

# Health Consultation

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A REVIEW OF SEDIMENT DATA

MARION PRESSURE TREATING COMPANY  
MARION, UNION PARISH, LOUISIANA

EPA FACILITY ID: LAD008473142

NOVEMBER 14, 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  
Atlanta, Georgia 30333

## **Health Consultation: A Note of Explanation**

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

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

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Prepared by:

Louisiana Department of Health and Hospitals  
Office of Public Health  
Section of Environmental Epidemiology and Toxicology  
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## **I. INTRODUCTION**

At the request of concerned residents around the Marion Pressure Treating Company Site, the Louisiana Department of Health and Hospitals/Office of Public Health/Section of Environmental Epidemiology and Toxicology (LDHH/OPH/SEET) has reviewed available sediment data for the Marion Pressure Treating Company (MPTC) in Marion, Union Parish, Louisiana. The data examined in this health consultation includes data from sediment samples collected and analyzed from June 2000, through September 2000 taken for the United States Environmental Protection Agency (EPA) Remedial Investigation/Feasibility Study (RIFS) [1]. This document serves as a review of possible pathways of human exposure by ingestion of and/or skin contact with contaminated sediment. SEET will utilize this information to help decide what further public health actions, if any, are needed.

## **II. BACKGROUND AND STATEMENT OF ISSUES**

From 1964 to 1989, the now-defunct Marion Pressure Treating Company (MPTC) used a creosote injection process to treat wood and wood products such as bridge pilings, railroad ties, fence posts and utility poles. The property on which it operated is now known as the MPTC site [1].

The MPTC site is a 10-acre tract of land in the city of Marion, Louisiana, in Union Parish along State Highway 551, approximately 0.5 miles north of the junction of State Highways 551 and 33 [Appendix A, Figure 1]. The site contaminants, however, have migrated off-site, so that possibly 20 acres of land have been impacted. The site is mostly rural, bound to the north, east, and south by a pine forest, and to the west by State Highway 551.

Per 1990 U.S. census data, the city of Marion has a reported population of approximately 775 people. According to an EPA contractor, approximately 46 residences and 11 businesses are located within a 0.5 mile radius of the site. Most of the city's residents live within 1 mile of the site. No on-site residences have been identified [2].

April 1, 2005, the Louisiana Department of Environmental Quality (LDEQ) conducted a site visit at the MPTC site. There is an 8-foot fence surrounding the site area. The entrance gate was locked and there were no signs of trespassing noted. Per LDEQ and EPA, there is little recreational value at the site, and it is not attractive to young children or other potential trespassers. Big Creek, a small surface water body with an intermittent flow, is approximately 500 feet east-southeast of the site. Big Creek empties into Bayou de Loutre, approximately 7.5 miles to the south. Recreational uses are unlikely within the reaches of Big Creek or the Unnamed Tributary near the MPTC site, as the depth of the water is very shallow, with many areas being completely dry. The MPTC site plan can be referenced in Appendix A, Figure 2. Wood treatment facilities such as the MPTC are the largest source of creosote in the environment. Creosote is a synthetic chemical that contains many compounds, particularly polycyclic aromatic hydrocarbons (PAHs).

The MPTC site comprises a former processing area, consolidation area, tank product storage area, and drainage ditches on the east and west sides of the former processing area. The processing area contained hazardous materials within and on structures and equipment integral to the operation and maintenance of the facility. Such hazardous materials were found in drums, above ground storage tanks, pressure vessels, and miscellaneous debris.

As noted in historical records, the MPTC disposed of creosote process wastewater in an on-site, unlined surface impoundment adjacent to the former processing and consolidation areas. The operational area drains to the east toward Big Creek through drainage gullies, and to the west toward the Unnamed Tributary.

To evaluate and assess the effects of historical site activities on sediments within Big Creek and the Unnamed Tributary, EPA contractors collected environmental samples as part of the RIFS field activities. Samples were collected during a three-phase investigation that took place between June 2000, and September 2000. Findings presented in this document are based upon sampling events from the aforementioned dates, and are detailed in the following sections.

From June to September 2000, EPA collected 3899 surface sediment grab samples at a depth of 0-6 inches from multiple on-site and off-site locations along Big Creek/East Ditch, and the Unnamed Tributary/West Ditch. SEET and the Agency for Toxic Substances and Disease Registry (ATSDR) consider surface sediment to be sediment collected within the top few inches below ground surface (bgs) where human contact and exposure to contaminants are likely to occur. All sediment samples were analyzed for volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs) including polycyclic aromatic hydrocarbons (PAHs). Select samples were also analyzed for metals, pesticides, polychlorinated biphenyls (PCBs), polychlorinated dibenzo-p-dioxins (PCDD), and polychlorinated dibenzofurans (PCDF). Sediment sampling locations are shown in Appendix A, Figure 3.

In September 2001, EPA released its proposed cleanup plan for public comment, conducting both an open house and a public meeting to gather the community's input into the cleanup decisions. In June 2002, EPA completed and released the Record of Decision for cleanup. Cleanup will consist of the excavation and treatment of surface and subsurface contaminated soils and sediments using onsite low temperature thermal desorption with offsite disposal of debris. This action will remove contaminants from the excavated soil and sediments, and treated soil and sediments will be returned to the MPTC site and used as backfill. Nonhazardous debris will be removed from the site and deposited in a subtitle D landfill. Hazardous debris prohibited in landfills will be removed from the site and incinerated. The site will be regraded and vegetated as appropriate. According to an assessment conducted by EPA and comments provided by town officials, the most likely future uses of the property would be for a park or recreation [3]. Per the EPA site manager, EPA continues to monitor the MPTC site to

ensure that there is no immediate threat to human health or the environment. EPA will consider funding cleanup at this site in fiscal year 2006 [4].

### III. DISCUSSION

SEET evaluated chemical contaminants in sediment from Big Creek/East Ditch and the Unnamed Tributary/West Ditch by comparing maximum concentrations of chemical contaminants to health-based assessment comparison (HAC) values for non-cancer and cancer endpoints. HAC values are media-specific concentrations of chemicals used by health assessors to select environmental contaminants for further evaluation. They are not used to predict health effects or to set clean-up levels. Contaminants with media concentrations above a HAC value do not necessarily represent a health threat, but are selected for further evaluation. Contaminants with media concentrations below a HAC value are unlikely to be associated with illness and are not evaluated further.

ATSDR's Reference Media Evaluation Guides (RMEGs), ATSDR's Environmental Media Evaluation Guides (EMEGs), EPA Region 6 Human Health Medium Specific Screening Levels (MSSLs), or EPA Region III Risk Based Concentrations (RBCs) were used as HAC values. RMEGs are estimated contaminant concentrations that are unlikely to cause adverse noncancer health effects. They are calculated from EPA's reference dose (RfD), which is an estimate of daily exposures to contaminants that are unlikely to cause adverse noncancer health effects, even if exposure occurs over a lifetime. EMEGs are also estimated contaminant concentrations that are unlikely to cause adverse noncarcinogenic health effects; however, they are calculated by using ATSDR's minimal risk level (MRL), which is also an estimate of daily exposure to contaminants that are unlikely to cause adverse noncancer health effects. MSSLs and RBCs are both estimated contaminant concentrations in a media at which noncarcinogenic or carcinogenic health effects are unlikely. The cancer risk comparison values in this health consultation are based on EPA's chemical-specific cancer slope factors (SF), representing an estimated lifetime risk of one excess cancer in 10,000 ( $1 \times 10^{-4}$ ) people exposed for a lifetime, with an assumed exposure period of 15 years.

