hazard was based on the following conclusions:

- Children who were repeatedly exposed to the highest concentration of PAHs in sediment might be at increased risk for carcinogenic health effects.
- Children who were repeatedly exposed to the highest concentration of dioxins in sediment might be at increased risk for carcinogenic and non-carcinogenic health effects.

As a result of these conclusions, ATSDR recommended the following actions:

- Prevent human exposure to contaminants in the referenced section of Mill Creek
- Fully characterize the extent of surface soil and sediment contamination at the site.

Current ATSDR Evaluation

Since the publication of the January 2005 health consultation, EPA installed a fence along the portion of Mill Creek of concern in our previous analysis. In March 2005, EPA conducted additional surface soil, subsurface soil, and groundwater sampling to supplement the data collected during previous investigations. Subsurface soil samples were collected from selected on-site locations. However, subsurface soils are not evaluated in this HC because people are not likely to come into contact with these below ground sources (samples collected approximately 3 to 4 feet below ground surface). Groundwater samples were collected from monitoring wells installed on or near the site. Reportedly, all of the residents within a 1 mile radius of the site obtain their potable water from a municipal source. (3) Therefore, groundwater is not evaluated as a potential exposure point in this health consultation because people are not expected to use groundwater (well) water for potable purposes.

In this health consultation, ATSDR will evaluate the new environmental data (collectively with the old data from 2002 and 2004) for soils and sediments over the entire site (on- and off-site). ATSDR will evaluate only soil and sediment data because these are the media of specific concern at the site at this time. ATSDR will evaluate any information that becomes available on additional completed or potential exposure pathways at this site in future documents, as necessary. ATSDR selected completed exposure pathways based on evidence observed during site visits, personal testimonies offered by residents during public meetings and public availability sessions, and the availability of quantitative environmental sampling data.

ENVIRONMENTAL DATA

In March 2005, EPA collected surface soils samples as five-point composites from grids approximately 150 feet on a side. All surface soil samples included in this HC (2004 and 2005) were collected from a depth of 0 to 6 inches below ground surface, except for two composite samples which were collected from a depth of 0 to 3 inches below ground surface. EPA collected surface soil samples from the on-site property, off-site residential properties in proximity to the facility, the school property, the public park property, and areas adjacent to Mill Creek. Samples were analyzed for semi-volatile organic compounds (SVOCs) and metals; samples from off-site properties were also analyzed for dioxins and furans.

EPA collected sediment samples in 2002 and 2004 from three areas in the vicinity of the site: 1) the ditch that drains a wood treatment facility west of the site, 2) Mill Creek and a short segment of the McCall River that Mill Creek feeds, and 3) several locations in the neighborhood south of the site. Nine soil samples were collected to represent residential exposures, including a sample from a garden in proximity to the site. All samples were analyzed for SVOCs and metals; samples from some locations were analyzed for dioxins and furans. Dioxins are expressed as toxic equivalency quotients (TEQs). The TEQs were calculated using the World Health Organization (WHO-98) method. The toxicity equivalent TEQ is calculated by multiplying the exposure level of a particular dioxin-like compound by its toxicity equivalency factor (TEF). The TEFs for the dioxins congeners contributing to the TEQ calculation are in Appendix B. Based on sampling results, most of the TEQ came from 1,2,3,4,6,7,8-heptachlorodibenzodioxin (approximately 25%). The other significant components were 1,2,3,6,7,8-hexachlorodibenzodioxin (approximately 9%); 1,2,3,4,6,7,8-heptachlorodibenzofuran (approximately 6%); and 1,2,3,4,7,8-hexachlorobenzofuran (approximately 5%). 1,2,3,4,6,7,8,9-octachlorodibenzodioxin and 1,2,3,4,6,7,8,9-octochlorodibenzofuran combined made up less than 2% of the total TEQ.

ATSDR's Evaluation Process

ATSDR compared the maximum level of each contaminant detected during environmental sampling with appropriate screening comparison values, when available, to select contaminants for further evaluation for carcinogenic and/or non-carcinogenic health effects. The contaminants selected for further evaluation are called contaminants of concern. (See Appendix D for a detailed discussion of ATSDR's evaluation process.)

The contaminants of concern in soils and sediment at this site are pentachlorophenol (PCP), metals (arsenic and chromium), and semi-volatile organic compounds (SVOCs), including polycyclic aromatic hydrocarbons (PAHs, expressed as BaP equivalents), and 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD or dioxins, expressed as TEQ). A detailed discussion of the contaminants of concern at this site is included in Appendix E of this document.

PATHWAYS ANALYSIS

To determine whether nearby residents or workers could be exposed to contaminants migrating from the site, ATSDR evaluated the environmental and human components that lead to exposure. This pathways analysis consists of the following 5 elements: a source of contamination, transport through the environmental medium, a point of exposure, a route of human exposure and a receptor population. ATSDR categorizes an exposure pathway as completed if all five elements of a pathway are present. Completed exposure pathways require further evaluation to determine whether exposures are sufficient in magnitude, duration, and frequency to result in adverse health effects.

For a potential exposure pathway, one or more of the elements may not be present, but information is insufficient to eliminate or exclude the element. Eliminated exposure pathways lack one or more of the specific elements.

Completed Exposure Pathways

Completed exposure pathways associated with the site are summarized in the Table 1 below.

Table 1. Completed Exposure Pathways

Pathway Name	Source	Medium	Exposure Point	Exposure Route	Receptor Population	Time of Exposure	Exposure Activities	Chemicals
On-site surface soil	Past wood treating operations	Surface soil; Waste products	Soil	Direct Skin Contact Ingestion Inhalation	On-site workers; Trespassers	Past Present Future	Working or trespassing on the site	Dioxins PAHs PCP Arsenic Chromium
Off site surface soil/sediment	Contaminants migrating from the site	Soil Sediments	Nearby yards; creek beds; public parks & schools	Direct Skin Contact Inhalation Ingestion	Nearby residents, park and creek users	Past Present Future	Outdoor recreation	Dioxins PAHs PCP Arsenic Chromium

<u>Soil in Residential Yards</u>

During the public availability sessions in February 2005, residents reported that a dark, creosote-like product flowed from the plant into nearby ditches and creeks. Residents reported that the ditches occasionally overflowed, causing the product to spread outward from the ditches into surrounding residential yards and properties. (Some residential properties abut the drainage ditches or Mill Creek.) In addition, airborne emissions from the plant may have been deposited into nearby residential yards.

Contaminants found in surface soil in residential yards are shown in Table 2 below. The data indicate the presence of contaminants of concern.

Table 2. Contaminant Levels Detected in Surface Soils (0-6 inches) in Residential Yards

CONTAMINANT	Milligrams/kilogram (mg/kg) or ppm				SOURCE	FREQUENCY DETECTED
	Minimum	Maximum	Mean	Comparison Value		
BaP Equivalents Total	0.2	19.8	3.2	0.1	Oral CREG	23/23
Pentachlorophenol (PCP)	ND	56	4.7	6	Oral CREG	13/23
TEQs (dioxins)	0.00001	0.007	0.002	0.00005	Chronic EMEG	18/18
Arsenic	ND	3.1	1.7	0.5	Oral CREG	22/23
Chromium	3.1	7.2	5.0	N/A	N/A	23/23

ND = not detected
N/A = not applicable
ppm = parts per million
EMEG = Environmental Media Evaluation Guide
TEQs = toxic equivalency quotient
CREG = Cancer Risk Evaluation Guide

People can be exposed to contaminants in surface soil through inhalation of suspended soil particles or through direct skin contact with, or incidental ingestion of, contaminated soil. Children might be exposed while playing outdoors in their yards or the yards of their neighbors. Adults might be exposed while doing yard work, gardening, or other outdoor activities.

Sediments in Residential Yards
Contaminants found in sediments from resident yards are shown in Table 3 below. The data indicate the presence of contaminants of concern.

Table 3. Contaminant Levels Detected in Sediment (0-6 inches) in Residential Yards

CONTAMINANT	Milligrams/kilogram (mg/kg) or ppm				SOURCE	FREQUENCY DETECTED
	Minimum	Maximum	Mean	Comparison Value		
BaP Equivalents Total	ND	25.1	6.9	0.1	Oral CREG	8/9
Pentachlorophenol (PCP)	ND	56.0	7.5	6	Oral CREG	5/9
TEQs (dioxins)	0.0001	0.01	0.003	0.00005	Chronic EMEG	9/9
Arsenic	1.4	15	4	0.5	Oral CREG	9/9
Chromium	2.6	46	10	N/A	N/A	9/9

ND = not detected
N/A = not applicable
ppm = parts per million
EMEG = Environmental Media Evaluation Guide
TEQs = toxic equivalency quotient
CREG = Cancer Risk Evaluation Guide

Since many residential homes abut drainage ditches or Mill Creek, seasonal fluctuations in rainfall and water levels could result in the migration and deposition of contaminants as sediments in residential areas. Children might be exposed to sediments while playing outdoors in their yards or the yards of their neighbors.

