

Health Consultation

**MCC RECYCLING, LLP FACILITY
(SUBSIDIARY OF US OIL RECOVERY, LP)**

PASADENA, HARRIS COUNTY, TEXAS

EPA FACILITY ID: TXN000606990

OCTOBER 27, 2009

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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Statement of Issues

The U.S. Environment Protection Agency (EPA) Region VI requested the Agency for Toxic Substances and Disease Registry (ATSDR) evaluate environmental data collected along the banks of Vince Bayou, an intertidal water feature that runs through the MCC Recycling, LLP facility located at 200 N. Richey Street, Pasadena, Texas (see Figure 1) [ATSDR 2009]. Specifically, EPA requested ATSDR review the levels of hazardous substances detected in soil and sediment samples to determine whether the detected levels pose a health hazard to recreational receptors.

This EPA request is being managed by ATSDR under their “Strike” process, which is a rapid-response, focused effort that usually does not include a comprehensive review of technical documents, site contaminants, and exposure pathways.

Site Description and History

MCC Recycling is a subsidiary of US Oil Recovery, LP. MCC Recycling is a treatment, storage, and disposal facility that receives wastes from another facility owned and operated by US Oil Recovery located at 400 N. Richey Street, Pasadena, Texas (see Figure 1). The US Oil Recovery facility processes and treats sludge and solids characteristically classified as hazardous waste, used oil, oily sludge and solids, municipal solid waste, and Class I and Class II Wastewater. Both facilities are located in an industrial area adjacent to the Houston Ship Channel in Pasadena, TX (see Figure 1).

The MCC Recycling facility was a former sewage treatment plant owned by the City of Pasadena that was taken out of service in 2004. In December 2008, the former sewage treatment plant was acquired by owners of US Oil Recovery to pre-treat wastewater from its oil recycling operations at 400 N. Richey. After pre-treatment, MCC Recycling initially planned to send the treated wastewater to the (new) Pasadena Sewage Treatment Plant; however, they later decided to apply for a NPDES permit from the Texas Commission on Environmental Quality (TCEQ) to discharge the treated wastewater into Vince Bayou. This permit, however, has not been approved.

Vince Bayou flows through the MCC Recycling facility and empties further downstream north of the facility directly into the Houston Ship Channel (see Figure 1). The bayou also extends south of the facility (i.e., upstream) into a residential area starting approximately $\frac{1}{4}$ – $\frac{1}{2}$ mile away from the facility. A public park (Memorial Park), 49 acres in size, sits along the southern stretch of the bayou (a green shaded polygon designating the outlined boundary of Memorial Park is shown in Figure 1). Fishing occurs along the bayou and near the facility. Residents also do recreational activities in or near the bayou at Memorial Park and could be potential receptors.

On May 20, 2009, MCC Recycling reported to the National Response Center (NRC Report #906156) a 600 gallon release of waste water from a holding tank used for gravity thickening [NRC 2009, EPA 2009]. Soil and sediment along the bayou was affected from the waste water release, which migrated into Vince Bayou.

Discussion

TCEQ contacted EPA Region VI and requested assistance with the May 2009 discharge from MCC Recycling. In response, EPA collected four surface soil samples: one from each side of Vince Bayou near the discharge area, one around the Roll Box on facility grounds, and one as a representative background sample further upstream in Memorial Park (see Figure 1). EPA also collected three sediment samples: one from each side of Vince Bayou near the discharge area, and one as background further upstream adjacent to Memorial Park (see Figure 1).

The soil and sediment samples were analyzed for metals, volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs). Of the detected substances in the soil and sediment samples, ATSDR selected arsenic, polycyclic aromatic hydrocarbons (PAHs), and total petroleum hydrocarbons for further in-depth analysis because their detected levels exceeded a representative environmental health comparison value or the substance itself had no available comparison value (see Table 1).

Arsenic levels detected in the soil and sediment samples, including background samples, ranged from 3.2 to 6.7 parts per million (ppm). The U.S. Geological Survey reports the mean and range of arsenic in soil and other surficial materials as 7.2 and <0.1–97 ppm, respectively [USGS 1984]. The site is located near a residential area and ATSDR assumed human exposure routes to soil are incidental ingestion, dermal contact, and inhalation.