The scenario used to estimate exposure assumes that a trespasser or recreational visitor is an older child (age 6 to 18 years); SEET used two different assumptions for body weight, 42 and 70 kilograms (one kilogram is equal to 2.2 pounds). The assumed ingestion rate of sediment was considered to be 100 mg (milligrams), 48 days per year for 10 years. The assumed skin surface available for contact with contaminated sediment was 5,000  $\text{cm}^2$  (square centimeters), with a skin to soil adherence factor of 0.2  $\text{mg}/\text{cm}^2$  (milligrams per square centimeters), 48 days per year for 10-15 years. The skin to soil adherence factor is the amount of sediment that adheres to the skin (based on skin surface area) when a dermal exposure occurs. Exposure rates were based on EPA's RIFS and HHRA (Human Health Risk Assessment) [1].



## A. Environmental Contamination

### *On-Site Contamination*

The definition of “on-site” in this health consultation is the area within the fence line on the MPTC site [see Appendix A, Figure 2]. This is the same figure used in the EPA RIFS.

### *On-Site Sediment at Big Creek*

Please note that there are three specific sampling locations on Big Creek that capture the majority of the maximum concentrations of COPCs. These sampling locations are referred to as hotspots and are located at SD02, SD03 (both locations are on-site), and SD01 (off-site). Where applicable, hotspots at Big Creek were evaluated separately from the other sampling locations at Big Creek in order to determine the “risk driving locations” at the MPTC site. Notations are made on all tables in the appendices when only hotspots are evaluated.

Tables 1 and 2 of Appendix B depict the Toxic Equivalency Factors (TEFs) for PAHs detected in on-site sediment samples at Big Creek. The overall carcinogenic potential of a mixture of PAHs is often expressed as the benzo(a)pyrene toxic equivalent (TEQ) concentration. The TEQ is an estimate of the pure benzo(a)pyrene concentration that would have the same carcinogenic potential as the mixture of PAHs in the sample. The available toxicological evidence indicate that there are no appreciable interactions between different PAH compounds; therefore, adding the effects of multiple PAHs is appropriate [5]. The total benzo(a)pyrene TEQ concentration is calculated by multiplying the maximum detected concentration of each of the PAHs by its respective toxic equivalency factor. The product of each is then added to obtain a total benzo(a)pyrene TEQ concentration. The benzo(a)pyrene TEQs for the hotspots at SD02 and SD03, and for all other on-site locations along Big Creek were 1122.1 mg/kg (Appendix B, Table 2), and 15.35 mg/kg [Appendix B, Table 1], respectively. Both benzo(a)pyrene TEQs exceeded their EPA Region III Risk Based Concentration (RBC) HAC value of 0.087 mg/kg [6].

Maximum concentrations of SVOCs and metals include 2-methylnaphthalene (5800 mg/kg), naphthalene (3000 mg/kg), carbazole (12000 mg/kg), dibenzofuran (9700 mg/kg) and arsenic (3.5 mg/kg). All COPCs were detected at their maximum concentrations from sampling location SD03, and all exceeded the medium specific screening level (MSSL) [ Appendix B, Table 3]. With regard to arsenic, it is important to note that even though the MSSL was exceeded, average background levels of arsenic at the MPTC site range from 1.8 mg/kg to as high as 8.9 mg/kg in some areas, thus, also exceeding the MSSL.

### *On-Site Sediment at East Ditch*

The East Ditch consists of a drainage ditch on the east side of the former processing area, which empties into Big Creek [ Appendix A, Tables 2 and 3]. All sampling events conducted at East Ditch were taken from one station located at SD11. Benzo(a)pyrene was the only COPC at East Ditch, at 4.2 mg/kg (Appendix B, Table 9), exceeding the RBC of 0.087 mg/kg.

### *On-Site Sediment at Unnamed Tributary*

Maximum on-site concentrations of COPCs at the Unnamed Tributary include arsenic, 2-methylnaphthalene, and benzo(a)pyrene. Arsenic was detected at 3.9 mg/kg in sediment samples from sampling location SD17, exceeding the MSSL of 0.39 mg/kg. Although it did not exceed the RMEG of 200 mg/kg, 2 -methylnaphthalene (0.1 mg/kg) was included as a COPC because of its historical association with site activities at the MPTC site (see Appendix B, Table 6). The benzo(a)pyrene TEQ of 4.75 mg/kg for sampling locations along the Unnamed Tributary can be viewed in detail in Appendix B, Table 4. The TEQ for the samples taken at this location exceeded the RBC of 0.087 mg/kg.

### *On-Site Sediment at West Ditch*

The West ditch consists of a drainage ditch on the west side of the former processing area, which empties into the Unnamed Tributary (see Appendix A, Tables 2 and 3). All on-site samples were taken from west ditch at station location SD24. Benzo(a)pyrene was the only COPC at west ditch, at 0.0033 mg/kg [Appendix B, Table 7]. The RBC was not exceeded; however, benzo(a)pyrene was retained as a COPC due to the ubiquitous PAH contamination throughout the MPTC site.

### *Off-Site Contamination*

The definition of “off-site” in this health consultation is the area outside of the fence line on the MPTC site [Appendix A, Figure 2]. This is the same figure used in the EPA RIFS.

### *Off-Site Sediment at Big Creek*

Arsenic was detected at a maximum concentration of 5.6 mg/kg from sampling location SD06, exceeding the MSSL of 0.39 mg/kg [Appendix B, Table 3]. The benzo(a)pyrene TEQs for the hotspot at SD01 and for all other off-site locations along Big Creek were 167.09 mg/kg (Appendix B, Table 2), and 23.61 mg/kg [Appendix B, Table 1], respectively. Both benzo(a)pyrene TEQs exceeded the RBC of 0.087 mg/kg.

Select sediment samples taken during the sampling event occurring from June 2000 through September 2000, were analyzed for poly-chlorinated dibenzo-p-dioxins/poly-chlorinated dibenzofurans (PCDDs/PCDFs). The overall mixture of these compounds is expressed as the 2,3,7,8-tetrachlorinated dibenzo-p-dioxin (2,3,7,8-TCDD) TEQ concentration [7]. The total 2,3,7,8-TCDD TEQ concentration is calculated by multiplying the maximum detected concentration of each of the PCDDs/PCDFs by its

respective toxic equivalency factor. The product of each is then added to obtain a total 2,3,7,8-TCDD TEQ concentration. The total 2,3,7,8-TCDD TEQ concentration was equal to  $9.3 \times 10^{-4}$  mg/kg [Appendix B, Table 10], exceeding ATSDR's EMEG of  $5 \times 10^{-5}$  mg/kg (0.05 parts per billion) [8]. All maximum PCDD/PCDF concentrations were located at sampling location SD01.

#### *Off-Site Sediment at Unnamed Tributary*

The benzo(a)pyrene TEQ for all off-site locations along the unnamed tributary was 0.271 mg/kg [Appendix B, Table 5], exceeding the RBC of 0.087 mg/kg. The total 2,3,7,8-TCDD TEQ concentration equaled  $1.1 \times 10^{-5}$  mg/kg [Appendix B, Table 11], exceeding ATSDR's EMEG of  $5 \times 10^{-5}$  mg/kg (0.05 parts per billion). All maximum PCDD/PCDF concentrations were located at sampling location SD15.

#### *Off-Site Sediment at West Ditch*

All off-site samples were taken from west ditch at station location SD23. Benzo(a)pyrene was the only COPC at west ditch, at 0.0811 mg/kg [Appendix B, Table 8]. The RBC was not exceeded, however, benzo(a)pyrene was retained as a COPC due to the ubiquitous PAH contamination throughout the MPTC site.