<u>Sediments in Mill Creek and surrounding ditches</u>

Operations at the Picayune Wood Treatment facility resulted in contamination of the sediments within Mill Creek and surrounding creekbeds. Open drainage ditches run throughout the residential neighborhood and cut through the backyards of many homes. ATSDR learned from personal testimonies, and through observations during site visits, that children play in the nearby creeks and/or cross the creeks to get to and from various locations. ATSDR observed evidence of activity along the creeks; including children's toys in Mill creek, ropes tied to trees bordering Mill creek, well-worn paths through vegetation surrounding the creek, and picnic tables behind a youth community center within 10 feet of Mill Creek.

In summer 2005, EPA installed a fence along selected portions of Mill Creek to restrict access to the creek. However, residents report that children occasionally breach (i.e., go under, over, around or through gaps in) the installed fence and gain access to Mill Creek. Additionally, the fence is occasionally in disrepair, allowing unimpeded access to Mill Creek. Contaminants found in Mill Creek and the surrounding ditches are shown in Table 4 below. The data indicate the presence of contaminants of concern.

Table 4. Contaminant Levels Detected in Sediments in Mill Creek & Surrounding Ditches

CONTAMINANT	Milligrams/kilogram (mg/kg) or ppm				SOURCE	FREQUENCY DETECTED
	Minimum	Maximum	Mean	Comparison Value		
BaP Equivalents Total	ND	55.6	3.4	0.1	Oral CREG	45/59
Pentachlorophenol (PCP)	ND	5.8	8.1*	6	Oral CREG	12/59
TEQs (dioxins)	0.0003	0.001	0.0003	0.00005	Chronic EMEG	8/8
Arsenic	ND	7	2	0.5	Oral CREG	19/43
Chromium	ND	23	5	N/A	N/A	51/59

ND = not detected
N/A = not applicable
ppm = parts per million
EMEG = Environmental Media Evaluation Guide
TEQs = toxic equivalency quotient
CREG = Cancer Risk Evaluation Guide

* The mean level of PCP is higher than the maximum level due to the high minimum quantitation limit for non-detects for this compound.

Because ATSDR believes that it would be difficult for very young children (less than 6 years of age) to breach the fence unassisted, we assumed that only adolescents are capable of breaching the fence. Adolescents who occasionally breach the fence to retrieve a ball or to play in the ditch could be exposed to the sediments in Mill Creek through direct skin contact and incidental ingestion of contaminated sediments.

Park/Playground Area

A park borders the site to the south. ATSDR observed children playing in the park during the February 2005 site visit. Children at the park can ingest contaminated soil, inhale contaminated dust, and get the contaminated soil on their skin while playing. Young children are of greatest concern because they tend to ingest more soil than adults because of their play habits, such as frequent hand-to-mouth activity and chewing on toys that have fallen to the ground. Contaminants found in surface soil at the public park are shown in Table 5 below. The data indicate the presence of contaminants of concern.

Table 5. Contaminant Levels Detected in Surface Soil (0-6 inches) at the Public Playground

CONTAMINANT	Milligrams/kilogram (mg/kg) or ppm				SOURCE	FREQUENCY DETECTED
	Minimum	Maximum	Mean	Comparison Value		
BaP Equivalents Total	0.3	9.7	1.3	0.1	Oral CREG	15/15
Pentachlorophenol (PCP)	ND	22.0	2.0	6	Oral CREG	9/15
TEQs (dioxins)	0.00007	0.004	0.0007	0.00005	Chronic EMEG	13/13
Arsenic	1	11	3.4	0.5	Oral CREG	14/14
Chromium	4.5	58	11.8	N/A	N/A	15/15

ND = not detected
N/A = not applicable
ppm = parts per million
EMEG = Environmental Media Evaluation Guide
TEQs = toxic equivalency quotient
CREG = Cancer Risk Evaluation Guide

Public Elementary School

Southside Upper Elementary School borders the site to the west. Children who attend the school may come into contact with surface soils while playing outdoors during recess or while walking across the school yard to get to and from other places. Children at the school can ingest contaminated soil, inhale contaminated dust, and get the contaminated soil on their skin while playing. Contaminants found in surface soil at the elementary school are shown in Table 6 below. The data indicate the presence of contaminants of concern.

Table 6. Contaminant Levels Detected in Surface Soil (0-6 inches) at the Elementary School

CONTAMINANT	Milligrams/kilogram (mg/kg) or ppm				SOURCE	FREQUENCY DETECTED
	Minimum	Maximum	Mean	Comparison Value		
BaP Equivalents Total	0.6	3.3	1.2	0.1	Oral CREG	4/4
Pentachlorophenol (PCP)	ND	ND	ND	6	Oral CREG	0/4
TEQs (dioxins)	0.000004	0.000016	0.000009	0.00005	Chronic EMEG	4/4
Arsenic	1.7	4.9	2.7	0.5	Oral CREG	4/4
Chromium	6.0	8.7	7.0	N/A	N/A	4/4

ND = not detected
N/A = not applicable
ppm = parts per million
EMEG = Environmental Media Evaluation Guide
TEQs = toxic equivalency quotient
CREG = Cancer Risk Evaluation Guide

On-site (plant) property

A completed exposure pathway to on-site soils existed in the past for employees of Picayune Wood Treating who worked at the wood treatment plant when it was operational. Exposures to workers could have occurred through ingestion, inhalation and dermal contact with contaminants while working. The level of exposure would have been related to the type of job performed and personal protective equipment used. Information regarding levels of exposure for specific job types is unavailable and no further evaluation of former employees has been conducted by ATSDR.

The site is partially fenced, although current and future exposures might occur if trespassers were to cut or climb the fence or if future workers needed to access the site. These trespassers and future workers would be exposed to contaminants in surface soils at the site. A teenager or adult would be most likely to trespass at the site. Contaminants found in surface soil at the on-site facility are shown in Table 7 below. The data indicate the presence of contaminants of concern.

Table 7. Contaminant Levels Detected in On-site Surface Soil (0-6 inches)

CONTAMINANT	Milligrams/kilogram (mg/kg) or ppm				SOURCE	FREQUENCY DETECTED
	Minimum	Maximum	Mean	Comparison Value		
BaP Equivalents Total	0.2	406	12.2	0.1	Oral CREG	87/87
Pentachlorophenol (PCP)	ND	1,410	26.4	6	Oral CREG	46/87
TEQs (dioxins)	0.000004	0.027	0.002	0.00005	Chronic EMEG	44/44
Arsenic	ND	87	6.6	0.5	Oral CREG	64/87
Chromium	3	150	16	N/A	N/A	87/87

ND = not detected
N/A = not applicable
ppm = parts per million
EMEG = Environmental Media Evaluation Guide
TEQs = toxic equivalency quotient
CREG = Cancer Risk Evaluation Guide

Current trespassers could be exposed to contaminants in surface soil by inhaling fugitive dusts, by direct skin contact with on-site soil, and by incidental ingestion of particles which adhere to the surface of the skin.

PUBLIC HEALTH IMPLICATIONS

For chemicals found to exceed comparison values, ATSDR performed calculations referred to as exposure doses and cancer risk estimates (4). These calculations estimate the amount of the chemicals of concern that individuals may have been exposed to and the likelihood of cancer and non-cancer health impacts. They are based on the types of activities that individuals may be involved with that result in contact with chemicals in the soil and sediment. In the event that calculated exposure doses exceed established health guidelines (e.g., ATSDR Minimal Risk Levels or EPA Reference Doses), an in-depth toxicological evaluation is necessary to determine the likelihood of health effects.

Each of the exposure scenarios and the assumptions used to estimate exposures is discussed in Appendix B. The mean soil or sediment concentrations were used in the calculations. The equations and additional information on the calculation of exposure doses and cancer risk are presented in Appendix D.

Calculated exposure doses were compared with the available health guidelines to determine whether the potential exists for adverse non-cancer health effects. Dioxins were the only chemicals found to exceed the non-cancer health guideline for some, but not all, of the scenarios considered. Dioxin exposure is discussed in the following text. Information about the increased risk of cancer from exposure to these chemicals is also provided for each of the exposure scenarios.