Using an exposure scenario for an adult recreational receptor (70 kilogram (kg) ingesting 100 milligrams soil per day (mg/day) for 2 days a week for 52 weeks), the estimated exposure doses of arsenic would range from 2.20E-07 to 4.61E-07 mg/kg/day.

ATSDR also calculated exposure doses for a recreational receptor who is a small child. Using the exposure scenario of a 15 kg child ingesting 200 mg/day for 2 days a week for 52 weeks, the estimated exposure doses of arsenic would range from 1.53E-06 to 3.20E-06 mg/kg/day. All of the adult and child estimated exposure doses are below ATSDR's minimal risk level (MRL) for arsenic, 3.00E-04 mg/kg/day [ATSDR 2007]. Considering that the recreational receptor is an adult or child, their estimated exposure doses are approximately 2 to 3 orders of magnitude (i.e., 100 times to 1,000 times) lower than the MRL. Based on the exposure scenarios specific to this site, ATSDR does not expect exposure to arsenic in the soil to result in non-cancer adverse health effects.

Arsenic is carcinogenic to humans. However, there are no studies that specifically address the carcinogenic potential of arsenic in contaminated soil. For oral (ingestion) exposure, this conclusion is based primarily on studies performed in non-U.S. populations exposed to high levels of arsenic in drinking water. Outside the United States, skin cancer is consistently associated with chronically high oral exposures to arsenic from drinking water. It is sometimes associated with an increased risk of certain internal cancers (especially bladder cancer), as well [Tseng et al. 1968, Wu et al. 1989, Chen et al. 1986, Bates et al. 1992, NRC 1999]. However, U.S. studies have revealed no increase in bladder cancer associated with arsenic in drinking water [Lamm et al. 2004, Steinmaus et al. 2003]. Studies have not established any increased skin cancer risk in U.S. populations exposed to 100–200 ppb arsenic in drinking water [Goldsmith et al.

1972; Harrington et al. 1978; Morton et al. 1976; Southwick 1981; ATSDR 2007]. Of additional relevance to the soil exposure pathway is the fact that the bioaccessibility and bioavailability of arsenic are much lower in soil (3%–50%) than water [ATSDR 2007].

Overall, ingestion of soil and sediment from the discharge area is unlikely to produce any arsenic-related carcinogenic adverse health effects for the following two reasons: arsenic is not as bioavailable in soil as in water, and arsenic in soil and sediment represents an intermittent exposure (as compared to drinking water every day, all year, which is a chronic exposure).

PAH levels detected in the soil and sediment samples, including background samples, were all below 5 parts per million (ppm). PAHs include hundreds of different chemicals that commonly occur as mixtures within the environment. The most potent and best studied PAH is benzo(a)pyrene (B(a)P). Therefore, B(a)P was used as a surrogate to assess the relative toxicity of PAHs in soil. In determining the toxicity of a mixture of PAHs, the concentration of each PAH is multiplied by its Toxic Equivalency Factor (TEF), which results in its B(a)P Toxic Equivalency (TEQ) concentration (see Table 2). The TEQ basically relates each PAH's toxicity to that of B(a)P. The sum of the TEQs for each sample are then added together to determine the total B(a)P TEQ for the mixture. Total B(a)P TEQs ranged from 0.018 ppm (background sample) to 2.9 ppm (sediment sample). The total B(a)P TEQ concentrations for each sample were used to assess the potential health risks of the PAH mixture for this site (see Table 2) [EPA 1993, Cal EPA 2005].