### **B. Pathway Analysis**

To determine whether an individual would be exposed to contaminants of concern found in sediment from Big Creek/East Ditch and the Unnamed Tributary/West Ditch, SEET evaluated the environmental and human components that lead to human exposure. An exposure pathway consists of five elements: a source of contamination, transport through an environmental medium, a point of exposure, a route of human exposure, and a receptor population. ATSDR categorizes an exposure pathway as a completed or potential exposure pathway if the exposure pathway cannot be eliminated. Completed pathways require that the five elements exist and indicate that exposure to a contaminant has occurred in the past, is currently occurring, or will occur in the future. Potential pathways, however, require that at least one of the five elements is missing, but could exist. Potential pathways indicate that exposure to a contaminant could have occurred in the past, could be occurring now, or could occur in the future. An exposure pathway can be eliminated if at least one of the five elements is missing and will never be present.

April 1, 2005, the LDEQ conducted a site visit at the MPTC site. There is an 8-foot fence surrounding the site area. The entrance gate was locked and there were no signs of trespassing noted. Per LDEQ and EPA, there is little recreational value at the site, and it is not attractive to young children or other potential trespassers. SEET evaluated exposure pathways for both trespassers and recreational visitors who may currently or in the future be exposed to contaminated sediments at Big Creek and/or the Unnamed Tributary via incidental ingestion or skin contact. No completed or potential exposure pathways have been identified at the MPTC site.

## C. Exposure Analysis

Exposure to constituents in sediment at the MPTC site through ingestion and dermal exposure routes were evaluated for the current and future trespasser and/or recreational visitor receptor only. No other receptors (off-site residents, on-site residents, on-site industrial workers) would reasonably be expected to contact sediment in Big Creek or the Unnamed Tributary. Exposure doses were calculated for each of the contaminants of potential concern at body weights of 42 and 70 kilograms on the basis of EPA's assumption that a trespasser or recreational visitor to Big Creek or the Unnamed Tributary would be between the ages of 6 to 18 with limited exposure to activities including hunting, hiking, wading or crayfish trapping [1].

### *Health Effects Evaluation*

Accidental ingestion of or dermal exposure to on-site and off-site sediment at the MPTC site would pose no apparent health risk. There are no completed or potential exposure pathways at the MPTC site, and exposure doses estimated for the COPCs identified in the sediments are lower than the established health guideline values for these contaminants and are therefore unlikely to cause adverse health effects.

### *Cancer Health Effects Evaluation*

There were three COPCs at the MPTC site that were evaluated for their cancer causing endpoints; arsenic, benzo(a)pyrene, and 2,3,7,8-TCDD. SEET estimated the cancer risk for all contaminants identified as acceptable risk level of one excess cancer in 10,000 ( $1 \times 10^{-4}$ ) persons exposed for a lifetime [9]. Based on this information, arsenic, benzo(a)pyrene and 2,3,7,8-TCDD would have acceptable exposure dose concentrations of  $6.66 \times 10^{-5}$  milligrams per kilogram per day (mg/kg/day),  $1.36 \times 10^{-5}$  mg/kg/day, and  $6.66 \times 10^{-10}$  mg/kg/day, respectively. Estimated exposure doses for cancer risk were calculated for both ingestion and dermal exposure routes.

Calculated estimated exposure doses for benzo(a)pyrene and 2,3,7,8-TCDD (ingestion and dermal routes) at on-site and off-site locations at Big Creek and the Unnamed Tributary, and on-site locations at the East Ditch did exceed acceptable dose concentrations for cancer risk. However, all on-site locations are access restricted by an 8-ft fence, and all off-site locations are heavily vegetated, remote, inaccessible areas. SEET found no completed or potential exposure pathways at the MPTC site. Exposure to contaminants in sediment via ingestion or dermal contact at the MPTC site is highly unlikely and not expected; as a result, no excess cancer risk is expected.

## **D. Child Health Considerations**

SEET and ATSDR recognize that infants and children can be uniquely vulnerable to the effects of toxic chemicals; and that any such vulnerabilities demand special attention. Unique childhood vulnerabilities result, at least in part, from the fact that at birth many organs and body systems, including the lungs and the immune, endocrine, reproductive, and nervous systems, have not achieved structural or functional maturity; these organ systems continue to develop throughout childhood and adolescence. Children can also differ from adults in absorption, metabolism, storage, and excretion of toxicants, any of which could result in higher biologically effective doses to target organs. Children's exposures to toxicants may be more significant than adult's because children consume more food and liquids in proportion to their body weight than do adults.

SEET evaluated the potential public health hazards to children who may trespass or recreate at Big Creek and/or the Unnamed Tributary. SEET found no public health hazard to children.

## **IV. CONCLUSIONS**

Recreational uses are unlikely within the reaches of Big Creek or the Unnamed Tributary near the MPTC site. The depth of the water is very shallow, with many areas being completely dry. In April 2005, LDEQ noted an 8-foot fence surrounding the site area, with no signs of recreational use or trespassing. The site is not attractive to young children or other potential trespassers. Calculated estimated exposure doses for benzo(a)pyrene and 2,3,7,8-TCDD (ingestion and dermal routes) at on-site and off-site locations at Big Creek and the Unnamed Tributary, and on-site locations at the East Ditch did exceed acceptable dose concentrations for cancer risk. However, SEET found no completed or potential exposure pathways at the MPTC site. Therefore, the MPTC site does not pose a public health hazard.

## **V. RECOMMENDATIONS**

1. Because some concentrations of PAHs and 2,3,7,8-TCDD exceed health guideline values, as part of prudent public health practice, SEET recommends that EPA ensure remediation of the MPTC site is conducted in a timely way.

## **VI. PUBLIC HEALTH ACTION PLAN**

### *Past Actions*

1. In December 2002, SEET released the public health assessment for the MPTC site.
2. In June 2003, SEET released the groundwater health consultation for the MPTC site.
3. In November 2003, SEET released the biota health consultation for the MPTC site.

*Future Actions*

1. SEET will place this health consultation in the Marion community repository.
2. SEET will provide health education at the MPTC site on an as needed basis.

## LIST OF ACRONYMS

ATSDR	Agency for Toxic Substances and Disease Registry
COPC	Contaminant of Potential Concern
ED	Exposure Dose
EMEGs	Environmental Media Evaluation Guides
EPA	Environmental Protection Agency
HAC	Health-based Assessment Comparison Values
HC	Health Consultation
HHRA	Human Health Risk Assessment
HpCDF	Heptachlorinated Dibenzofuran
HxCDD	Hexachlorinated Dibenzo-p-Dioxin
HxCDF	Hexachlorinated Dibenzofuran
kg	Kilogram
LDHH	Louisiana Department of Health and Hospitals
mg/kg	Milligrams per Kilogram
mg/kg/day	Milligrams per Kilogram per Day
MPTC	Marion Pressure Treating Company
MRL	Minimal Risk Level
MSSLs	Medium Specific Screening Levels
OCDD	Octachlorinated Dibenzo-p-Dioxin
OCDF	Octachlorinated Dibenzofuran
OPH	Office of Public Health
PAHs	Polycyclic Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
PCDDs	Polychlorinated Dibenzo-p-Dioxins
PCDFs	Polychlorinated Dibenzofurans
PeCDD	Pentachlorinated Dibenzo-p-Dioxins
PeCDF	Pentachlorinated Dibenzofuran
pg/g	Picograms per Gram
PHA	Public Health Assessment
RBCs	Risk Based Concentrations

## LIST OF ACRONYMS

RfD	Reference Dose
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RI/FS	Remedial Investigation/Feasibility Study
RMEGs	Reference Media Evaluation Guides
SEET	Section of Environmental Epidemiology and Toxicology
SF	Slope Factor
SVOCs	Semi-volatile Organic Compounds
TCDD	Tetrachlorinated Dibenzo-p-Dioxin
TCDF	Tetrachlorinated Dibenzofuran
TEFs	Toxic Equivalency Factors
TEQ	Toxic Equivalency Quotient
VOCs	Volatile Organic Compounds
WHO	World Health Organization