Further evaluation of the contaminants of concern demonstrates that benzo(a)pyrene, pentachlorophenol, arsenic and chromium found in soil and sediment are not at levels of public health concern. A summary of the calculated exposure doses (non-cancer effects) and cancer risk for each scenario is presented in Tables 8 and 9 in Appendix F.

Surface Soils

None of the calculated doses for adults exposed to soil in residential yards exceed the health guideline for adults. None of the calculated doses for children playing at the school yard exceed a health guideline. For children in residential yards, the calculated dose for ingestion and direct contact with TEQs (dioxins) in soil of 1.05×10^{-8} milligrams per kilogram per day (mg/kg/day) slightly exceeds the health guideline, ATSDR's chronic oral Minimal Risk Level (MRL) of 1.00×10^{-9} mg/kg/day (5). ATSDR's MRL is about one to two orders of magnitude below any effect levels demonstrated either experimentally or in epidemiologic studies for both cancer and non-cancer health end points (6). The calculated doses for ingestion and direct contact with arsenic, chromium, B(a)P equivalents, and pentachlorophenol were all below health guidelines for children. Calculated doses for inhalation of fugitive dust were also below available health guidelines.

For children playing at the playground, the calculated dose for ingestion and direct contact with TEQs (dioxins) of 4.63×10^{-9}mg/kg/day slightly exceeds ATSDR's chronic oral MRL of 1.00×10^{-9} mg/kg/day. The calculated doses for ingestion and direct contact with arsenic, chromium, B(a)P equivalents, and pentachlorophenol were all below health guidelines. Calculated doses for inhalation of fugitive dust were also below available health guidelines.

For the on-site adolescent trespasser, the calculated dose for ingestion and direct contact with TEQs (dioxins) is 1.35×10^{-9} mg/kg/day, which slightly exceeds ATSDR's chronic oral MRL of 1.00×10^{-9} mg/kg/day. The calculated doses for arsenic, chromium, B(a)P equivalents, and pentachlorophenol were all below health guidelines. Calculated doses for inhalation of fugitive dust were also below available health guidelines.

Summary of Non-Cancer Effects for Soil Exposure

None of the exposures associated with the adult resident exceed health guidelines; therefore, non-cancer health effects are not expected. Less serious developmental and reproductive health effects that have been noted in animal studies of dioxin exposure were at doses approximately 10 to 25 times greater than the doses for the child resident and child playing in the playground, respectively, and approximately 90 times greater than the on-site adolescent trespasser exposure scenario (6). These health impacts include altered social behavior and moderate reproductive effects, specifically moderate endometriosis. At higher dioxin exposure doses, animal studies concluded more serious reproductive and developmental effects. Decreased reproduction and offspring survival, and severe endometriosis were the more serious adverse health effects reported in the available scientific literature. The exposure doses in these animal studies were approximately 60 times greater than those calculated for the child resident and hundreds of times greater than those for children playing in the playground and adolescent trespassers (5).

In conclusion, it is possible that exposure to dioxin at this site by the child resident, child playing in the playground, and adolescent trespasser may put these individuals at risk for some developmental and reproductive effects.

Summary of Cancer Risk for Soil Exposure

The increased risk of these individuals developing cancer from exposure (ingestion, direct contact, and inhalation of dust) to chemicals in soil was also considered. Cancer risk was calculated for the adult resident (includes exposure as an adult only) and the combined scenarios (includes exposure as a child, adolescent trespasser, and as an adult), for conservatism. The combination of the risks to the adult, adolescent and child is considered based on site-specific information provided by the community. ATSDR notes that this approach is very conservative and may overestimate the actual risks of these individuals. ATSDR's evaluation concludes that a no apparent to low increased risk of cancer for exposures occurring to the adult resident only. A low increased cancer risk was indicated for exposures occurring during childhood, adolescence, and adulthood (combined). The majority of the risk associated with combined exposures results from ingestion of dioxins in soil.

Several human and animal studies suggest that exposure to dioxins (specifically 2,3,7,8-TCDD which is considered the most harmful dioxin compound) increases the risk of developing cancer. Studies in humans reported increases in overall cancer deaths (all types combined), but only in highly exposed workers with long latency periods (6). The evidence for response-specific cancers is inconclusive, with some data suggesting a possible relationship between soft-tissue sarcomas (cancer of soft tissues of the body including muscles, tendons, vessels that carry blood or lymph, joints, and fat), non-Hodgkin's lymphoma (cancer of the cells of the lymphatic system which can impact the liver, bone marrow, and spleen), respiratory, thyroid, and liver cancer. Many studies reported only small relative risks and the possible impact of confounding factors was not sufficiently evaluated (6). The World Health Organization (WHO) has determined that 2,3,7,8-TCDD is a human carcinogen. The Department of Health and Human Services (DHHS) has determined that 2,3,7,8-TCDD may reasonably be anticipated to cause cancer (5).

Sediments

For the child resident who plays in sediment in and around a residential yard, the calculated dose for ingestion and direct contact with TEQs (dioxins) of 1.88×10^{-8} mg/kg/day exceeds ATSDR's chronic oral MRL of 1.00×10^{-9} mg/kg/day. As previously stated, ATSDR's MRL is about one to two orders of magnitude below any effect levels demonstrated either experimentally or in epidemiologic studies for both cancer and non-cancer health end points (6).The doses calculated for ingestion and direct contact with arsenic, chromium, B(a)P equivalents, and PCP in sediment were all below health guidelines. Calculated doses for inhalation of fugitive dust were also below available health guidelines.

For an adolescent who breaches the installed fence and gains access to Mill Creek, the ingestion and direct contact exposure doses for TEQs (dioxins), arsenic, chromium, B(a)P equivalents, and pentachlorophenol were all below their respective health guidelines. Calculated doses for inhalation of fugitive dust were also below available health guidelines.

Summary of Non-Cancer Effects for Sediment Exposure

None of the exposures associated with the adolescent fence breach scenario exceed health guideline and therefore, non-cancer health effects are not expected. Less serious developmental and reproductive health effects that have been noted in animal studies of dioxin exposure are at doses approximately 6 times greater than the doses for the child resident. At higher dioxin exposure doses, additional animal studies concluded more serious reproductive and developmental effects. Animal study exposure dose were approximately 30 times greater than those calculated for the child resident (5).

Therefore, exposure to dioxin in sediment by the child resident may put these individuals at risk for developmental and reproductive effects. As previously discussed, less serious health impacts include altered social behavior and moderate reproductive effects, specifically moderate endometriosis. Decreased reproduction and offspring survival, and severe endometriosis were the more serious adverse health effects reported in the available scientific literature (5).

Summary of Cancer Risk for Sediment Exposure

An evaluation of the increased risk of developing cancer from exposure to chemicals in sediment was also completed as part of this assessment. Cancer risk was calculated for the combination of the two scenarios (includes exposures occurring as a child resident and an adolescent trespasser). It has been determined that a low increased cancer risk exists for these individuals. The majority of the cancer risk is attributed to ingestion of dioxins in sediment

As previously discussed, exposure to dioxins has been associated with an increased risk in cancer cases overall, but only in highly exposed workers with long latency periods (6). The evidence for specific types of cancer from dioxin exposure is insufficient, some data suggest a relationship between soft-tissue sarcoma, non-Hodgkin's lymphoma, respiratory, thyroid, and liver cancer (5). Many of the available studies found small relative risks and did not control for possible impact of confounding factors (5).

CHILD HEALTH CONSIDERATIONS

In communities faced with air, water, or food contamination, the many physical differences between children and adults demand special emphasis. Children could be at greater risk than are adults from certain kinds of exposure to hazardous substances. Children play outdoors and sometimes engage in hand-to-mouth behaviors that increase their exposure potential. Children are shorter than are adults; this means they breathe dust, soil, and vapors close to the ground. A child's lower body weight and higher intake rate results in a greater dose of hazardous substance per unit of body weight. If toxic exposure levels are high enough during critical growth stages, the developing body systems of children can sustain damage. Finally, children are dependent on adults for access to housing, for access to medical care, and for risk identification. Thus adults need as much information as possible to make informed decisions regarding their children's health. ATSDR is committed to evaluating the special interests of children at sites such as Picayune Wood Treating Site.

As part of this Health Consultation, ATSDR considered the concentrations of chemicals that children could be exposed to and the likelihood of adverse effects resulting from their exposure. Using U.S. Census 2000 information, about 620 children (age 6 and younger) reside within 1 mile of the site. The conclusion of ATSDR's evaluation of childhood exposures indicates that it is possible that children exposed to soil and sediment associated with the Picayune Wood Treating site may be at risk for adverse health effects, including some reproductive and developmental effects.

