

Health Consultation

PICAYUNE WOOD TREATING SITE

PICAYUNE, PEARL RIVER COUNTY, MISSISSIPPI

EPA FACILITY ID: MSD065490930

JANUARY 13, 2005

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

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Agency for Toxic Substances and Disease Registry
U.S. Department of Health and Human Services

Statement of Issues

On September 10, 2004, the Agency for Toxic Substances and Disease Registry (ATSDR) received a request from the U.S. Environmental Protection Agency (EPA) Region IV to review soil and sediment data for the Picayune Wood Treating site in Picayune, Mississippi. EPA asked ATSDR to determine whether levels of dioxins (or 2,3,7,8-TCDD equivalents) and polycyclic aromatic hydrocarbons (expressed as BaP equivalents) detected in samples collected from Mill Creek pose a health hazard to humans. Specifically, ATSDR was to determine whether these contaminant levels along an approximate 3,000 linear foot section of Mill Creek (identified by sample numbers SD- 8 through 11) pose a health hazard to children playing in Mill Creek.

This evaluation is to determine whether EPA should restrict access to the area if adverse health effects are likely to occur in children exposed to sediments/soils in Mill Creek. This evaluation is prospective because it addresses only the time period that the most recent sampling data were collected (2004) until the time when EPA can implement a long-term remedy (cleanup) for the site (estimated to begin in the year 2008 or 2009).

Background

The Picayune Wood Treating, Inc., facility is located at 403 Davis Street on a 25-acre parcel of land in Picayune, Pearl River County, Mississippi. The facility was constructed in 1945 and operated as a wood preserving plant from 1946 until 1999. The facility is bounded by residential, commercial, and industrial areas. Southside Elementary School borders the site on the west, and a public park borders the site on the south. The facility contains five drainage ditches, four of which flow into Mill Creek. Mill Creek is the main drainage ditch for the surrounding area and flows into the Pearl River. Children from the nearby residences play in Mill Creek, which flows adjacent to the public park and behind some of the residences (see attached map).

Environmental Data

In 2004, EPA collected sediment and soil samples from Mill Creek. This health consultation (HC) is based on the site-specific data provided to ATSDR from this most recent sampling (2004) of Mill Creek. ATSDR was requested to evaluate only the samples collected from the 3,000 linear foot section of Mill Creek. ATSDR assumes that the data were collected and analyzed in accordance with adequate quality assurance and quality control measures.

Discussion

Site Visit

On November 4, 2004, ATSDR team members conducted a site visit of selected portions of Mill Creek and the surrounding neighborhood. The ATSDR team made the following observations:

- Mill Creek is comprised of many intersecting drainage ditches that serve as the stormwater drainage basin for the surrounding area. These open drainage ditches traverse nearly every block of the residential neighborhood. The drainage ditches are near residential homes and play areas.
- The area of Mill Creek where the highest concentration of dioxins was detected is bordered by residential homes and a community center. ATSDR noted evidence of children playing in this area. A rope tied to a tree bordering the creek and descending into the creek; bare ground surrounding the trees/creek in contrast to the surrounding foliated landscape; and various wheels, buckets and other objects in the creek suggested children's play activities in the creek. A picnic table was observed adjacent to the community center and within 10 feet of Mill Creek.
- The portion of Mill Creek adjacent to the park was fenced with signage warning against trespassing in the creek.

Exposure Pathways

Access is unrestricted to the 3,000 linear foot section of Mill Creek of concern in this HC. The highest concentration of dioxins, or 2,3,7,8-TCDD equivalents, was detected in a section of Mill Creek bounded by residential homes and a community center. ATSDR noticed evidence of children playing in this portion of Mill Creek.