Using the same exposure routes and scenarios for arsenic, the estimated exposure doses of PAHs for an adult recreational receptor ranged from 5.93E-09 to 1.23E-06 mg/kg/day. Similarly, ATSDR calculated the exposure dose for a small child, which ranged from 2.16E-08 to 4.47E-06 mg/kg/day. ATSDR has not derived MRLs for any of the selected PAHs; however, there are lowest-observed-adverse-effect-levels (LOAELs) and no-observed-adverse-effect-level (NOAELs) available [ATSDR 1995]. An intermediate NOAEL of 1.3 mg/kg/day was observed for mice exposed to B(a)P. The LOAEL (2.6 mg/kg/day) for B(a)P is based upon the appearance of gastric tumors. Systemic effects occurred at much higher exposure doses in acute and intermediate duration exposures [ATSDR 1995] for B(a)P and other PAHs. The estimated exposure doses for both adults and small children for PAHs in soil are several orders of magnitude (i.e., approximately 5 to 8) below the NOAEL and LOAEL for B(a)P. Based on the exposure scenarios specific for this site, ATSDR does not expect exposures to PAHs in the soil to result in non-cancer adverse health effects.

B(a)P, along with several other PAHs, have been classified as a “probable human carcinogen” [ATSDR 1995]. Human data specifically linking B(a)P, or any other PAH, to a carcinogenic effect are lacking. Although lung cancer has been found in humans who had received exposure to various mixtures of PAHs known to contain B(a)P – including cigarette smoke, roofing tar, and coke oven emissions – it is not possible to conclude from this information that B(a)P, or any other PAH, is the responsible agent [ATSDR 1995]. Incidental ingestion of soil is not a chronic exposure pathway (365 days per year, for life), but rather an intermittent one that varies from day to day, week to week, and

year to year; therefore, ATSDR expects no significant increase in cancer risk from the exposures to PAHs in the soil and sediment.

The soil and sediment samples were also analyzed for total petroleum hydrocarbons (TPHs). All of the samples, except the two background samples, showed appreciable levels of TPHs above the laboratory reporting limit. .

Before conducting a further in-depth analysis of the TPHs, ATSDR first considered the TPHs to be a whole petroleum product. The whole petroleum product considered for the in-depth analysis was crude oil. This assumption is based upon the description of operations conducted at the two facilities of interest, MCC Recycling and US Oil Recovery. Both facilities reclaimed, processed, and recycled a vast amount of waste associated with crude oil operations along the Gulf Coast of Louisiana and Texas. Second, ATSDR separated the TPHs into aromatic and aliphatic fractions. Crude oils are exceedingly complex mixtures that vary greatly depending on their source [ATSDR 1999]. Most of the chemicals in crude oils are hydrocarbons: straight, branched and cyclic alkanes (i.e., aliphatics); and aromatics including benzene, alkylbenzenes, naphthalenes and PAHs. Lab analyses of the soil and sediment samples showed no detection of benzene but the two alkylbenzenes (ethylbenzene and xylenes) were detected at less than negligible amounts; thus, the only aromatic fractions in the TPHs would consist mostly of naphthalenes and PAHs. Subtracting the summed concentrations of naphthalenes and PAHs from the total concentration of TPHs for each sample, this would give the total concentration of TPHs that are considered aliphatics (see Table 2, C₆ – C₃₅ (*Aliphatics Estimated*)).

The approach taken by ATSDR to evaluate the potential public health implications for TPHs is based on the efforts of the Total Petroleum Hydrocarbon Criteria Working Group (TPHCWG) of using a reduced number of TPH fractions (i.e., categorizing the TPHs into three groups of aliphatic fractions and three groups of aromatic fractions) [TPHCWG 1997a, TPHCWG 1997b]. ATSDR then established health effects screening values based on the toxicity of representative surrogate chemicals or-mixtures for each of these groups, the same strategy commonly used to develop ATSDR minimal risk levels (MRLs). The table shown on page 5 presents the ATSDR TPH fractions and their surrogate compounds or mixtures. In general, the most toxic surrogate compound or mixture for each fraction is used to indicate the potential toxicity of the entire fraction.

Referring to Table 1, most of the TPHs were detected within the carbon range of C₁₂ – C₃₅. Assuming the concentrations of compounds within the carbon range of C₁₂ – C₁₆ are negligible, then the carbon range of the detected TPHs is C_{>16} – C₃₅ (see above table). Since the components of the aromatic fractions were already discussed in the PAH analysis, the remaining in-depth analysis will focus only on the aliphatic fractions of the TPHs.