## VII. REFERENCES

1. Tetra Tech. Remedial investigation and feasibility study for Marion Pressure Treating Company, Marion, Union Parish, Louisiana, Human Health Risk Assessment; 2001.
2. Louisiana Department of Health and Hospitals, Office of Public Health, Section of Environmental Epidemiology and Toxicology. Public health assessment for the Marion Pressure Treating Company, Marion, Union Parish, Louisiana. 2002Aug.
3. United States Environmental Protection Agency. Record of Decision for the Marion Pressure Treating Company Superfund site, Union Parish, Marion, Louisiana, EPA Facility ID: LAD008473142. June 2002.
4. U.S. Environmental Protection Agency. Marion Pressure Treating Company, Marion, Union Parish, Louisiana. Fact Sheet Updated July 2005. Available at: URL: <http://www.epa.gov/earth1r6/6sf/pdf/files/0604491.pdf>
5. Agency for Toxic Substances and Disease Registry. Toxicological profile for polycyclic aromatic hydrocarbons (PAHs). Atlanta: US Department of Health and Human Services; 1995.
6. U.S. Environmental Protection Agency Region III. Risk Based Concentration Tables. Available at: URL: <http://www.epa.gov/reg3hwmd/risk/human/rbc/rbc0404.pdf>
7. Agency for Toxic Substances and Disease Registry. Toxicological profile for Chlorinated Dibenzo-p-Dioxins. Atlanta: US Department of Health and Human Services; Update. 1998 Dec.
8. U.S. Environmental Protection Agency Region VI. Human Health Medium Specific Screening Levels. Available at: URL: [http://www.epa.gov/Region6/6pd/rcra\\_c/pd-n/screen.htm](http://www.epa.gov/Region6/6pd/rcra_c/pd-n/screen.htm)
9. U.S. Environmental Protection Agency. Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual. Supplemental Region VI Risk Assessment Guidance. Draft. 1995 May.
10. Agency for Toxic Substances and Disease Registry. Reference Media Evaluation Guide. Soil Comparison Values. 2004 Jun.

## **VII. REFERENCES**

11. Van den Berg et. al. Toxic equivalency factors (TEFs) for PCBs, PCDDs, PCDFs for humans and wildlife. *Environmental Health Perspectives*. Volume 106, Number 12, Pages 775 through 792; 1998.
  
12. U.S. Environmental Protection Agency. Health Effects Assessment Summary Tables (HEAST). Update. 1997 Jul.

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## **CERTIFICATION**

This Marion Pressure Treating Company Site, A Review of Soil Data, health consultation was prepared by the Louisiana Department of Health and Hospitals under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with approved methodology and procedures at the time the health consultation was begun. Editorial review was completed by the Cooperative Agreement Partner.

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Technical Project Officer, Cooperative Agreement Team (CAT), Superfund and Program Assessment Branch (SPAB), Division of Health Assessment and Consultation (DHAC),  
ATSDR

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

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Team Leader, CAT, SPAB, DHAC, ATSDR

**APPENDIX A: FIGURES 1, 2 & 3**



500  
0  
500

LEGEND

- Old Features
- New Features
- Operational Boundary

50 0 50 100 150  
State Location Map

MARION PRESSURE TREATING  
MARION, LOUISIANA  
AREA PRIORITY MA

FIGURE 1  
AREA PRIORITY MA









## **APPENDIX B: TABLES**

**Table 1. Maximum Polycyclic Aromatic Hydrocarbons (PAHs) Concentrations Detected in On-Site and Off-Site Sediments (0-6 inches) in Big Creek, Marion Pressure Treating Company, Union Parish, Louisiana (June-September 2000).**

Contaminants of Concern	Max. Conc. Detected (mg/kg) <sup>1</sup>		Toxic Equivalency Factor <sup>2</sup>	Product <sup>3</sup>	
	On-Site	Off-Site		On-Site	Off-Site
<b>PAHs</b>					
Acenaphthene	8400	12	0.001	8.4	.012
Acenaphthylene	.41	2.3	0.001	.00041	.0023
Anthracene	1.3	14	0.01	.013	.014
Benzo(a)anthracene	2.5	11	0.1	.25	1.1
Benzo(a)pyrene	5	14	1.0	5	14
Benzo(b)fluoranthene	11	33	0.1	1.1	3.3
Benzo(g,h,i)perylene	.83	4.2	0.01	.0083	.042
Benzo(k)fluoranthene	.73	42	0.1	.073	4.2
Chrysene	5.4	21	0.01	.054	.21
Dibenzo(a,h)anthracene	1.3	1.4	0.01	.013	.014
Fluoranthene	1.2	22	0.001	.0012	.022
Indeno(1,2,3-cd)pyrene	4.3	6.4	0.1	.43	.64
Phenanthrene	.97	36	0.001	.00097	.036
Pyrene	3	13	0.001	.003	.013
Benzo(a)pyrene TOXIC EQUIVALENT				15.35	23.61
EPA Region III Risk Based Concentration (HAC value)					8.7E-2

<sup>1</sup>mg/kg - milligrams per kilogram

<sup>2</sup>Source: ATSDR Toxicological Profile for PAHs [5]

<sup>3</sup>product = (maximum concentration detected) (TEF)

**Table 2. Maximum Polycyclic Aromatic Hydrocarbons (PAHs) Concentrations Detected in On-Site Hot-Spots (Samples SD-02, SD-03) and in Off-Site Hot-Spots (Sample SD-01) in Sediments (0-6 inches) in Big Creek, Marion Pressure Treating Company, Union Parish, Louisiana (June-September 2000).**

Contaminants of Concern	Max. Conc. Detected (mg/kg) <sup>1</sup>		Toxic Equivalency Factor <sup>2</sup>	Product <sup>3</sup>	
	On-Site	Off-Site		On-Site	Off-Site
<b>PAHs</b>					
Acenaphthene	8400	72	0.001	8.4	.072
Acenaphthylene	140	7.4	0.001	0.14	.0074
Anthracene	41000	820	0.01	410	8.2
Benzo(a)anthracene	1400	220	0.1	140	22
Benzo(a)pyrene	410	100	1.0	410	100
Benzo(b)fluoranthene	670	120	0.1	67	12
Benzo(g,h,i)perylene	91	26	0.01	0.91	.26
Benzo(k)fluoranthene	360	140	0.1	36	14
Chrysene	1800	310	0.01	18	3.1
Dibenzo(a,h)anthracene	35	7.7	0.01	0.35	.077
Fluoranthene	3800	1200	0.001	3.8	1.2
Indeno(1,2,3-cd)pyrene	120	52	0.1	12	5.2
Phenanthrene	12000	91	0.001	12	.091
Pyrene	3500	890	0.001	3.5	.89
Benzo(a)pyrene TOXIC EQUIVALENT				1122.1	167.09
EPA Region III Risk Based Concentration (HAC value)					8.7E-2

<sup>1</sup>mg/kg - milligrams per kilogram

<sup>2</sup>Source: ATSDR Toxicological Profile for PAHs [5]

<sup>3</sup>product = (maximum concentration detected) (TEF)

**Table 3. Maximum Concentrations in On-Site and Off-Site Sediments (0-6 inches) in Big Creek, Marion Pressure Treating Company, Union Parish, Louisiana (June-September 2000).**