Adults and children have unlimited access to the sediments in Mill Creek and to the soils on the banks of Mill Creek. ATSDR is limiting this evaluation to children because children have been known to play in the identified portion of Mill Creek. Also, children are at greater risk than adults because they weigh less, have more hand-to-mouth activity than adults, and have undeveloped enzyme systems, which may result in higher doses of chemical exposure per body weight. The potential routes of exposure associated with the soil/sediments of Mill Creek include

- accidental ingestion of contaminated soil/sediments
- direct dermal (skin) contact with contaminated soil/sediments

This evaluation will focus on ingestion of and dermal contact with contaminated soil or sediments because these are the most likely routes of human exposure associated with Mill Creek. Ingestion of contaminated soil/sediments is usually incidental and occurs from hand-to-mouth contact as a result of outdoor play activities in the case of children. Dermal exposures occur when contaminated soil/sediments come into contact with skin and are absorbed through the skin. Typically, skin contact involves the hands and lower arms but can include the legs, feet, face, and other body parts for outdoor activities during warmer months. Children's play activities in Mill Creek may lead to increased bodily (surface area) contact with contaminated sediments/soils and greater soil adherence to skin because of the wet soils/sediments associated with Mill Creek.

Although not evaluated in this HC, another potential exposure pathway associated with Mill Creek includes children south of the site crossing Mill Creek to get to the other side. Crossing the creek may result in an unknown quantity of contaminated soil/sediment adhering to the soles of shoes and other footwear, which may ultimately be tracked onto the floors of schools, homes, or other indoor surfaces. ATSDR has no way to quantify this potential exposure pathway and, therefore, will not evaluate the potential pathway.

Estimating Exposures

The major chemicals of concern at the site are polycyclic aromatic hydrocarbons (PAHs), expressed as benzo(a)pyrene (BaP) equivalents, and dioxins, expressed as 2,3,7,8-TCDD toxicity equivalent quotients (TEQs). (Table 1 shows the TEQs in the dioxin mixture.) The concentration of BaP detected in soil/sediment in the referenced area ranged from 3.0 ppm to 10.5 ppm. The concentration of TCDDs ranged from 0.01 to 12 ppb. The highest detected concentration of BaP (10.5 ppm) and TCDDs (12 ppb) was used in our evaluation.

For purposes of this evaluation, ATSDR assumed that a 21 kilogram (kg) (or 46 pound) child ingests 200 milligrams (mg) of the maximum level of contaminated soil/sediment per day. We also conservatively assumed that a child would come into contact with the highest level of contamination (BaP and TCDDs) detected in Mill Creek for 4 days per week in the summer/fall and 2 days per week in the winter (length of seasons was assumed to be 9 and 3 months, respectively).

For dermal exposures, ATSDR assumed that a child playing in Mill Creek would wear a short-sleeved shirt, shorts, and no shoes (bare feet) in the summer; therefore, the exposed skin surface is limited to the hands, arms, legs, and feet (a total of approximately 3,850 square centimeters of body surface area). ATSDR assumed that children would wear long pants and shoes in the winter; thereby exposing only their hands and arms (a total of approximately 1,320 square centimeters of body surface area). Dermal exposures would occur at the same frequency as the above ingestion exposure scenario (4 days per week in the summer/fall and 2 days per week in the winter). A soil adherence factor of 20 mg/cm² was used for children playing in mud. The dermal absorption fraction from soil was assumed to be 0.13 for BaP (3) and 0.03 for TCDDs. Based upon EPA's projected time frame for implementing a remedy at the site, we estimated the exposure duration to be 5 years.

Using the highest detected concentration (10.5 ppm) of BaP, the child exposure dose for BaP is 2.3×10^{-3} milligrams per kilogram per day (mg/kg/day), or 0.0023 mg/kg/day. No acute or chronic Minimal Risk Levels (MRLs) have been derived for PAHs because no adequate human or animal dose-response data are available that identify threshold levels for appropriate non-cancer health effects. However, intermediate-duration oral MRLs of 0.4 mg/kg/day have been derived for fluoranthene and for fluorene; both were based on Lowest Observed Adverse Effect Levels (LOAELs) of 125 mg/kg/day for increased relative liver weight in male mice (2).