Again, using the same exposure routes and scenarios for arsenic and PAHs, the estimated exposure doses of TPHs for an adult recreational receptor ranged from 1.42E-06 to 2.79E-05 mg/kg/day and a small child ranged from 1.12E-05 to 2.21E-04 mg/kg/day. An oral reference dose (RfD) of 2 mg/kg/day has been derived for the aliphatic fraction of TPHs with a carbon range of C_{>16} – C₃₅ assuming its toxicity is similar to “low” molecular weight mineral oils [TPHCWG 1997b, ATSDR 1999]. The oral RfD is based

on an intermediate NOAEL of 200 mg/kg/day observed in Fischer 344 (F344) rats [TPHCWG 1997b, ATSDR 1999]. The NOAEL was established on abnormalities observed in the liver. The estimated exposure doses for both adults and small children of TPHs in soil are several orders of magnitude (i.e., approximately 4 to 6) below the oral RfD for TPHs. Based on the exposure scenarios specific to this site, ATSDR does not expect exposures to TPHs in the soil to result in non-cancer adverse health effects.

ATSDR TPH Fractions and Representative Compounds

Chemical fraction, in EC ^a	Representative compounds
Aromatics	
EC ₆ – EC ₉	Benzene, toluene, ethylbenzene, xylenes
EC _{>9} – EC ₁₆	Isopropyl benzene, naphthalene
EC _{>16} – EC ₃₅	Fluorene, fluoranthene, benzo(a)pyrene
Aliphatics	
EC ₅ – EC ₈	<i>n</i> -Hexane
EC _{>8} – EC ₁₆	JP-5, JP-7, JP-8, kerosene, dearomatized petroleum stream
EC _{>16} – EC ₃₅	Mineral oils

^a EC = equivalent carbon number index. EC is based on equivalent retention times on a boiling point gas chromatograph (GC) column, normalized to *n*-alkanes

Source: [ATSDR 1999]

A number of studies of the carcinogenicity of dermal application of crude oil to animals have been reviewed by the International Agency for Research on Cancer (IARC), which concluded that there is limited evidence for the carcinogenicity of crude oil to experimental animals [IARC 1989a]. IARC also reviewed a cohort study of U.S. petroleum-producing and pipeline workers, and case control studies that included exposure during crude oil exploration and production [IARC 1989a], which concluded that there is inadequate evidence for the carcinogenicity of crude oil in humans. Additional investigations on occupational exposures in petroleum refining concluded that there is limited evidence that working in petroleum refineries entails a risk of skin cancer and leukemia [IARC 1989b]. Exposures encountered during petroleum refining, however, are not particularly relevant to exposures that occur at non-refinery or hazardous waste sites with crude oil. Due to the limited evidence and considering the exposure pathway of

a recreational receptor, ATSDR expects no significant increase in cancer risk from the exposures to TPHs.

Sampling and Data Limitations

ATSDR's review of the lab analyses for the soil and sediment samples showed no speciation analyses of the TPHs into aromatics and aliphatics. Without speciation analyses, most environmental health investigators assume the composition of TPHs is 50% aromatics and 50% aliphatics. This generic compositional split normally provides a health protective assumption without assuming that all of the detected hydrocarbons are aromatic. ATSDR, however, believed that this generic split was too conservative for the site since the assumed whole petroleum product for the TPHs was crude oil. Normally, aromatic hydrocarbons may account for about 1 to 20 percent of the total hydrocarbons in crude oil [Speight 1991]. This was indicative of the lab analyses for the soil and sediment samples, where the estimated aromatic fraction of TPHs ranged from 0.4 to 21 percent. Thus, ATSDR used these estimated aromatic fractions within their evaluation instead of the usual generic compositional assumption of 50% aromatics. Preferably, ATSDR recommends the use of analytical methods that do provide speciation of contaminants such as PAHs and TPHs, especially when collecting environmental samples from hazardous waste sites or facilities that store, treat, and dispose of crude oil.