CONCLUSIONS

1. Based on the available soil and sediment data and likely exposure scenarios, ATSDR has determined that exposure to contaminants at the Picayune Wood Treating site poses a **public health hazard**.
2. Children and adolescents might be at increased risk for developmental and reproductive effects from exposure (via ingestion, direct skin contact, and inhalation of dust) to dioxins in surface soils on and around the facility.
3. Children might be at increased risk for developmental and reproductive effects from exposure to dioxins in sediments in residential yards and creekbeds in proximity to the site.
4. Residents exposed to chemicals in soil during adulthood are expected to have no apparent increased cancer risk. However, individuals who have lived in the community throughout their lives and have been exposed to chemicals in soil as children, adolescents, and adults have a low increased cancer risk.
5. Individuals exposed to chemicals in sediment as children and adolescents have a low to moderate increased cancer risk.

RECOMMENDATIONS

1. Take measures to reduce or eliminate human exposures to contaminants in surface soils and sediments on and around the site.
2. Conduct additional sampling in the area to further define the extent of contamination, with particular focus on areas where exposures to vulnerable populations may occur (e.g., daycare centers, schools, nursing homes, etc.).
3. Ensure that protective barriers are properly maintained to prevent access to areas with contaminated soil and sediment.
4. Remove on-site contamination sources that contribute to continued off-site migration of contaminants.

PUBLIC HEALTH ACTION PLAN

The Public Health Action Plan (PHAP) for the Picayune Wood Treating Site contains actions to be taken by ATSDR or other government agencies at the site. The purpose of the PHAP is to ensure that this health consultation not only identifies public health hazards, but also provides an action plan to mitigate and prevent adverse human health effects resulting from past, present, and/or future exposures to hazardous substances at or near the site.

Public Health Actions Completed:

- On January 13, 2005, ATSDR completed a health consultation for the Picayune Wood Treating site in response to a request from EPA. The health consultation evaluated soil and sediment data for the specific portion of Mill Creek for which a fence was proposed.
- In July 2005, ATSDR sent residents a creosote fact sheet as requested by community members during our February 2005 public availability sessions. The fact sheet contained general information about creosote and how it can affect a person's health.
- In February 2005, ATSDR held two public availability sessions to gather community health concerns.

Public Health Actions Planned

- ATSDR will coordinate with the appropriate agencies to address community health concerns. ATSDR will communicate the findings to the community through fact sheets, letters, or public availability sessions.
- ATSDR will develop and implement a health education plan for the site. The plan will focus on ways to reduce or eliminate incidental exposures to contaminated soils and sediments.
- ATSDR will evaluate any further data that becomes available about human exposure to contaminants at the site.

ATSDR will reevaluate new environmental, toxicological, or health outcome data that may determine the need to additional actions at this site.

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1. US Environmental Protection Agency. Draft Data Summary Report Phase IV Investigation. Picayune Wood Treating Site. Picayune, Mississippi. July 2005.
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3. US Environmental Protection Agency. Draft Preliminary Assessment/Site Inspection Report. Picayune Wood Treating, Inc. Picayune, Pearl River County, Mississippi. March 21, 2001.
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6. Pohl HR, Hicks HE, Jones DE, Hansen H, DeRosa CT. Public Health Perspectives on Dioxin Risks: Two Decades of Evaluations. Hum. Ecol. Risk Assessment 8(2): 233-250. 2002.

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Picayune Wood Treating Site

Picayune, MS

EPA Facility ID: MSD065490930

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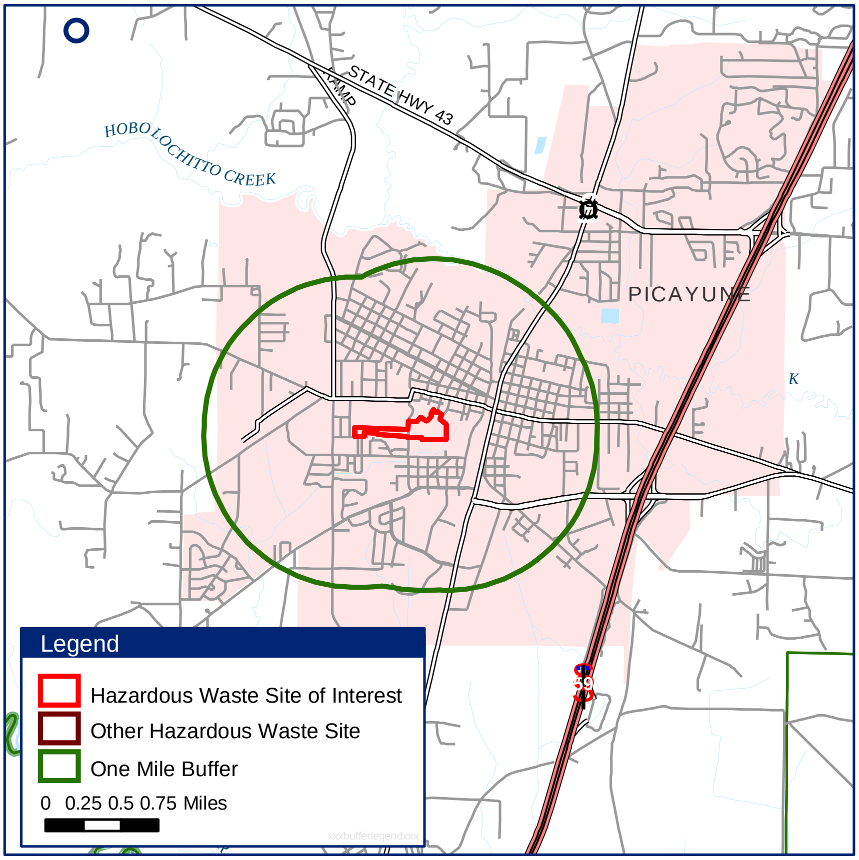
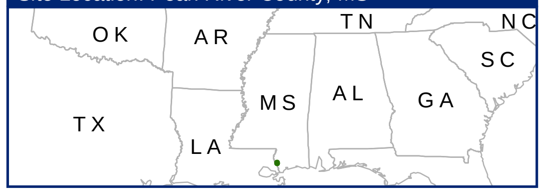


Base Map Source: Geographic Data Technology (DYNAMAP 2000), August 2002
Site Boundary Data Source: ATSDR Public Health GIS Program, August 2002
Coordinate System (All Panels): NAD 1983 StatePlane Mississippi East FIPS 2301 Feet

Site Location: Pearl River County, MS



Demographic Statistics

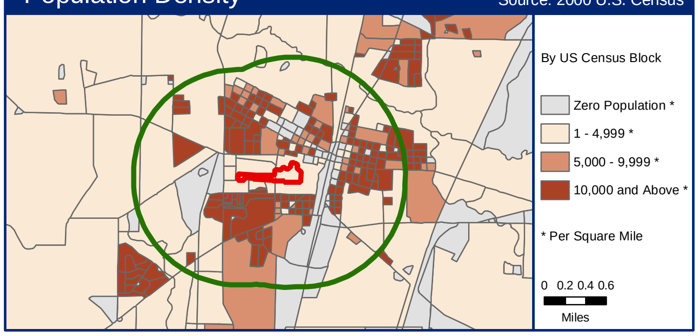
Within Specified Distance of Site*

	0.5 mi	1 mi	4 mi
Total Population	2,471	5,661	18,700
White Alone	1,082	2,855	14,220
Black Alone	1,341	2,707	4,039
Am. Indian & AK Native Alone	3	15	90
Asian Alone	6	11	65
Native Hawaiian & Other Pacific Islander Alone	0	2	6
Some Other Race Alone	5	9	61
Two or More Races	33	62	221
Hispanic or Latino**	25	56	266
Children Aged 6 & Younger	301	620	1,876
Adults Aged 65 & Older	321	787	2,662
Females Aged 15 to 44	562	1,229	3,907
Total Housing Units	1,146	2,543	8,014

Demographics Statistics Source: 2000 U.S. Census
* Calculated using an area-proportion spatial analysis technique
** People who identify their origin as Hispanic or Latino may be of any race.