The estimated child dose of 0.0023 mg/kg/day is several orders of magnitude lower than the most conservative MRL of 0.4 mg/kg/day for any of the PAHs. Therefore, it seems unlikely that any non-cancerous adverse health effects would occur in children.

However, ATSDR calculated that the theoretical excess cancer risk for ingestion of and dermal contact with BaP in soil/sediment is equivalent to approximately 1 cancer case per 1,000 individuals exposed (or 1×10^{-3}). The excess cancer risk level exceeds the generally accepted level of 1 in 10,000. Therefore, the cancer risk for BaP is considered to be a public health concern.

Using the same analysis as above for TCDDs for non-carcinogenic effects, the child exposure dose for TCDD is estimated to be 6.6×10^{-7} mg/kg/day. The estimated child dose is two orders of magnitude greater than ATSDR's oral chronic Minimum Risk Level (MRL) of 1.0×10^{-9} mg/kg/day for TCDDs. Because the dose was greater than the MRL, ATSDR next compared the child dose to known toxicological values, starting with the LOAEL used to derive the MRL. The calculated child's dose is approximately six times higher than the Lowest Observed Adverse Effect Level (LOAEL) of 1.2×10^{-7} mg/kg/day. Therefore, it is likely that the level of TCDDs in soil/sediment poses a public health hazard to children who play in Mill Creek.

TCDD is classified by EPA as a probable human carcinogen. The estimated child dose (6.6×10^{-7} mg/kg/day) is close to ATSDR's Cancer Effect Level (CEL) of 7.1×10^{-6} mg/kg/day in rats. The level also exceeds the effect level of 1.4×10^{-7} mg/kg/day that caused tumors in rats. Therefore, exposure to TCDD at the estimated level is a potential public health concern for carcinogenic effects.

Other Concerns/Limitations

The data evaluated at this site is limited to the specified area of Mill Creek, a man-made swale that drains water from the surrounding industrial complexes. The measurement of TCDD and PAHs in the creek indicates that pollutants have migrated from one or more of the industrial sites. Because the measurements are limited to the creek, higher levels of pollution may be present elsewhere.

This HC evaluates potential health hazards associated with the identified 3,000 linear section of Mill Creek only. Health hazards associated with other sections of Mill Creek cannot be deduced from this evaluation.

This HC does not evaluate past (historical) exposures. Because contaminants in sediment tend to dissipate over time, concentrations of contaminants in Mill Creek prior to the Picayune facility closing were likely higher than the levels used in this HC.

This HC does not evaluate exposures to adults. The most sensitive receptors likely to come into contact with sediments in Mill Creek are children; therefore, this HC addresses only this at-risk population.

This HC does not evaluate all potential exposure pathways associated with the site. This HC evaluates only those exposures associated with incidental ingestion and dermal exposures associated with soil/sediments of Mill Creek. An analysis of all potential pathways associated with the Picayune site will be addressed during the release of the public health assessment (PHA) document for the site.

This HC assumes a very conservative exposure scenario when estimating exposures. Therefore, the actual exposures to contaminants are likely to be much less.

Question

Does exposure to the levels of contaminants detected in samples collected from the specified section of Mill Creek pose a health hazard to children?

Conclusions

Based on the information provided and assuming a very conservative exposure scenario, ATSDR concludes the following about the referenced section of Mill Creek:

1. Repeated exposure to the highest concentration of PAHs (expressed as BaP equivalents) is not likely to result in non-carcinogenic health effects in children. However, the increased risk of carcinogenic health effects from exposure to PAHs is a potential public health hazard.
2. Repeated exposure to the highest concentration of dioxins (expressed as TCDD TEQs) may result in increased risk of carcinogenic and non-carcinogenic health effects; therefore, the exposure to dioxins is a potential public health hazard.