Conclusions and Recommendations

Based on the exposure scenarios evaluated, ATSDR concludes that exposure to arsenic, PAHs, TPHs and other substances detected in the soil and sediment along the banks of Vince Bayou near the MCC Recycling facility does not pose a public health hazard to recreational receptors.

ATSDR recommends the current facility owners to continue and follow any imposed actions set by environmental regulatory authorities in regards to the past discharge into Vince Bayou as a measure to further reduce any associated exposure risks to recreational receptors walking along Vince Bayou.

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APPENDIX A. Tables

TABLES

TABLE 1

Concentrations in Soil/Sediment Samples collected from Vince Bayou (source: EPA Region 6)

CHEMICAL SUBSTANCE	DETECTED CHEMICAL CONCENTRATIONS (ppm)												SOIL COMPARISON VALUES (ppm)		FURTHER PUBLIC HEALTH EVALUATION REQUIRED		
	Soil						Sediment										
	Background	East Side of Bayou	West Side of Bayou	Background	East Side of Bayou	West Side of Bayou	Background	East Side of Bayou	West Side of Bayou	Background	East Side of Bayou	West Side of Bayou	Roll Off Box				
Metals																	
Arsenic	4.10		3.20		4.20		6.70		3.60		4.20		4.60	0.5	CREG	YES	
Barium	150.00	B	130.00	B	200.00	B	370.00	B	90.00	B	110.00	B	220.00	400	iEMEG (pica child)	NO	
Cadmium	0.48		0.57		0.80		0.43		0.58		0.62		0.87	1	iEMEG (pica child)	NO	
Chromium, Total (1:6 ratio Cr VI : Cr III)	13.00		11.00		16.00		10.00		14.00		20.00		18.00	280	RSL (carcinogenic)	NO	
Lead	63.00		38.00		47.00		8.60		54.00		48.00		47.00	400	RSL (child)	NO	
Mercury	0.093		0.13		0.36		0.063	U	0.26		0.11		0.31	4.3	RSL (child)	NO	
Selenium	0.30	J	0.71	J	0.57	J	0.42	J	0.69	J	0.81	J	0.76	300	cEMEG (child)	NO	
Silver	0.14	J	2.40		3.80		0.64	U	0.40	J	0.77	J	3.80	300	cEMEG (child)	NO	
Volatile Organic Compounds (VOCs)																	
Acetone	0.011	U	0.013	U	0.012	U	0.021		0.084		0.71		0.013	U	4,000	iEMEG (pica child)	NO
Ethylbenzene	0.0057	U	0.0063	U	0.0058	U	0.0066	U	0.015		0.009	U	0.0063	U	1,000	iEMEG (pica child)	NO
Methylene Chloride	0.016	B	0.021	B	0.017	B	0.013	J/B	0.019	J/B	0.021	B	0.017	B	90	CREG	NO
Xylenes	0.0057	U	0.0063	U	0.0058	U	0.0066	U	0.041		0.009	U	0.0063	U	800	iEMEG (pica child)	NO
Semi-Volatile Organic Compounds (SVOCs)																	
Bis(2-ethylhexyl)phthalate	0.14	U	0.68		0.68		0.033	U	1.90		1.10		0.51	J	50	CREG	NO
Butyl benzyl phthalate	0.11	U	0.38	J	0.15	J	0.026	U	0.82	U	0.27	J	0.50	U	10,000	RMEG (child)	NO
Di-n-butyl phthalate	0.11	U	0.51	U	0.095	J/B	0.0044	J/B	0.82	U	0.36	U	0.50	U	1,000	aEMEG (pica child)	NO
Di-n-octyl phthalate	0.17	U	0.76	U	0.70	U	0.017	J	0.60	J	0.25	J	0.75	U	800	iEMEG (pica child)	NO
Polycyclic Aromatic Hydrocarbons (subcategory of SVOCs)																	
Benzo(a)anthracene	1.80		0.67		0.32		0.0044	J	1.30		0.91		0.28		See B[a]P TEQ Table (Table 2)		---
Benzo(b)fluoranthene	1.90		1.40		0.66	J	0.019	J	3.20		1.40		0.66	J	See B[a]P TEQ Table (Table 2)		---
Benzo(k)fluoranthene	1.40		0.97		0.28	J	0.039	U	1.90		0.91		0.23	J	See B[a]P TEQ Table (Table 2)		---
Benzo(a)pyrene	1.30		1.00		0.60		0.014		2.10		1.20		0.49		See B[a]P TEQ Table (Table 2)		---
Chrysene	1.70		0.95		0.60		0.013	U	2.20		1.30		0.51		See B[a]P TEQ Table (Table 2)		---
Indeno(1,2,3-cd)pyrene	0.54		0.56	J	0.43	J	0.013	J	1.40		0.81		0.29	J	See B[a]P TEQ Table (Table 2)		---
B[a]P TEQ	1.881		1.3695		0.775		0.017853		2.902		1.616		0.6411		0.1	CREG	YES
Dibenz(a,h)anthracene	0.21		0.51	U	0.29	J	0.014	J	0.84		0.32	J	0.50	U	0.015	RSL (carcinogenic)	YES
Acenaphthalene	0.086	U	0.38	U	0.35	U	0.02	U	0.62	U	0.091	J	0.38	U	3,400	RSL (child)	NO
Anthracene	0.21		0.25	U	0.23	U	0.013	U	0.41	U	0.15	J	0.25	U	20,000	iEMEG (pica child)	NO
Benzo(g,h,i)perylene	0.43		0.31	J	0.31	J	0.026	U	1.20		0.68		0.50	U	None		YES
Fluoranthene	3.30		1.40		0.57		0.02	U	3.40		2.30		0.28	J	800	iEMEG (pica child)	NO
Fluorene	0.057	U	0.25	U	0.23	U	0.013	U	0.41	U	0.10	J	0.25	U	800	iEMEG (pica child)	NO

