

Health Consultation

A REVIEW OF SURFACE WATER AND SEDIMENT DATA
TEXACO, INC. SHREVEPORT WORKS SITE
ANDERSON ISLAND
CADDO PARISH, LOUISIANA

EPA FACILITY ID: LAD980622278

AUGUST 21, 2007

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
Under Cooperative Agreement with the
U.S. Department of Health and Human Services
Agency for Toxic Substances and Disease Registry

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List of Acronyms

AI	Anderson Island
ATSDR	Agency for Toxic Substances and Disease Registry
B(a)P	Benzo(a)pyrene
BTEX	Benzene, toluene, ethylbenzene, and total xylenes
CREG	Cancer Risk Evaluation Guide
CVs	Health based comparison values
EMEG	Environmental Media Evaluation Guide
EPA	Environmental Protection Agency
kg	Kilograms
LDEQ	Louisiana Department of Environmental Quality
LDHH	Louisiana Department of Health and Hospitals
MCL	Maximum Contaminant Level
mg/kg	Milligrams per kilogram
mg/kg/day	Milligrams per kilogram per day
MO-3	Management Option 3
MRL	Minimal Risk Level
OPH	Office of Public Health
PAHs	Polycyclic aromatic hydrocarbons
RBC	EPA Region III Risk-Based Concentration
RECAP	Risk Evaluation Corrective Action Program
RfD	Reference dose
RI	Remedial Investigation
RMEG	Reference Media Evaluation Guide
SDWA	Safe Drinking Water Act
SEET	Section of Environmental Epidemiology and Toxicology
SF	Cancer slope factor
SPI	Sediment Phase I Investigation
SPII	Sediment Phase II Investigation
SVOCs	Semi volatile organic hydrocarbons
TEF	Toxicity Equivalency Factors
TEQ	Toxicity Equivalence Quotient
TPH	Total petroleum hydrocarbons

Summary and Statement of Issues

As part of prudent public health practice, the Louisiana Department of Health and Hospitals/Office of Public Health/Section of Environmental Epidemiology and Toxicology (LDHH/OPH/SEET) under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR) has reviewed available Phase I and II data from Anderson Island, formerly named Texaco Inc., Shreveport Works site located in Shreveport, Caddo Parish, Louisiana. The data examined in this health consultation includes data from surface water and bayou sediment samples collected and analyzed by the Louisiana Department of Environmental Quality (LDEQ) in July 2005 and August 2006. SEET reviewed the contaminant concentrations found in surface water and bayou sediments from the Anderson Island site to determine whether ingestion of and/or skin contact with the above mentioned media would pose a threat to human health and to establish what further public health actions, if any, may be needed.

Background

Site Description and History

The Anderson Island (AI) site consists of approximately two hundred sixty acres and is located within the city limits of Shreveport, Louisiana (appendix A map 1). Texaco operated the Texaco Inc., Shreveport Works topping plant and tank farm at Anderson Island from approximately 1911 to 1939. The topping plant distilled fuels such as gasoline, kerosene, and diesel from crude oil. The portion of the crude remaining after extracting the fuels was shipped to another facility in Texas by pipeline. Petroleum and petroleum products such as gasoline and diesel fuel were transported to and from the site by rail and pipeline. There were forty-two 37,500 barrel storage tanks at this facility. Texaco dismantled the topping plant in 1940 and sold the property to Mr. Alexander Knight in 1941. Texaco leased thirty acres of the site from Mr. Knight and continued operating the pipeline until 1945. Mr. Knight began residential development of the property in the early 1950's, which was essentially complete by 1980 [1].

In response to community concerns, LDEQ conducted limited sampling events at the Anderson Island site on three separate occasions between October 1997 and August 1998. These events focused on former facility operational areas most likely to be associated with hydrocarbon releases. Soil and sediment samples were collected from twenty-five onsite locations and two background offsite locations. Sample results detected petroleum hydrocarbons in a few of the soil samples at levels below screening standards for health hazards; however, LDEQ Risk Evaluation / Corrective Action Program (RECAP) regulations required further evaluation to determine the extent of the hydrocarbon material [1].

LDEQ completed Site Assessment Phase I and Phase II evaluations in May 1999 at the AI site. They are currently conducting a phased Remedial Investigation (RI). The first phase of the RI, the Site-Wide Characterization Work Plan, was completed in April 2001. Bayou sediment samples were collected from three of the six bayou locations that were not sampled during the Site Assessment events. The Site-Wide Characterization Report identified areas that required further testing, as well as eliminated unaffected areas.