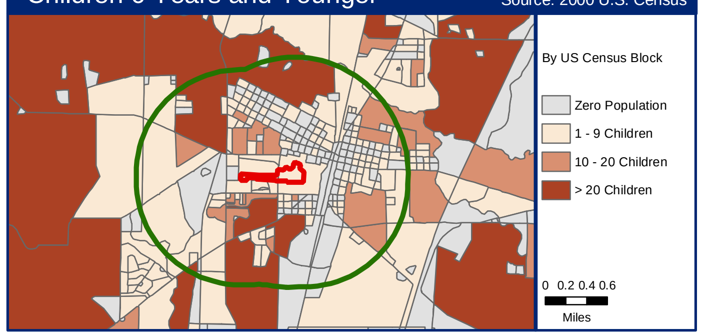
Population Density

Source: 2000 U.S. Census



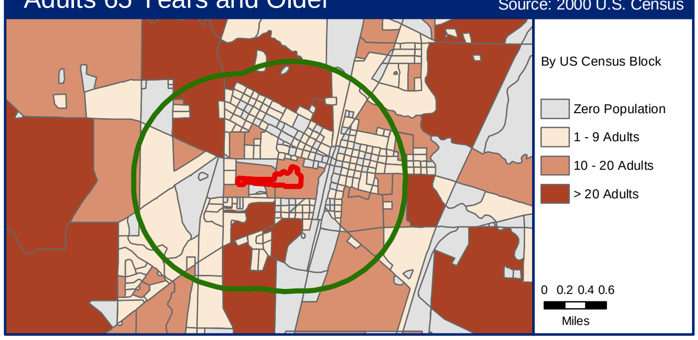
Children 6 Years and Younger

Source: 2000 U.S. Census



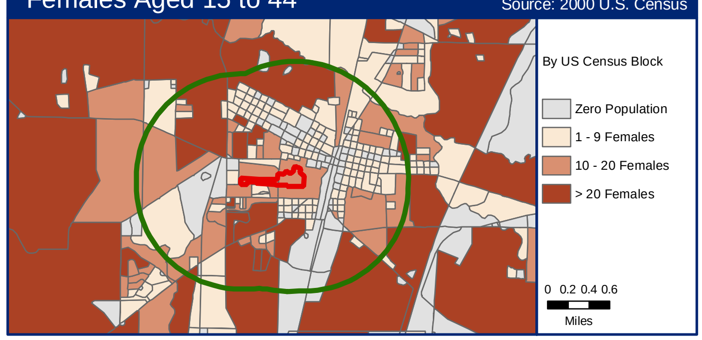
Adults 65 Years and Older

Source: 2000 U.S. Census



Females Aged 15 to 44

Source: 2000 U.S. Census



GENERATED: 06-02-2005

Appendix B: WHO TEFs for Human Health Assessment

ANALYTE	WHO/98 (TEFs)
2,3,7,8-TETRACHLORODIBENZO-P-DIOXIN	1
1,2,3,7,8-PENTACHLORODIBENZO-P-DIOXIN	1
1,2,3,4,7,8-HEXACHLORODIBENZO-P-DIOXIN	0.1
1,2,3,6,7,8-HEXACHLORODIBENZO-P-DIOXIN	0.1
1,2,3,7,8,9-HEXACHLORODIBENZO-P-DIOXIN	0.1
1,2,3,4,6,7,8-HEPTACHLORODIBENZO-P-DIOXIN	0.01
1,2,3,4,6,7,8,9-OCTACHLORODIBENZO-P-DIOXIN	0.0001
2,3,7,8-TETRACHLORODIBENZOFURAN	0.1
2,3,7,8-TETRACHLORODIBENZOFURAN	0.1
1,2,3,7,8-PENTACHLORODIBENZOFURAN	0.05
2,3,4,7,8-PENTACHLORODIBENZOFURAN	0.5
1,2,3,4,7,8-HEXACHLORODIBENZOFURAN	0.1
1,2,3,6,7,8-HEXACHLORODIBENZOFURAN	0.1
1,2,3,7,8,9-HEXACHLORODIBENZOFURAN	0.1
2,3,4,6,7,8-HEXACHLORODIBENZOFURAN	0.1
1,2,3,4,6,7,8-HEPTACHLORODIBENZOFURAN	0.01
1,2,3,4,7,8,9-HEPTACHLORODIBENZOFURAN	0.01
1,2,3,4,6,7,8,9-OCTACHLORODIBENZOFURAN	0.0001

APPENDIX C: EXPOSURE ASSUMPTIONS

Adult Residents

Adult residents were assumed to be exposed to chemicals in soil while gardening (3 days per week for 5 months of the year) and doing yard work (2 days per week for 7 months of the year). Incidental ingestion, inhalation of chemicals in dust generated during activities, and direct skin contact with chemicals in residential yards or in the ditches adjacent to residential yards has been considered.

It was assumed that these individuals ingest 100 mg of soil per day (mg/day) and weighed 70 kilograms (kg) (153pounds). The surface area available for direct skin contact is 2,479 cubic centimeters per day (cm^2/day) which represents exposure of the face, hands, and arms. An adherence factor of 0.07 milligrams per cubic centimeter (mg/cm^3) and, when available, a chemical-specific absorption factor was used. Individuals were assumed to be exposed for 30 years. For inhalation of dust, individuals were assumed to have an inhalation rate of 0.80 cubic meters per hour (m^3/hour) and be exposed for 4 hours per event. A default particulate emissions factor of $1.32 \times 10^{+9}$ cubic meter per kilogram (m^3/kg) was also used in the calculations.

Children Residents

Children residents were assumed to be exposed to chemicals while playing in contaminated soil or sediment in their yards in the summer, fall, and spring (4 days of the week for 9 months of the year) as well as the winter (2 days per week for 3 months of the year). Incidental ingestion, inhalation of chemicals in dust generated during activities, and direct skin contact with chemicals in residential yards while playing has been considered.

It was assumed that children residents ingest 200 mg/day and weighed 16 kg (35 pounds). The surface area available for direct skin contact is 4,785 cm^2/day in the summer, fall, and spring months which represents exposure of the face, hands, arms, legs, and feet. The surface area considered for winter months was 1,880 cm^2/day which accounts for exposure of the face, hands, and arms. An adherence factor of 0.2 mg/cm^2 and, when available, a chemical-specific absorption factor was used. Individuals were assumed to be exposed for 6 years. For inhalation of dust, individuals were assumed to have an inhalation rate of 0.42 m^3/hour and be exposed for 8 hours per event. A default particulate emissions factor of $1.32 \times 10^{+9}$ m^3/kg was also used in the calculations.

Children in Playground

The majority of the exposure assumptions used to estimate exposure to children in the playground are the same as for residential children. One exception was that the mean soil concentration from the playground area was used in these calculation.

Child Playing at School

The majority of the exposure assumptions used to estimate exposure to children playing on and around the school were the same as for residential children. One exception was that the mean soil concentration from the samples collected in the school area was used in the calculation.

On-Site Adolescent Trespassers

Adolescent trespassers were assumed to be exposed to chemicals in soil while trespassing on the site 2 days per week. Incidental ingestion, inhalation of chemicals in dust generated during activities, and direct skin contact with chemicals in on-site soil has been considered.

It was assumed that these individuals ingested 100 mg/day and weighed 50 kg (110 pounds). The surface area available for direct skin contact is 7,730 cm^2/day in the summer, fall, and spring months which represents exposure of the face, hands, arms, and legs. The surface area considered for winter months was 2,950 cm^2/day which accounts for exposure of the face, hands, and arms. An adherence factor of 0.2 mg/cm^2 and, when available, a chemical-specific absorption factor was used. Individuals were assumed to be exposed for 5 years. For inhalation of dust, individuals were assumed to have an inhalation rate of 0.42 m^3/hour and be exposed for 4 hours per event. A default particulate emissions factor $1.32 \times 10^{+9}$ m^3/kg was also used in the calculations.

Mill Creek Fence Breach Adolescents

Based on accounts from local residents, it is possible for individuals to get through the existing fence adjacent to Mill Creek and come in contact with chemicals in sediment. The majority of the exposure assumptions used to estimate exposure to these individuals was the same as for the on-site adolescent trespassers. One exception was that the mean soil concentration from sediment in Mill Creek and surrounding ditches was used in the calculation.

Appendix D: ATSDR's Evaluation Process

Step 1 – Comparison Values and the Screening Process

To evaluate the available data, ATSDR used comparison values (CVs) to determine which chemicals to examine more closely. CVs are the contaminant concentrations found in a specific media (for example: air, soil, or water) and are used to select contaminants for further evaluation. CVs incorporate assumptions of daily exposure to the chemical and a standard amount of air, water, and soil that someone may inhale or ingest each day. CVs are generated to be conservative and non-site specific. These values are used only to screen out chemicals that do not need further evaluation; CVs are not intended as environmental clean-up levels or to indicate that health effects occur at concentrations that exceed these values.