TABLE 1 (cont'd)

Concentrations in Soil/Sediment Samples collected from Vince Bayou (source: EPA Region 6)

CHEMICAL SUBSTANCE	DETECTED CHEMICAL CONCENTRATIONS (ppm)												SOIL COMPARISON VALUES (ppm)		FURTHER PUBLIC HEALTH EVALUATION REQUIRED		
	Soil						Sediment										
	Background	East Side of Bayou	West Side of Bayou	Background	East Side of Bayou	West Side of Bayou	Soil Roll Off Box										
Polycyclic Aromatic Hydrocarbons (subcategory of SVOCs)																	
2-Methylnaphthalene	0.11	U	0.51	U	0.46	U	0.026	U	0.20	J	0.19	J	0.50	U	2,000	cEMEG (child)	NO
Naphthalene	0.086	U	0.38	U	0.35	U	0.02	U	0.21	J	0.11	J	0.38	U	1,000	iEMEG (pica child)	NO
Phenanthrene	1.10		0.36		0.30		0.013	U	0.99		0.87		0.25	U		None	YES
Pyrene	2.50		1.20		0.76		0.02	U	2.80		1.90		0.61		2,000	RMEG (child)	NO
Total Petroleum Hydrocarbons (TPH)																	
C6 – C35	57.00	U	82.00		450.00		66.00	U	110.00		250.00		1400.00			None	YES
	57.00	U	63.00	U	58.00	U	66.00	U	100.00	U	90.00	U	130.00	U		---	---
C6 – C12 C6 – C28	57.00	U	56.00	J	300.00		66.00	U	68.00	J	160.00		950.00			---	---
>C28 – C35	57.00	U	26.00	J	150.00		66.00	U	42.00	J	82.00	J	410.00			---	---
C6 – C35 (Aliphatics Estimated)	57.00	U	70.90		443.26		66.00	U	86.82		236.76		1393.64			---	---
<p>Notes: A substance is selected for further in-depth analysis if its maximum detected level exceeds the listed comparison value or if the substance has no available comparison value.</p> <p>CREG = Cancer Risk Evaluation Guide</p> <p>EMEG = Environmental Media Evaluation Guide for a specified exposure period (i.e., a – acute, i – intermediate, and c – chronic)</p> <p>J = estimated value</p> <p>J/B = estimated value; detected in blank sample</p> <p>ppm = parts per million</p> <p>RMEG = Reference Dose Media Evaluation Guide</p> <p>RSL = Regional Screening Level (environmental screening values adopted in all EPA regions and as listed within tables of the following hyperlink: http://www.epa.gov/reg3hscd/risk/human/rb-concentration_table/Generic_Tables/index.htm)</p> <p>U = not detected</p> <p>--- = not applicable</p>																	