This health consultation will evaluate surface water and sediment data from the July 2005 and August 2006 Sediment Phase I and II Investigations for the bayou systems bordering the AI site.

The purpose of the evaluation is to determine the potential for adverse public health effects from exposure to chemicals in these media. Other media-specific data will be evaluated in separate documents as it becomes available.

Current land use of the AI site includes residential neighborhoods, a park, and commercial properties such as shopping centers and office complexes. The site is bordered by the Shreveport-Barksdale Highway to the south, and the Clyde Fant Parkway to the east. Additionally, the site is bounded on the north, northwest, and southwest by six bayou segments. Measured during the July 2005 sampling event, each of the six bayous ranged from approximately 500 to 4100 feet in length and from 2.8 to six feet deep [2]. The bayous formed from tributaries modified by meandering of the Red River, which is currently located along the eastern boundary of the site [3]. The bayous are numbered by LDEQ from 1 to 6, with number 1 being the southernmost bayou segment, and each successive number proceeding clockwise to circumscribe the site, culminating with number 6 being the bayou segment at the northeast limit of the site [see figure 1 in appendix]. Currently, the water flow in each of the six bayous is slow or stagnant during most periods of the year [2].

Demographics

The AI site is located in Caddo Parish, Louisiana. Census 2000 results record a parish population of 252,161. The largest ethnic group in that parish at that time was Caucasian (52.9%), followed by African American (44.6%), American Indian or Alaska Native (0.4%), Asian (0.7%), with 1.4% of the population reporting as other. Seventy-eight point seven percent (78.7%) of the population age 25 or older in 2000 had earned at least a high school diploma. The median household income in 1999 was \$31,467 with 21.1% of persons living below poverty level [4]. The largest employers in the parish were the health care and social assistance industry; retail trade; accommodation and food services; administrative and support, waste management, and remediation services [5].

According to Census 2000 tract 214 population estimates, 2,081 residents live in the Anderson Island community. The largest ethnic group in the tract at that time was Caucasian (76.5%), followed by African American (18.4%), American Indian or Alaska Native (0.7%), Asian (1.8%), with 2.6% of the population reporting as other. Eighty-eight point eight percent (88.8%) of the population age 25 or older in 2000 had earned at least a high school diploma. The median household income in 1999 was \$35,694 with 10.6% of persons living below poverty level [6].

Discussion

Data Used

Sediment Phase I Investigation (SPI)

A sediment Phase I Investigation (SPI) was conducted by LDEQ in July 2005 in order to evaluate site conditions in the bayou sediments and surface waters surrounding the Anderson Island site. Bayou sediments were sampled from 26 locations in bayous 1-6, and a total of six surface water samples were collected, one from each of the bayous (appendix A map 2). All samples were analyzed for benzene, toluene, ethylbenzene, and total xylenes (BTEX), total

petroleum hydrocarbons (TPH), metals, and semi-volatile organic compounds (SVOCs), including polycyclic aromatic hydrocarbons (PAHs).

With the exception of PAHs, all sediment and surface water sample concentrations were below health based comparison values (CVs). Total PAHs in sediment exceeded the Cancer Risk Evaluation Guide (CREG) at five of the 26 sampling locations from bayous 1 thru 6. These samples are evaluated below.

CVs 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 health based comparison value do not necessarily represent a health threat, but are selected for further evaluation. Contaminants with media concentrations below a health based comparison value are unlikely to be associated with illness and are not evaluated further.

Table 1 depicts total PAHs detected above health based comparison values in bayou sediment samples from the AI site. Toxicity equivalency factors (TEFs) were used to weight each PAH's toxicity relative to the toxicity of benzo(a)pyrene (B(a)P) [7]. The TEF of B(a)P is set to 1. Multiplying the concentration of each PAH by its respective TEF produces a toxicity equivalence quotient (TEQ). The total TEQ at each sample location was used in this data evaluation. To ensure a conservative, protective estimation, constituents with non-detect values are assumed at half the method detection limit in the total PAH determination.

Table 1. Total PAHs detected in sediment (bayous 1, 2, and 6) above health based comparison values at the Anderson Island site, Caddo Parish, LA. Sediment Phase I Sampling, July 2005.