Contaminants of Potential Concern	On-Site Sediments in Big Creek		Off-site Sediments in Big Creek		Comparison Values	
	Max. Conc. Detected (mg/kg) <sup>1</sup>	Background	Max. Conc. Detected (mg/kg)	Background	mg/kg	Source
<b>Semi-volatiles</b>						
2-methyl-naphthalene	5,800	NA <sup>2</sup>	3.9	NA	200/120	RMEG <sup>3</sup> (child)/MSSL <sup>4</sup>
Naphthalene	3,000	0.36	1.4	0.36	1,000/120	RMEG (child)/MSSL
Carbazole	12,000	0.36	6.4	0.36	24	MSSL
Dibenzofuran	9,700	0.36	6.6	0.36	150	MSSL
<b>Inorganics</b>						
Arsenic	3.5	1.8 - 8.9	5.6	1.8 - 8.9	0.39	MSSL

<sup>1</sup> mg/kg - milligrams per kilogram

<sup>2</sup> NA = Not available

<sup>3</sup> RMEG = Reference Dose Media Evaluation Guide [10]

<sup>4</sup> MSSL = Medium Specific Screening Level [8]

**Table 4. Maximum Polycyclic Aromatic Hydrocarbons (PAHs) Concentrations Detected in On-Site Sediments (0-6 inches) in East Ditch, Marion Pressure Treating Company, Union Parish, Louisiana (June-September 2000).**

Contaminants of Concern	Max. Conc. Detected (mg/kg) <sup>1</sup>	Toxic Equivalency Factor <sup>2</sup>	Product <sup>3</sup>
Anthracene	1	0.01	.01
Benzo(a)anthracene	.87	0.1	.087
Benzo(a)pyrene	2.8	1.0	2.8
Benzo(b)fluoranthene	6.6	0.1	.66
Benzo(g,h,i)perylene	.96	0.01	.0096
Benzo(k)fluoranthene	4.3	0.1	.43
Chrysene	1.9	0.01	.019
Dibenzo(a,h)anthracene	.68	0.01	.0068
Fluoranthene	.61	0.001	.00061
Indeno(1,2,3-cd)pyrene	1.9	0.1	.19
Pyrene	1.5	0.001	.0015
Benzo(a)pyrene TOXIC EQUIVALENT			4.215
EPA Region III Risk Based Concentration (HAC value)			8.7E-2

<sup>1</sup>mg/kg - milligrams per kilogram

<sup>2</sup>Source: ATSDR Toxicological Profile for PAHs [5]

<sup>3</sup>product = (maximum concentration detected) (TEF)

**Table 5. Maximum Concentrations in On-Site Sediments (0-6 inches) in the Unnamed Tributary, Marion Pressure Treating Company, Union Parish, Louisiana, (June - September 2000).**

Contaminants of Potential Concern	On-Site Sediments in Unnamed Tributary		Comparison Values	
	Max. Conc. Detected (mg/kg) <sup>1</sup>	Background	mg/kg	Source
<b>Semi-volatiles</b>				
2-methyl-naphthalene*	0.1	NA <sup>2</sup>	200/120	RMEG <sup>3</sup> (child)/ MSSL <sup>4</sup>
<b>Inorganics</b>				
Arsenic	3.9	1.8 - 8.9	0.39	MSSL

<sup>1</sup> mg/kg - milligrams per kilogram

<sup>2</sup> NA = Not available

<sup>3</sup> RMEG = Reference Dose Media Evaluation Guide [10]

<sup>4</sup> MSSL = Medium Specific Screening Level [8]

\* included as a COPC because it is historically associated with the site

**Table 6. Maximum Polycyclic Aromatic Hydrocarbons (PAHs) Concentrations Detected in On-Site Sediments (0-6 inches) in Unnamed Tributary, Marion Pressure Treating Company, Union Parish, Louisiana (June-September 2000).**

Contaminants of Concern	Max. Conc. Detected (mg/kg) <sup>1</sup>	Toxic Equivalency Factor <sup>2</sup>	Product <sup>3</sup>
Acenaphthylene	.65	0.001	.00065
Anthracene	2.5	0.01	.025
Benzo(a)anthracene	.89	0.1	.089
Benzo(a)pyrene	3.5	1.0	3.5
Benzo(b)fluoranthene	4.5	0.1	.45
Benzo(g,h,i)perylene	.83	0.01	.0083
Benzo(k)fluoranthene	5.3	0.1	.53
Chrysene	1.6	0.01	.016
Dibenzo(a,h)anthracene	.46	0.01	.0046
Fluoranthene	1.1	0.001	.0011
Indeno(1,2,3-cd)pyrene	1.2	0.1	.12
Phenanthrene	2.2	0.001	.0022
Pyrene	1.6	0.001	.0016
Benzo(a)pyrene TOXIC EQUIVALENT			4.75
EPA Region III Risk Based Concentration (HAC value)			8.7E-2

<sup>1</sup>mg/kg - milligrams per kilogram

<sup>2</sup>Source: ATSDR Toxicological Profile for PAHs [5]

<sup>3</sup>product = (maximum concentration detected) (TEF)



**Table 7. Maximum Polycyclic Aromatic Hydrocarbons (PAHs) Concentrations Detected in On-Site Sediments (0-6 inches) in West Ditch, Marion Pressure Treating Company, Union Parish, Louisiana (June-September 2000).**

Contaminants of Concern	Max. Conc. Detected (mg/kg) <sup>1</sup>	Toxic Equivalency Factor <sup>2</sup>	Product <sup>3</sup>
Acenaphthene	1.6	0.001	.0016
Pyrene	1.7	0.001	.0017
Benzo(a)pyrene Toxic Equivalent			.0033
EPA Region III Risk Based Concentration (HAC value)			8.7E-2

<sup>1</sup> mg/kg - milligrams per kilogram

<sup>2</sup> Source: ATSDR Toxicological Profile for PAHs [5]

<sup>3</sup> product = (maximum concentration detected) (TEF)

**Table 8. Maximum Poly-chlorinated dibenzo-p-dioxins / poly-chlorinated dibenzofurans (PCDDs / PCDFs) Concentrations Detected in Off-Site Sediments (0-6 inches) in Big Creek, Marion Pressure Treating Company, Union Parish, Louisiana (June-September 2000).**

Contaminants of Concern	Max. Conc. Detected (pg/g) <sup>1</sup>	Toxic Equivalency Factor <sup>2</sup>	Product <sup>3</sup>	Concentration (mg/kg) <sup>4</sup>
1,2,3,4,6,7,8-HpCDF	191	0.01	1.91	1.9E-6
1,2,3,4,6,7,8-HpCDD	6240	0.01	62.4	6.2E-5
1,2,3,4,7,8,9-HpCDF	16.8	0.01	0.168	1.6E-7
1,2,3,4,7,8-HxCDF	13.2	0.1	1.32	1.3E-6
1,2,3,4,7,8-HxCDD	12.2	0.1	1.22	1.2E-6
1,2,3,6,7,8-HxCDD	152	0.1	15.2	1.5E-5
1,2,3,7,8,9-HxCDD	17	0.1	1.7	1.7E-6
2,3,4,6,7,8-HxCDF	8.7	0.1	0.87	8.7E-7
2,3,7,8-TCDF	1.9	0.1	0.19	1.9E-7
HpCDF	999	0.01	9.99	9.9E-7
HpCDD	45310	0.01	453.1	4.5E-4
HxCDF	570	0.1	57	5.7E-5
HxCDD	2340	0.1	234	2.3E-4
OCDF	988	0.0001	0.0988	9.8E-8
OCDD	49010	0.0001	4.901	4.9E-6
PeCDF	133	0.5	66.5	6.6E-5
PeCDD	15.2	1	15.2	1.5E-5
TCDF	88.1	0.1	8.81	8.8E-6
TOXIC EQUIVALENT			934.58	9.3E-4
ATSDR Environmental Media Evaluation Guide (EMEG)				5.0E <sup>-5</sup>