CVs can be based on either carcinogenic (cancer-causing) or non-carcinogenic effects. Cancer-based comparison values are calculated from the U.S. Environmental Protection Agency's (EPA) oral cancer slope factor (CSF) or inhalation risk unit. CVs based on cancerous effects account for a lifetime exposure (70 years) with an unacceptable theoretical excess lifetime cancer risk of 1 new case per 1 million exposed people. Non-cancer values are calculated from ATSDR's Minimal Risk Levels (MRLs), EPA's Reference Doses (RfDs), or EPA's Reference Concentrations (RfCs). When a cancer and non-cancer CV exists for the same chemical, the lower of these values is used in the comparison for conservatism. The chemical and media-specific CVs utilized during the preparation of this PHA are listed below:

An **Environmental Media Evaluation Guide (EMEG)** is an estimated comparison concentration for which exposure is unlikely to cause adverse health effects, as determined by ATSDR from its toxicological profiles for a specific chemical.

A **Cancer Risk Evaluation Guide (CREG)** is a comparison concentration that is based on an excess cancer rate of one in a million persons and is calculated using EPA's cancer slope factor (CSF).

Step 2 – Evaluation of Public Health Implications

The next step in the evaluation process is to take those contaminants that are above their respective CVs and further identify which chemicals and exposure situations are likely to be a health hazard. Separate child and adult exposure doses (or the amount of a contaminant that gets into a person's body) are calculated for site-specific exposure scenarios, using assumptions regarding an individual's likelihood of accessing the site and contacting contamination. A brief explanation of the calculation of estimated exposure doses for the site is presented below. Calculated doses are reported in units of milligrams per kilograms per day (mg/kg/day). Separate calculations have been performed to account for non-cancer and cancer health effects for each chemical based on the health impacts reported for each chemical. The same dose equations have been used for non-cancer and cancer calculations with the indicated modifications. Some chemicals are associated with non-cancer effects while the scientific literature many indicate that cancer-related health impacts are not expected from exposure.

Exposure Dose Estimation

When chemical concentrations at the site exceed the established CVs, it is necessary for a more thorough evaluation of the chemical to be conducted. In order to evaluate the potential for human exposure to contaminants present at the site and potential health effects from site-specific activities, ATSDR estimates human exposure to the site contaminant from different environmental media by calculating exposure doses. A brief discussion of the calculations and assumptions is presented below. The equations and the assumptions are based on the EPA Risk Assessment Guidance for Superfund, Part A[1] and the EPA Exposure Factors Handbook[2], unless otherwise specified. A discussion of the cancer and non-cancer evaluation of exposure is presented following the equations for each pathway.

<u>Incidental Ingestion of Contaminants Present in Soil and Sediment</u>

(Exposure to adults during gardening; Children during playing)

Adult residents may be exposed to contaminants in soil gardening and yard work via unintentional ingestion. Children residents may also be exposed to chemicals in soil and sediment in residential yards and along the creek bank behind their homes while playing. The exposure dose for incidental ingestion of soil and/or sediment is

$$Dose(mg/kg/day) = \frac{C \times IR \times EF \times ED \times CF}{BW \times AT}$$

where

C = chemical concentration (mg/kg)

IR = ingestion rate (mg/day)

EF = exposure frequency (days/years)

ED = exposure duration (years)

CF = conversion factor (1×10^{-6} kg/mg)

BW = body weight (kg)

AT = averaging time (days)

<u>Direct Skin (Dermal) Contact with Contaminants Present in Soil and Sediment</u>

Dermal absorption depends on numerous factors, including the area of exposed skin, anatomical location of the exposed skin, length of contact, concentration of the chemical in contact with the skin, and other factors. Because chemicals differ greatly in their potential to be absorbed through the skin, each chemical needs to be evaluated separately.

The exposure dose for direct contact with drinking water during showering or bathing is

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[1] U.S. Environmental Protection Agency. Risk Assessment Guidance for Superfund. December 1989.

[2] U.S. Environmental Protection Agency. Exposure Factors Handbook. August 1997.

$$Dose\,(mg/kg/day) = \frac{C \times SA \times AF \times ABS \times EF \times ED \times CF}{BW \times AT}$$

where

C = chemical concentration (mg/kg)

SA = surface area exposed (square centimeters/day or cm^2/day)

AF = adherence factor (milligrams per square centimeters or mg/cm^2)

ABS = Absorption factor (unitless)

ET = exposure time (hours/day)

EF = exposure frequency (days/year)

ED = exposure duration (years)

CF = conversion factor (1×10^{-6} kg/mg)

BW = body weight (kg)

AT = averaging time (days)

Inhalation of Contaminants in Fugitive Dust Generated from Soil and Sediment

Individuals may generate dust that can be inhaled during gardening, playing, and other activities with soil and sediment. The dose to evaluate this potential exposure is

$$Dose\,(mg/kg/day) = \frac{C \times IR \times ET \times EF \times ED}{PEF \times BW \times AT}$$

where

C = chemical concentration (mg/kg)

IR = inhalation rate (m^3/hour)

ET = exposure time (hours/day)

EF = exposure frequency (days/year)

ED = exposure duration (years)

PEF = particulate emissions factor (m^3/kg)

BW = body weight (kg)

AT = averaging time (days)

Non-Cancer Health Effects

The doses calculated for exposure to each individual chemical are then compared to an established health guideline, such as a MRL or RfD, in order to assess whether adverse health impacts from exposure are expected. These health guidelines, developed by ATSDR and EPA, are chemical-specific values that are based on the available scientific literature and are considered protective of human health. Non-carcinogenic effects, unlike carcinogenic effects, are believed to have a threshold, that is, a dose below which adverse health effects will not occur. As a result, the current practice for deriving health guidelines is to identify, usually from animal toxicology experiments, a No Observed Adverse Effect Level (or NOAEL), which indicates that no effects are observed at a particular exposure level. This is the experimental exposure level in animals (and sometimes humans) at which no adverse toxic effect is observed. The NOAEL is then modified with an uncertainty (or safety) factor, which reflects the degree of uncertainty that exists when experimental animal data are extrapolated to the general human population. The magnitude of the uncertainty factor considers various factors such as sensitive subpopulations (for example; children, pregnant women, and the elderly), extrapolation from animals to humans, and the completeness of available data. Thus, exposure doses at or below the established health guideline are not expected to result in adverse health effects because these values are much lower (and more human health protective) than doses, which do not cause adverse health effects in laboratory animal studies. For non-cancer health effects, the following health guidelines are described below in more detail. It is important to consider that the methodology used to develop these health guidelines does not provide any information on the presence, absence, or level of cancer risk. Therefore, a separate cancer evaluation is necessary for potentially cancer-causing chemicals detected in samples at this site. A more detailed discussion of the evaluation of cancer risks is presented in the following section.

Minimal Risk Levels (MRLs) – developed by ATSDR

ATSDR has developed MRLs for contaminants commonly found at hazardous waste sites. The MRL is an estimate of daily exposure to a contaminant below which non-cancer, adverse health effects are unlikely to occur. MRLs are developed for different routes of exposure, such as inhalation and ingestion, and for lengths of exposure, such as acute (less than 14 days), intermediate (15-364 days), and chronic (365 days or greater). At this time, ATSDR has not developed MRLs for dermal exposure. A complete list of the available MRLs can be found at http://www.atsdr.cdc.gov/mrls.html.

References Doses (RfDs) – developed by EPA

An estimate of the daily, lifetime exposure of human populations to a possible hazard that is not likely to cause non-cancerous health effects. RfDs consider exposures to sensitive sub-populations, such as the elderly, children, and the developing fetus. EPA RfDs have been developed using information from the available scientific literature and have been calculated for oral and inhalation exposures. A complete list of the available RfDs can be found at http://www.epa.gov/iris.

If the estimated exposure dose for a chemical is less than the health guideline value, the exposure is unlikely to result in non-cancer health effects. Non-cancer health effects from dermal exposure were evaluated slightly differently that ingestion and inhalation exposure. Since health guidelines are not available for dermal exposure, the calculated dermal dose was compared with the oral health guideline value (RfD or MRL).