Recommendations

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

Public Health Action Plan

The purpose of the Public Health Action Plan (PHAP) is to identify public health actions that will be taken by ATSDR or other government agencies at the site. For this site, ATSDR will prepare a public health assessment (PHA) that will address the public health implications of the site. The PHA will evaluate all environmental data, community health concerns, and health outcome data to determine the site's impact on public health, to develop health advisories or other recommendations, and to determine if further action is needed to mitigate or prevent human exposures. The PHA will guide ATSDR in the implementation of appropriate follow-up activities if needed.

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3. Hoang, K. T. Dermal Exposure Assessment: Principles and Applications. Environmental Protection Agency, Office of Health and Environmental Assessment, Washington, DC, EPA/600/8-91/011B, 1992
4. Agency for Toxic Substances and Disease Registry. Toxicological Profile for Polycyclic Aromatic Hydrocarbons (PAHs) (Update). Atlanta: U.S. Department of Health and Human Services, 1995.
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Table 1. Concentration of Dioxins (or 2,3,7,8-TCDD toxicity equivalent quotients) in Soil/Sediment Samples Collected From a Selected Portion of Mill Creek (2004)

Analyte		Sample ID MSSD5	Sample ID MSSD6	Sample ID MSSD7
1,2,3,4,6,7,8-Heptachlorodibenzodioxin	ng/kg	400,000J	280,000J	380
1,2,3,4,6,7,8-Heptachlorodibenzofuran	ng/kg	150,000J	91,000J	120
1,2,3,4,7,8,9-Heptachlorodibenzofuran	ng/kg	15,000	9,200	14U
1,2,3,4,7,8-Hexachlorodibenzodioxin	ng/kg	850	510	1.1U
1,2,3,4,7,8-Hexachlorodibenzofuran	ng/kg	14,000	12,000	16
1,2,3,6,7,8-Hexachlorodibenzodioxin	ng/kg	21,000J	11,000	19U
1,2,3,6,7,8-Hexachlorodibenzofuran	ng/kg	4,100	3,900	3.8U
1,2,3,7,8,9-Hexachlorodibenzodioxin	ng/kg	2,500	1,500	6.6U
1,2,3,7,8,9-Hexachlorodibenzofuran	ng/kg	750	600	1.5U
1,2,3,7,8-Pentachlorodibenzodioxin	ng/kg	130	80	1.2U
1,2,3,7,8-Pentachlorodibenzofuran	ng/kg	1,800	2,700	1.8U
2,3,4,6,7,8-Hexachlorodibenzofuran	ng/kg	2,200	2,200	3.2J
2,3,4,7,8-Pentachlorodibenzofuran	ng/kg	1,400	2,400	3.4U
2,3,7,8-Tetrachlorodibenzodioxin	ng/kg	8.1U	2.8U	0.57U
2,3,7,8-Tetrachlorodibenzofuran	ng/kg	190J	390J	0.72U
Heptachlorodibenzodioxin (Total)	ng/kg	820,000J	56,000J	890J
Heptachlorodibenzofuran (Total)	ng/kg	630,000J	88,000J	470J
Hexachlorodibenzodioxin (Total)	ng/kg	70,000J	65,000J	70J
Hexachlorodibenzofuran (Total)	ng/kg	270,000J	80,000J	180J
Octachlorodibenzodioxin	ng/kg	540,000J	2,000,000J	2,300
Octachlorodibenzofuran	ng/kg	240,000J	400,000J	270
Pentachlorodibenzodioxin (Total)	ng/kg	500UJ	580J	1.2UJ
Pentachlorodibenzofuran (Total)	ng/kg	18,000J	28,000J	16J
TEQ (Toxic. Equiv. Value)	ng/kg	12,000J	11,000J	10
Tetrachlorodibenzodioxin (Total)	ng/kg	8.1UJ	7.8J	0.57UJ
Tetrachlorodibenzofuran (Total)	ng/kg	350J		1,100J