<sup>1</sup> pg/g - picograms per gram

<sup>2</sup> Source: World Health Organization (WHO) [11]

<sup>3</sup> product - (maximum concentration detected) (TEF)

<sup>4</sup> mg/kg - milligrams per kilogram

**Table 9. Maximum Polycyclic Aromatic Hydrocarbons (PAHs) Concentrations Detected in Off-Site Sediments (0-6 inches) in Unnamed Tributary, Marion Pressure Treating Company, Union Parish, Louisiana (June-September 2000).**

Contaminants of Concern	Max. Conc. Detected (mg/kg) <sup>1</sup>	Toxic Equivalency Factor <sup>2</sup>	Product <sup>3</sup>
Anthracene	.84	0.01	.0084
Benzo(b)fluoranthene	1.1	0.1	.11
Benzo(k)fluoranthene	1.4	0.1	.14
Chrysene	.83	0.01	.0083
Fluorene	.39	0.01	.0039
Pyrene	.38	0.001	.00038
Benzo(a)pyrene TOXIC EQUIVALENT			.271
EPA Region III Risk Based Concentration (HAC value)			8.7E-2

<sup>1</sup>mg/kg - milligrams per kilogram

<sup>2</sup>Source: ATSDR Toxicological Profile for PAHs [5]

<sup>3</sup>product = (maximum concentration detected) (TEF)

**Table 10. Maximum Poly-chlorinated dibenzo-p-dioxins / poly-chlorinated dibenzofurans (PCDDs / PCDFs) Concentrations Detected in Off-Site Sediments (0-6 inches) in Unnamed Tributary, Marion Pressure Treating Company, Union Parish, Louisiana (June-September 2000).**

Contaminants of Concern	Max. Conc. Detected (pg/g) <sup>1</sup>	Toxic Equivalency Factor <sup>2</sup>	Product <sup>3</sup>	Concentration (mg/kg) <sup>4</sup>
1,2,3,4,6,7,8-HpCDF	4.2	0.01	0.042	4.2E-8
1,2,3,4,6,7,8-HpCDD	65.8	0.01	0.658	6.5E-7
1,2,3,6,7,8-HxCDD	2.3	0.1	0.23	2.3E-7
1,2,3,7,8,9-HxCDD	0.92	0.1	0.092	9.2E-8
HpCDF	18	0.01	0.18	1.8E-7
HpCDD	462	0.01	4.62	4.6E-6
HxCDD	34.6	0.1	3.46	3.4E-6
PeCDD	1.5	1	1.5	1.5E-6
TOXIC EQUIVALENT			10.78	1.1E-5
ATSDR Environmental Media Evaluation Guide (EMEG)				5.0E <sup>-5</sup>

<sup>1</sup> pg/g - picograms per gram

<sup>2</sup> Source: World Health Organization (WHO) [11]

<sup>3</sup> product - (maximum concentration detected) (TEF)

<sup>4</sup> mg/kg - milligrams per kilogram

**Table 11. Maximum Polycyclic Aromatic Hydrocarbons (PAHs) Concentrations Detected in Off-Site Sediments (0-6 inches) in West Ditch, Marion Pressure Treating Company, Union Parish, Louisiana (June-September 2000).**

Contaminants of Concern	Max. Conc. Detected (mg/kg) <sup>1</sup>	Toxic Equivalency Factor <sup>2</sup>	Product <sup>3</sup>
Benzo(a)anthracene	.37	0.1	.037
Benzo(b)fluoranthene	.42	0.1	.042
Chrysene	.42	0.001	.00042
Fluoranthene	.89	0.001	.00089
Pyrene	.8	0.001	.0008
Benzo(a)pyrene TOXIC EQUIVALENT			.0811
EPA Region III Risk Based Concentration (HAC value)			8.7E-2

<sup>1</sup>mg/kg - milligrams per kilogram

<sup>2</sup>Source: ATSDR Toxicological Profile for PAHs [5]

<sup>3</sup>product = (maximum concentration detected) (TEF)

**Table 12. Calculated Estimated Exposure Doses for Noncancer Health Effects Based on Ingestion of On-Site Sediment in Big Creek, Marion Pressure Treating Company, Union Parish, Louisiana, (June - September 2000).**

Bodyweight (kg) <sup>1</sup>	Arsenic ED <sup>2</sup> (mg/kg/day) <sup>3</sup>	Carbazole ED (mg/kg/day)	Dibenzofuran ED (mg/kg/day)	2-Methyl-naphthalene ED (mg/kg/day)	Naphthalene ED (mg/kg/day)
42	1.1E-6	4E-3	3.2E-3	1.9E-3	1E-3
70	7E-7	2.4E-3	1.9E-3	1.1E-3	6E-4

<sup>1</sup>kg - kilogram

<sup>2</sup>ED- exposure dose (estimated)

<sup>3</sup>mg/kg/day - milligrams per kilogram per day

**Table 13. Calculated Estimated Exposure Doses for Noncancer Health Effects Based on Ingestion of Off-Site Sediment in Big Creek, Marion Pressure Treating Company, Union Parish, Louisiana, (June - September 2000).**

Bodyweight (kg) <sup>1</sup>	Arsenic ED <sup>2</sup> (mg/kg/day) <sup>3</sup>	Carbazole ED (mg/kg/day)	Dibenzofuran ED (mg/kg/day)	2-Methyl-naphthalene ED (mg/kg/day)	Naphthalene ED (mg/kg/day)	2,3,7,8-TCDD ED (mg/kg/day)
42	1.8E-6	2.1E-6	2.1E-6	1.2E-6	4.5E-7	3.0E-10
70	1.1E-6	1.2E-6	1.3E-6	7.7E-7	2.7E-7	1.8E-10

<sup>1</sup>kg - kilogram

<sup>2</sup>ED- exposure dose (estimated)

<sup>3</sup>mg/kg/day - milligrams per kilogram per day

**Table 14. Calculated Estimated Exposure Doses for Benzo(a)pyrene for Noncancer Health Effects Based On Ingestion of On-Site Sediments at Marion Pressure Treating Company, Union Parish, Louisiana, (June - September 2000).**

Bodyweight (kg) <sup>1</sup>	Onsite Big Creek	Onsite Big Creek Hotspots	Onsite Unnamed Tributary	Onsite West Ditch	Onsite East Ditch
42	5E-6	3.7E-4	1.5E-6	1.0E-9	1.4E-6
70	3E-6	2.2E-4	9.4E-7	6.5E-10	8.4E-7

<sup>1</sup>kg - kilogram

**Table 15. Calculated Estimated Exposure Doses for Benzo(a)pyrene for Noncancer Health Effects Based On Ingestion of Off-Site Sediments at Marion Pressure Treating Company, Union Parish, Louisiana, (June - September 2000).**

Bodyweight (kg) <sup>1</sup>	Offsite Big Creek	Offsite Big Creek Hotspots	Offsite Unnamed Tributary	Offsite West Ditch
42	7.8E-6	5.4E-5	8.8E-8	2.6E-8
70	4.7E-6	3.2E-5	5.2E-8	1.5E-8

<sup>1</sup>kg - kilogram

**Table 16. Calculated Estimated Exposure Doses for Benzo(a)pyrene for Cancer Health Effects Based on Ingestion of On-Site and Off-Site Sediment from Big Creek and the Unnamed Tributary, Marion Pressure Treating Company, Union Parish, Louisiana, (June - September 2000).**

Bodyweight (kg) <sup>1</sup>	Onsite Big Creek	Offsite Big Creek	Onsite Unnamed Tributary	Offsite Unnamed Tributary
42	3.6E-5	5.7E-5	1.1E-5	6.4E-7
70	2.1E-5	3.4E-5	6.8E-6	3.8E-7