If the calculated exposure dose is greater than the health guideline, the exposure dose is compared to known toxicological values for the particular chemical and is discussed in more detail in the text of the PHA. The known toxicological values are doses derived from human and animal studies that are presented in the ATSDR Toxicological Profiles and EPA's Integrated Information System (IRIS). A direct comparison of site-specific exposure doses to study-derived exposures and doses found to cause adverse health effects is the basis for deciding whether health effects are likely to occur. This in-depth evaluation is performed by comparing calculated exposure doses with known toxicological values, such as the no-observed adverse-effect-level (NOAEL) and the lowest-observed-adverse-effect-level (LOAEL) from studies used to derive the MRL or RfD for a chemical. As part of this comparison to toxicological values, a margin of exposure (MOE) is calculated by dividing the NOAEL and/or LOAEL by the site-specific exposure dose. Generally, when the MOE is greater than 1,000, harmful health effects are not expected. When the MOE ranges from approximately 100 to 1,000, further toxicological evaluation is necessary to determine whether harmful effects are likely. This may include a closer look at the studies used to derive the NOAELs and LOAELs. Adverse health effects may occur when the MOE is less than 10.

Cancer Risks

Exposure to a cancer-causing compound, even at low concentrations, is assumed to be associated with some increased risk for evaluation purposes. The estimated excess risk of developing cancer from exposure to contaminants associated with the site was calculated by multiplying the site-specific adult exposure doses, with a slight modification, by EPA's chemical-specific Cancer Slope Factors (CSFs or cancer potency estimates), which are available at http://www.epa.gov/iris. Calculated dermal doses were compared with the oral CSFs.

An increased excess lifetime cancer risk is not a specific estimate of expected cancers. Rather, it is an estimate of the increase in the probability that a person may develop cancer sometime during his or her lifetime following exposure to a particular contaminant. Therefore, the cancer risk calculation incorporates the equations and parameters (including the exposure duration and frequency) used to calculate the dose estimates, but the estimated value is divided by 25,550 days (or the averaging time), which is equal to a lifetime of exposure (70 years) for 365 days/year.

There are varying suggestions among the scientific community regarding an acceptable excess lifetime cancer risk, due to the uncertainties regarding the mechanism of cancer. The recommendations of many scientists and EPA have been in the risk range of 1 in 1 million to 1 in 10,000 (as referred to as 1×10^{-6} to 1×10^{-4}) excess cancer cases. An increased lifetime cancer risk of one in one million or less is generally considered an insignificant increase in cancer risk. Cancer risk less than 1 in 10,000 (or 1×10^{-5}) are not typically considered a health concern. An important consideration when determining cancer risk estimates is that the risk calculations incorporate several very conservative assumptions that are expected to overestimate actual exposure scenarios. For example, the method used to calculate EPA's CSFs assumes that high-dose animal data can be used to estimate the risk for low dose exposures in humans. As previously stated, the method also assumes that there is no safe level for exposure. Lastly, the method computes the 95% upper bound for the risk, rather than the average risk, suggesting that the cancer risk is actually lower, perhaps by several orders of magnitude.

Because of the uncertainties involved with estimating carcinogenic risk, ATSDR employs a weight-of-evidence approach in evaluating all relevant data. Therefore, the carcinogenic risk is also described in words (qualitatively) rather than giving a numerical risk estimate only. The numerical risk estimate must be considered in the context of the variables and assumptions involved in their derivation and in the broader context of biomedical opinion, host factors, and actual exposure conditions. The actual parameters of environmental exposures have been given careful and thorough consideration in evaluating the assumptions and variables relating to both toxicity and exposure. A complete review of the toxicological data regarding the doses associated with the production of cancer and the site-specific doses for the site is an important element in determining the likelihood of exposed individuals being at a greater risk for cancer.

APPENDIX E: WHAT YOU NEED TO KNOW ABOUT THE CONTAMINANTS OF CONCERN

Dioxins (Reference: Tox Profile and ToxFAQs)

Dioxins are a group of 75 different chemicals that have varying harmful effects. One of the most toxic dioxin compound is 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD). Dioxins are known to occur naturally and are also produced by human activities. Dioxins are not intentionally manufactured by industry except for research purposes. Dioxins may be produced by incineration and combustion processes. Dioxins (primarily 2,3,7,8-TCDD) may also be formed during the chlorine bleaching process used by pulp and paper mills. Chemicals that are used to preserve wood (such as pentachlorophenol) contains some dioxin compounds, but 2,3,7,8-TCDD is not usually found.

The most noted health effect in people exposed to large amounts of 2,3,7,8-TCDD is chloracne. Chloracne is a severe skin disease with acne-like lesions that occur mainly on the face and upper body. Other skin effects noted in people exposed to high doses of 2,3,7,8-TCDD include skin rashes, discoloration, and excessive body hair. Changes in blood and urine that may indicate liver damage also are seen in people. Exposure to high concentrations of dioxins may induce long-term alterations in glucose metabolism and subtle changes in hormonal levels.

A variety of other effects, such as weight loss, liver damage, and disruption of the endocrine system have been reported in studies of animals that were exposed to low levels of dioxin compounds. In many species of animals, 2,3,7,8-TCDD weakens the immune system and causes a decrease in the system's ability to fight bacteria and viruses. In other animal studies, exposure to 2,3,7,8-TCDD has caused reproductive damage and birth defects.

Several studies suggest that exposure to 2,3,7,8-TCDD increases the risk of cancer in people. Animal studies have also shown an increased risk of cancer from exposure to 2,3,7,8-TCDD. Human Cancer Data: According to the tox profile (p 67): Several studies suggest that 2,3,7,8-TCDD may be a human carcinogen. An increased risk for all cancers were found in highly exposed workers. The evidence for site-specific cancers is weaker, with some data suggesting a possible relationship between soft-tissue sarcoma, non-Hodgkin's lymphoma, or respiratory cancer with 2,3,7,8-TCDD exposure. The World Health Organization (WHO) has determined that 2,3,7,8-TCDD is a human carcinogen. The Department of Health and Human Services (DHHS) has determined that 2,3,7,8-TCDD may reasonably be anticipated to cause cancer.

Pentachlorophenol (Source: Tox Profile and ToxFAQs)

Pentachlorophenol (PCP) was widely used as a pesticide and wood preservative until 1984 when its use was restricted to certified applicators. It is no longer available to the general public but is still used industrially as a wood preservative for utility poles and railroad ties. PCP is a manufactured chemical and does not occur naturally.

Long-term exposure to low levels of pentachlorophenol that occur in the workplace can cause damage to the liver, kidneys, blood, and nervous system. Studies of workers exposed to PCP reported an increase in individuals' body temperature which can result in high fever, profuse sweating, and difficulty breathing. High body temperature can also injure various organs and tissues in the body. Additional studies of workers exposed to high levels of PCP for long periods of time indicated liver and immune system effects.

Studies in animals also suggest that the endocrine system and immune system can also be damaged following long-term exposure to low levels of pentachlorophenol. Laboratory animals exposed to PCP at high doses were found to experience damage to the thyroid and reproductive system. It is unknown whether pentachlorophenol produces all of the same effects in humans that it causes in animals.

Human studies regarding PCP exposure and cancer have provided conflicting results. Studies of workers exposed to high levels of PCP reported a possible association with several types of cancer, specifically Hodgkin's disease, soft tissue carcinoma, and acute leukemia. Other occupational studies did not have the same findings. Increases in liver, adrenal gland, and nasal tumors have been found in laboratory animals exposed to high doses of PCP.

EPA has determined that PCP is a probable human carcinogen and the IARC (spell out) also considers it possible of producing cancer in humans. An increased risk of cancer has been shown in some laboratory animals given large amounts of pentachlorophenol orally for a long time. There is weak evidence that pentachlorophenol causes cancer in humans.

Polyaromatic Hydrocarbons (PAHs) (Source: Tox Profile and Creosote fact sheet)

PAHs are a group of 100 different chemicals that are formed during the incomplete combustion of coal, oil, gas, wood, garbage, or other organic substances. PAHs can be found in substances such as crude oil, coal tar pitch, creosote, and roofing tar.

Creosote compounds are created by high-temperature treatment of woods (referred to as wood creosote), coal (referred to as coal tar creosote), or from the resin of the creosote bush. The creosote product associated with the Picayune Wood Treating Site is coal tar creosote, which is a thick, black, oily liquid. Coal tar creosote is the most widely used wood preservative in the U.S. These chemicals are also used in medicines to treat skin diseases such as psoriasis, and are also used as animal and bird repellents, insecticides, pesticides, and fungicides.

Health Information: Mice fed benzo(a)pyrene during pregnancy had difficulty reproducing and so did their offspring. The offspring of mice fed this chemical also showed other harmful effects, such as birth defects and decreased body weights. Other short and long-term animal studies have shown that PAHs can cause harmful effects on skin, body fluids, and the body's system for fighting disease. Blood chemistry changes, as well as mild liver effects have been observed among animals exposed to PAHs.