TABLE 2

Conversion of Detected PAH Concentrations to Toxicity Equivalence Concentrations of Benzo[a]Pyrene

POLYCYCLIC AROMATIC HYDROCARBON FRACTION	TEF	SOURCE	DETECTED CHEMICAL CONCENTRATIONS (ppm)													
			Soil						Sediment						Soil	
			Background		East Side of Bayou		West Side of Bayou		Background		East Side of Bayou		West Side of Bayou		Roll Off Box	
			Conc.	B[a]P TEQ	Conc.	B[a]P TEQ	Conc.	B[a]P TEQ	Conc.	B[a]P TEQ	Conc.	B[a]P TEQ	Conc.	B[a]P TEQ	Conc.	B[a]P TEQ
Benzo[a]anthracene	0.1	Cal EPA; US EPA	1.80	0.18	0.67	0.067	0.32	0.032	0.0044	0.00044	1.30	0.13	0.91	0.091	0.28	0.028
Benzo[b]fluoranthene	0.1	Cal EPA; US EPA	1.90	0.19	1.40	0.14	0.66	0.066	0.019	0.0019	3.20	0.32	1.40	0.14	0.66	0.066
Benzo[k]fluoranthene	0.1	Cal EPA	1.40	0.14	0.97	0.097	0.28	0.028	0.002	0.0002	1.90	0.19	0.91	0.091	0.23	0.023
Benzo[a]pyrene	1	Cal EPA; US EPA	1.30	1.3	1.00	1	0.60	0.6	0.014	0.014	2.10	2.1	1.20	1.2	0.49	0.49
Chrysene	0.01	Cal EPA	1.70	0.017	0.95	0.0095	0.60	0.006	0.0013	0.000013	2.20	0.022	1.30	0.013	0.51	0.0051
Indeno[1,2,3-c,d]pyrene	0.1	Cal EPA; US EPA	0.54	0.054	0.56	0.056	0.43	0.043	0.013	0.0013	1.40	0.14	0.81	0.081	0.29	0.029
Benzo[j]fluoranthene	0.1	Cal EPA	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Dibenz[a,j]acridine	0.1	Cal EPA	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Dibenz[a,h]acridine	0.1	Cal EPA	---	---	---	---	---	---	---	---	---	---	---	---	---	---
7H-dibenzo[c,g]carbazole	1	Cal EPA	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Dibenzo[a,e]pyrene	1	Cal EPA	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Dibenzo[a,h]pyrene	10	Cal EPA	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Dibenzo[a,i]pyrene	10	Cal EPA	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Dibenzo[a,l]pyrene	10	Cal EPA	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1,6-dinitropyrene	10	Cal EPA	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1,8-dinitropyrene	1	Cal EPA	---	---	---	---	---	---	---	---	---	---	---	---	---	---
5-methylchrysene	1	Cal EPA	---	---	---	---	---	---	---	---	---	---	---	---	---	---
6-nitrochrysene	10	Cal EPA	---	---	---	---	---	---	---	---	---	---	---	---	---	---
2-nitrofluorene	0.01	Cal EPA	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1-nitropyrene	0.1	Cal EPA	---	---	---	---	---	---	---	---	---	---	---	---	---	---
4-nitropyrene	0.1	Cal EPA	---	---	---	---	---	---	---	---	---	---	---	---	---	---
B[a]P TEQ (total)				1.881		1.3695		0.775		0.017853		2.902		1.616		0.6411

Notes: B(a)P = benzo(a)pyrene
 ppm = parts per million
 TEF = Toxic Equivalency Factor
 TEQ = Toxic Equivalency
 --- not applicable

APPENDIX B. Figures

FIGURES

Figure 1

Site Map