<sup>1</sup>kg- kilograms

**Table 17. Calculated Estimated Exposure Doses for Benzo(a)pyrene for Cancer Health Effects Based on Ingestion of Sediment from On-Site Hot-Spots (Samples SD-02, SD-03) and Off-Site Hot-Spots (Sample SD-01) in Big Creek, Marion Pressure Treating Company, Union Parish, Louisiana, (June - September 2000).**

Bodyweight (kg) <sup>1</sup>	Onsite Hot-Spots Big Creek	Offsite Hot-Spots Big Creek
42	2.7E-3	3.9E-4
70	1.6E-3	2.3E-4

<sup>1</sup>kg- kilograms

**Table 18. Calculated Estimated Exposure Doses for Benzo(a)pyrene for Cancer Health Effects Based on Ingestion of On-Site Sediments from East Ditch, Marion Pressure Treating Company, Union Parish, Louisiana (June - September 2000).**

Bodyweight (kg) <sup>1</sup>	Onsite East Ditch
42	1.0E-5
70	6.1E-6

<sup>1</sup>kg- kilograms

**Table 19. Calculated Estimated Exposure Doses for Arsenic for Cancer Health Effects Based on Ingestion of On-Site and Off-Site Sediment from Big Creek and from On-Site Sediment from Unnamed Tributary, Marion Pressure Treating Company, Union Parish, Louisiana, (June - September 2000).**

Bodyweight (kg) <sup>1</sup>	Onsite Big Creek	Offsite Big Creek	Onsite Unnamed Tributary
42	1.7E-6	2.7E-6	1.9E-6
70	1.0E-6	1.6E-6	1.1E-6

<sup>1</sup>kg- kilograms

**Table 20. Calculated Estimated Exposure Doses for Poly-chlorinated dibenzo-p-dioxins / poly-chlorinated dibenzofurans (PCDDs/PCDFs) for Cancer Health Effects Based on Ingestion of Off-Site Sediment from Big Creek and Unnamed Tributary, Marion Pressure Treating Company, Union Parish, Louisiana, (June - September 2000).**

Bodyweight (kg) <sup>1</sup>	Offsite Big Creek	Offsite Unnamed Tributary
42	4.6E-5	5.5E-7
70	2.7E-5	3.3E-7

<sup>1</sup>kg- kilograms



**Table 21. Calculated Estimated Exposure Doses for Noncancer Health Effects Based on Dermal Contact with On-Site Sediment in Big Creek, Marion Pressure Treating Company, Union Parish, Louisiana, (June - September 2000).**

Bodyweight (kg) <sup>1</sup>	Arsenic ED <sup>2</sup> (mg/kg/day) <sup>3</sup>	Carbazole ED (mg/kg/day)	Dibenzofuran ED (mg/kg/day)	2-Methyl-naphthalene ED (mg/kg/day)	Naphthalene ED (mg/kg/day)
42	3.2E-7	3.7E-3	3.0E-3	1.8E-3	9.3E-4
70	1.9E-7	2.2E-3	1.8E-3	1.0E-3	5.6E-4

<sup>1</sup>kg - kilogram

<sup>2</sup>ED- exposure dose (estimated)

<sup>3</sup>mg/kg/day - milligrams per kilogram per day

**Table 22. Calculated Estimated Exposure Doses for Noncancer Health Effects Based on Dermal Contact with Off-Site Sediment in Big Creek, Marion Pressure Treating Company, Union Parish, Louisiana, (June - September 2000).**

Bodyweight (kg) <sup>1</sup>	Arsenic ED <sup>2</sup> (mg/kg/day) <sup>3</sup>	Carbazole ED (mg/kg/day)	Dibenzofuran ED (mg/kg/day)	2-Methyl-naphthalene ED (mg/kg/day)	Naphthalene ED (mg/kg/day)	2,3,7,8-TCDD ED (mg/kg/day)
42	1.3E-7	2.0E-6	2.0E-6	1.2E-6	4.3E-7	8.4E-11
70	7.9E-8	1.2E-6	1.2E-6	7.3E-7	2.6E-7	5.0E-11

<sup>1</sup>kg - kilogram

<sup>2</sup>ED- exposure dose (estimated)

<sup>3</sup>mg/kg/day - milligrams per kilogram per day

**Table 23. Calculated Estimated Exposure Doses for Benzo(a)pyrene for Noncancer Health Effects Based On Dermal Contact With On-Site Sediments at Marion Pressure Treating Company, Union Parish, Louisiana, (June - September 2000).**

Bodyweight (kg) <sup>1</sup>	Onsite Big Creek	Onsite Big Creek Hotspots	Onsite Unnamed Tributary	Onsite West Ditch	Onsite East Ditch
42	6.2E-6	4.5E-4	1.9E-6	1.3E-9	1.7E-6
70	3.7E-6	2.7E-4	1.1E-6	7.8E-10	1.0E-6

<sup>1</sup>kg - kilogram

**Table 24. Calculated Estimated Exposure Doses for Benzo(a)pyrene for Noncancer Health Effects Based On Dermal Contact With Off-Site Sediments at Marion Pressure Treating Company, Union Parish, Louisiana, (June - September 2000).**

Bodyweight (kg) <sup>1</sup>	Offsite Big Creek	Offsite Big Creek Hotspots	Offsite Unnamed Tributary	Offsite West Ditch
42	9.5E-6	6.7E-5	1.1E-7	3.2E-8
70	5.7E-6	4.0E-5	6.6E-8	1.9E-8

<sup>1</sup>kg - kilogram

**Table 25. Calculated Estimated Exposure Doses for Benzo(a)pyrene for Cancer Health Effects Based on Dermal Contact With On-Site and Off-Site Sediment from Big Creek and the Unnamed Tributary, Marion Pressure Treating Company, Union Parish, Louisiana, (June - September 2000).**

Bodyweight (kg) <sup>1</sup>	Onsite Big Creek	Offsite Big Creek	Onsite Unnamed Tributary	Offsite Unnamed Tributary
42	6.7E-5	1.0E-4	2.0E-5	1.1E-6
70	4.0E-5	6.2E-5	1.2E-5	7.0E-7

<sup>1</sup>kg- kilograms

**Table 26. Calculated Estimated Exposure Doses for Benzo(a)pyrene for Cancer Health Effects Based on Dermal Contact with Sediment from On-Site Hot-Spots (Samples SD-02, SD-03) and Off-Site Hot-Spots (Sample SD-01) in Big Creek, Marion Pressure Treating Company, Union Parish, Louisiana, (June - September 2000).**

Bodyweight (kg) <sup>1</sup>	Onsite Hot-Spots Big Creek	Offsite Hot-Spots Big Creek
42	4.9E-3	7.3E-4
70	2.9E-3	4.4E-4

<sup>1</sup>kg- kilograms

**Table 27. Calculated Estimated Exposure Doses for Benzo(a)pyrene for Cancer Health Effects Based on Dermal Contact With On-Site Sediments from East Ditch, Marion Pressure Treating Company, Union Parish, Louisiana (June - September 2000).**

Bodyweight (kg) <sup>1</sup>	Onsite East Ditch
42	1.8E-5
70	1.0E-5

<sup>1</sup>kg- kilograms

**Table 28. Calculated Estimated Exposure Doses for Arsenic for Cancer Health Effects Based on Dermal Contact With On-Site and Off-Site Sediment from Big Creek and from On-Site Sediment from Unnamed Tributary, Marion Pressure Treating Company, Union Parish, Louisiana, (June - September 2000).**