Eating large amounts of creosote may cause a burning of the mouth and throat, and stomach pains. Skin damage, such as blistering or peeling, may result from long-term exposure to creosote. The results of animal studies indicate liver and kidney effects following ingestion of creosote. Harmful effects have been observed among the offspring of animals whose mothers inhaled high concentrations of creosote during pregnancy.

Several PAHs, including benzo(a)pyrene, have been found to cause tumors in laboratory animals when they breathed these substances in air (lung and respiratory cancer), when eaten (gastric tumors), or when they had long periods of skin contact with them (skin cancer). Human studies showed that people who breathed or had skin contact with PAHs for long periods also developed cancer.

Workers who had long-term skin contact with creosote, especially during wood treatment or manufacturing processes, reported increases in skin cancer and cancer of the scrotum. Cancer of the scrotum has been associated with long-term exposure to soot and coal tar creosotes by chimney sweeps. Animal studies have also shown an association between creosote exposure and skin cancer.

The Department of Health and Human Services (DHHS) has determined that some PAHs (including benzo(a)pyrene) are known animal carcinogens. The International Agency for Research on Cancer (IARC) and EPA have also indicated that several PAHs are probably carcinogenic to humans. Cancer classification information for all PAH compounds are unavailable.

APPENDIX F: Summary of Calculated Exposure Doses

Table 8 - Summary of Calculated Exposure Doses

Picayune Wood Site

	Ingestion & Direct Contact Dose (mg/kg/day)	Oral Health Guideline (mg/kg/day)	Exceeds Health Guideline?	Health Guideline Source	Inhalation Dose (mg/kg/day)(a)	Inhalation Health Guideline (mg/kg/day)(b)	Exceeds Health Guideline?
Adult Resident - Soil Pathway							
Dioxins	8.34E-10	1.00E-09	No	(c)	NA	NA	
Arsenic	8.82E-07	3.00E-04	No	(d)	NA	NA	
Benzo(a)pyrene	1.94E-06	4.00E-01	No	(c)	NA	NA	
Chromium	2.90E-06	3.00E-03	No	(f)	5.99E-11	3.00E-05	No
Pentachlorophenol	3.33E-06	1.00E-03	No	(c)	NA	NA	
Child Resident - Soil Pathway							
Dioxins	1.05E-08	1.00E-09	**Yes**	(c)	NA	NA	
Arsenic	1.20E-05	3.00E-04	No	(d)	NA	NA	
Benzo(a)pyrene	3.12E-05	4.00E-01	No	(c)	NA	NA	
Chromium	4.48E-05	3.00E-03	No	(f)	3.97E-10	3.00E-05	No
Pentachlorophenol	6.13E-05	1.00E-03	No	(c)	NA	NA	
Child Playground - Soil Pathway							
Dioxins	4.63E-09	1.00E-09	**Yes**	(c)	NA	NA	
Arsenic	2.40E-05	3.00E-04	No	(d)	NA	NA	
Benzo(a)pyrene	1.27E-05	4.00E-01	No	(c)	NA	NA	
Chromium	1.06E-04	3.00E-03	No	(f)	9.36E-10	3.00E-05	No
Pentachlorophenol	2.61E-05	1.00E-03	No	(c)	NA	NA	
Child at School - Soil Pathway							
Dioxins	5.63E-11	1.00E-09	No	(c)	NA	NA	
Arsenic	1.92E-05	3.00E-04	No	(d)	NA	NA	
Benzo(a)pyrene	1.15E-05	4.00E-01	No	(c)	NA	NA	
Chromium	6.27E-05	3.00E-03	No	(f)	5.55E-10	3.00E-05	No
		1.00E-03	No	(c)	NA	NA	
Adolescent Trespasser - Soil Pathway							
Dioxins	1.35E-09	1.00E-09	**Yes**	(c)	NA	NA	
Arsenic	5.24E-06	3.00E-04	No	(d)	NA	NA	
Benzo(a)pyrene	1.88E-05	4.00E-01	No	(c)	NA	NA	
Chromium	2.11E-05	3.00E-03	No	(f)	1.16E-10	3.00E-05	No
Pentachlorophenol	6.42E-05	1.00E-03	No	(c)	NA	NA	
Child Resident - Sediment Pathway							
Dioxins	1.88E-08	1.00E-09	**Yes**	(c)	NA	NA	
Arsenic	2.82E-05	3.00E-04	No	(d)	NA	NA	
Benzo(a)pyrene	6.74E-05	4.00E-01	No	(c)	NA	NA	
Chromium	8.96E-05	3.00E-03	No	(f)	7.93E-10	3.00E-05	No
Pentachlorophenol	9.77E-05	1.00E-03	No	(c)	NA	NA	

Table 8 Continued - Summary of Calculated Exposure Doses							
Picayune Wood Site							
	Ingestion & Direct Contact Dose (mg/kg/day)	**Oral Health Guideline (mg/kg/day)**	**Exceeds Health Guideline?**	**Health Guideline Source**	**Inhalation Dose (mg/kg/day)(a)**	**Inhalation Health Guideline (mg/kg/day)(b)**	**Exceeds Health Guideline?**
Adolescent Fence Breach Scenario - Sediment Pathway							
Dioxins	1.73E-10	1.00E-09	No	(c)	NA	NA	
Arsenic	1.59E-06	3.00E-04	No	(d)	NA	NA	
Benzo(a)pyrene	5.23E-06	4.00E-01	No	(c)	NA	NA	
Chromium	6.57E-06	3.00E-03	No	(f)	3.63E-11	3.00E-05	No
Pentachlorophenol	1.97E-05	1.00E-03	No	(c)	NA	NA	
NOTES:							
(a) Inhalation doses were calculated only for contaminants with an available inhalation health guideline.							
(b) EPA's Inhalation Reference Dose							
(c) ATSDR's Chronic Oral Minimal Risk Level							
(d) ATSDR's Chronic Oral Minimal Risk Level and EPA's Oral Reference Dose							
(e) ATSDR's Chronic Oral Minimal Risk Level and EPA's Reference Dose							
(f) EPA's Oral Refence Dose							
NA = Not available							

Table 9 - Summary of Theoretical Cancer Risk

Picayune Wood Site

	Calculated Theoretical Lifetime Cancer Risk				
	Ingestion	**Direct Contact**	**Inhalation of Dust**	**Total Cancer Risk**	**Cancer Risk Conclusion**
Adult Resident[(1)] - Soil Pathway					
Dioxins	5.36E-05	9.30E-08	1.30E-09	5.37E-05	**No Apparent/Low Increased Cancer Risk**
Arsenic	5.39E-07	2.81E-08	1.32E-10	5.67E-07	
Benzo(a)pyrene	4.94E-06	1.11E-06	5.08E-11	6.05E-06	
Chromium	NA	NA	1.05E-09	1.05E-09	
Pentachlorophenol	1.19E-07	5.17E-08	NA	1.71E-07	
Total Risk for Contaminants				**6.05E-05**	
Combined[(2)] - Soil Pathway					
Dioxins	2.03E-04	8.35E-07	3.20E-09	2.04E-04	**Low/Moderate Increased Cancer Risk**
Arsenic	2.30E-06	3.54E-07	3.58E-10	2.65E-06	
Benzo(a)pyrene	2.10E-05	1.39E-05	1.38E-10	3.49E-05	
Chromium	NA	NA	2.79E-09	2.79E-09	
Pentachlorophenol	5.49E-07	7.82E-07	NA	1.33E-06	
Total Risk for Contaminants				**2.43E-04**	
Combined[(3)] - Sediment Pathway					
Dioxins	2.42E-04	2.93E-06	3.57E-08	2.45E-04	**Low/Moderate Increased Cancer Risk**
Arsenic	3.33E-06	1.21E-06	4.81E-09	4.54E-06	
Benzo(a)pyrene	2.79E-05	4.40E-05	1.70E-09	7.19E-05	
Chromium	NA	NA	3.26E-08	3.26E-08	
Pentachlorophenol	5.20E-07	1.58E-06	NA	2.10E-06	
Total Risk for Contaminants				**3.24E-04**	

NOTES:

(1) Adult Resident Soil Pathway includes the risk from exposure occuring only as an adult.

(2) Combined Soil Pathway includes the risk from exposure occurring as a child resident, adolescent trespasser, and adult resident. The combination of these pathways was considered based on site-specific information gathered from the community. It is considered a conservative approach that may result in an overestimation of risk.

(3) Combined Sediment Pathway includes the risk from exposure occurring as a child resident or adolescent who has breached the fence and has come in contact with sediment. The combination of these pathways was considered based on site-specific information gathered from the community. It is considered a conservative approach that may result in an overestimation of risk.