Bodyweight (kg) <sup>1</sup>	Onsite Big Creek	Offsite Big Creek	Onsite Unnamed Tributary
42	7.3E-7	1.1E-6	8.2E-7
70	4.4E-7	7.0E-7	4.9E-7

<sup>1</sup>kg- kilograms

**Table 29. Calculated Estimated Exposure Doses for Poly-chlorinated dibenzo-p-dioxins / poly-chlorinated dibenzofurans (PCDDs/PCDFs) for Cancer Health Effects Based on Dermal Contact With Off-Site Sediment from Big Creek and Unnamed Tributary, Marion Pressure Treating Company, Union Parish, Louisiana, (June - September 2000).**

Bodyweight (kg) <sup>1</sup>	Offsite Big Creek	Offsite Unnamed Tributary
42	1.9E-5	2.2E-7
70	1.1E-5	1.3E-7

<sup>1</sup>kg- kilograms

## **APPENDIX C: CALCULATIONS**

**Table 1. Equation Variables for Sediment Ingestion Dose, Marion Pressure Treating Company, Union Parish, Louisiana.**

Variable	Value used
C = Concentration in sediment	Chemical-specific (mg/kg)
IR = Ingestion rate	100 mg/day
CF = Conversion factor	10 <sup>-6</sup> kg/mg
EF = Exposure frequency	2 days/week x 26 weeks/yr; 365 days/yr
ED=Exposure Duration	10 years
BW = Body weight	42 kg & 70 kg

The sediment ingestion non-cancer risk can be estimated as follows:

$$ID_s = [(C) (IR) (EF) (CF)] / (BW)$$

Where:

ID<sub>s</sub> = sediment ingestion non-cancer risk (mg/kg/day)

C = contaminant concentration (mg/kg)

IR = sediment ingestion rate (mg/day)

EF = exposure factor (unitless) = (exposure frequency) (exposure duration) / (exposure time)

BW = body weight (kg)

CF = conversion factor (10<sup>-6</sup> kg/mg); is required to convert the sediment contaminant concentration from mg/kg sediment to mg/mg sediment

**Table 2. Equation Variables for Sediment Ingestion Cancer Risk, Marion Pressure Treating Company, Union Parish, Louisiana.**

Variable	Value Used
C = Concentration in Sediment	Chemical-specific (mg/kg)
IR = Ingestion Rate	100 mg/day
CF = Conversion Factor	10 <sup>-6</sup> kg/mg
EF = Exposure Frequency	2 days/week x 26 weeks/yr; 365 days/yr
ED = Exposure Duration	15 years
ET = Exposure Time	365 days/yr X 15 years
BW = Body Weight	42 kg & 70 kg
SF = Cancer Slope Factor	Chemical specific (mg/kg/day) <sup>-1</sup> benzo(a)pyrene = 7.3 mg/kg/day <sup>-1</sup> 2,3,7,8-TCDD = 1.50 E+05 mg/kg/day <sup>-1</sup> [12] arsenic = 1.5 mg/kg/day <sup>-1</sup>

The sediment ingestion cancer risk can be estimated as follows:

$$ID_s = [(C) (IR) (EF) (CF) / (BW)] * (SF)$$

Where:

ID<sub>s</sub> = Sediment ingestion cancer risk (mg/kg/day)

C = Contaminant concentration (mg/kg)

IR = Sediment ingestion rate (mg/day)

EF = Exposure factor (unitless) = (exposure frequency) (exposure duration) / (exposure time)

BW = Body weight (kg)

CF = Conversion factor (10<sup>-6</sup> kg/mg); is required to convert the sediment contaminant concentration from mg/kg sediment to mg/mg sediment

SF = Cancer slope factor (mg/kg/day)<sup>-1</sup>

**Table 3. Equation Variables for Sediment Dermal Non-Cancer Risk, Marion Pressure Treating Company, Union Parish, Louisiana.**

Variable	Value Used
C = Concentration in Sediment	Chemical-specific (mg/kg)
CF = Conversion Factor	10 <sup>-6</sup> kg/mg
SA = Surface Area	5000 cm <sup>2</sup>
AF = Sediment to Skin Adherence Factor	0.2 mg/cm <sup>2</sup>
ABS = Absorption Factor	(unitless) Arsenic = 0.03 SVOCs = 0.1 PAHs = 0.13 2,3,7,8-TCDD = 0.03
EF = Exposure Frequency	2 days/week x 26 weeks/yr; 365 days/yr
ED = Exposure Duration	10 years
BW = Body Weight	42 kg & 70 kg
AT = Averaging Time	3650 days

The sediment dermal non-cancer risk can be estimated as follows:

$$DD_s = \frac{[(C) (CF) (SA) (AF) (ABS) (EF) (ED)]}{[(BW) (AT)]}$$

Where:

DD<sub>s</sub> = Sediment dermal non-cancer risk (mg/kg/day)

C = Contaminant concentration (mg/kg)

CF = Conversion factor (10<sup>-6</sup> kg/mg); is required to convert the sediment contaminant concentration from mg/kg sediment to mg/mg sediment

SA = Surface area (cm<sup>2</sup>)= the amount of skin surface available for contact with sediment

AF = Soil to skin adherence factor (mg/cm<sup>2</sup>) = the amount of COPC in sediment, that transfers to the blood when a dermal (skin) exposure occurs

ABS = Absorption factor (unitless)

EF = Exposure factor (unitless) = (exposure frequency) (exposure duration) / (exposure time)

BW = Body weight (kg)

AT = Averaging time (days)

**Table 4. Equation Variables for Sediment Dermal Cancer Risk, Marion Pressure Treating Company, Union Parish, Louisiana.**

Variable	Value Used
C = Concentration in Sediment	Chemical-specific (mg/kg)
CF = Conversion Factor	10 <sup>-6</sup> kg/mg
SA = Surface Area	5000 cm <sup>2</sup>
AF = Sediment to Skin Adherence Factor	0.2 mg/cm <sup>2</sup>
ABS = Absorption Factor	(unitless) Arsenic = 0.03, SVOCs = 0.1 PAHs = 0.13, 2,3,7,8-TCDD = 0.03
EF = Exposure Frequency	2 days/week x 26 weeks/yr; 365 days/yr
ED = Exposure Duration	15 years
ET = Exposure Time	365 days/yr X 15 years
BW = Body Weight	42 kg & 70 kg
AT = Averaging Time	3650 days
SF = Cancer Slope Factor	Chemical specific (mg/kg/day) <sup>-1</sup> benzo(a)pyrene = 7.3 mg/kg/day <sup>-1</sup> 2,3,7,8-TCDD = 1.50 E+05 mg/kg/day <sup>-1</sup> [12] arsenic = 1.5 mg/kg/day <sup>-1</sup>

The sediment dermal cancer risk can be estimated as follows:

$$DD_s = [(C) (CF) (SA) (AF) (ABS) (EF)] / [(BW) (AT)] * (SF)$$

Where:

DD<sub>s</sub> = Sediment dermal cancer risk (mg/kg/day)

C = Contaminant concentration (mg/kg)

CF = Conversion factor (10<sup>-6</sup> kg/mg); is required to convert the sediment contaminant concentration from mg/kg sediment to mg/mg sediment

SA = Surface area (cm<sup>2</sup>)= the amount of skin surface available for contact with sediment

AF = Soil to skin adherence factor (mg/cm<sup>2</sup>) = the amount of COPC in sediment, that transfers to the blood when a dermal (skin) exposure occurs

ABS = Absorption factor (unitless)

EF = Exposure factor (unitless) = (exposure frequency) (exposure duration) / (exposure time)

BW = Body weight (kg)

AT = Averaging time (days)

SF = Cancer slope factor (mg/kg/day)<sup>-1</sup>