Detected Contaminant (mg/kg) ¹	Bayou 1			Bayou 2	Bayou 6	Health Based Comparison Values (mg/kg) ¹
	BAY 06	BAY 07	BAY 08	BAY 09	BAY 30	
Total PAHs ²	.685	.124	.315	.116	.145	0.1 CREG ³

¹mg/kg- milligrams per kilogram; ²PAHs- Polycyclic aromatic hydrocarbons; ³CREG- ATSDR Cancer Risk Evaluation Guide

Sediment Phase II Investigation (SPII)

In August 2006, LDEQ conducted a sediment Phase II Investigation (SPII), collecting an additional 11 bayou sediment samples from three of the six bayous (1, 2, and 6) surrounding the AI site (appendix A map 3). Additional samples were collected from these bayous to further evaluate PAH concentrations at these locations. Samples were submitted to the laboratory for SVOCs analysis, specifically carcinogenic PAHs. Each of the sediment sampling locations exceeded the CREG (table 2).

Table 2. Total PAHs detected in sediment (bayous 1, 2, and 6) above health based comparison values at the Anderson Island site, Caddo Parish, LA. SPII, August 2006.

Detected Contaminant (mg/kg) ¹	Bayou 1					Bayou 2				Bayou 6	Health Based Comp. Values (mg/kg) ¹
	BAY 06A	BAY 06B	BAY 06C	BAY 06D	BAY 08A	BAY 09A	BAY 09B	BAY 09C	BAY 09D	BAY 30A	
Total PAHs ²	.221	1.13	.375	.196	.254	.154	.131	.410	.237	.170	0.1 CREG ³

¹mg/kg- milligrams per kilogram; ²PAHs- Polycyclic aromatic hydrocarbons; ³CREG- ATSDR Cancer Risk Evaluation Guide

Exposure Pathways

SEET evaluated the environmental and human factors that lead to exposure in order to determine whether a child or adult would be exposed to contaminants detected in sampled media from the Anderson Island site. An exposure pathway contains the following five elements: a source of contamination, transport through some kind of environmental medium, a point of exposure, a route of 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 presently occurring, or will occur in the future. Potential pathways, however, 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.

Bayou Sediments

Bayou sediments were collected from 26 locations in bayous 1 thru 6 during the SPI, with an additional 11 locations in bayous 1, 2, and 6 during the SPII (appendix Map 3). As previously mentioned, each of the six bayous circumscribes the prominently residential Anderson Island site. There has been a swimming advisory in place for each of these bayous since September 1997 per a Shreveport City Ordinance (Ord. No. 148, 1997, 11-11-97). LDEQ contractors report that there are no placards posted with which to inform the public of the ordinance. However, as reported by LDEQ, there has been no current or historical evidence or observation of swimming and/or fishing in any of the bayous due to shallow water depth and stagnant water current. Also, per LDEQ, the community has a general knowledge that the bayous are unsuitable for recreational usage, as it is documented in the City of Shreveport Master Drainage Plan that the bayous surrounding the AI site are catchment areas for storm water and ditch/street drainage. If the public continues to adhere to the advisory, there are no exposure pathways between bayou sediment contaminants and the local population. To ensure that this occurs, SEET recommends that the City of Shreveport post placards to inform the public of the ordinance.

Surface Water

Surface water samples were collected from each of the six bayous during the SPI. None of the analyzed constituents were detected above health based comparison values. Furthermore, due to the stated City of Shreveport Ordinance described above deeming it unlawful to swim in the bayous and knowledge of adherence to the advisory, there should be no exposure pathways between surface waters and the local population surrounding the AI site.

Evaluation Process

All contaminant concentrations detected in surface water and bayou sediments were screened against highly protective health based comparison values (CVs). These values, which are derived from human and animal studies, are calculated with safety margins or uncertainty factors to account for variations of sensitivity within a human population and for differences between human and animal studies. These values are used for screening purposes only, and do not determine whether adverse health effects will occur. A detailed description of the screening process can be located in appendix B.

Samples with a total PAH value detected above CVs in SPI and SPII bayou sediments were selected for further evaluation, as they exceeded the CREG at each of the noted sampling locations. Total PAHs were examined further by estimating adult ingestion and dermal exposure doses to evaluate potential carcinogenic risk. A detailed description of the dose equations can be accessed in the appendix.

PAHs are a class of more than 100 different compounds that generally exist as complex mixtures of compounds. Because they are formed during the incomplete combustion of coal, oil, wood, and other organic substances, PAHs are widespread in the environment. They are also found in petroleum-based products such as coal tar and asphalt as well as in the manufacture of medicines, dyes, plastics and pesticides [7].

SEET evaluated bayou sediments and surface water data from the SPI and SPII sampling events. Ingestion of or dermal contact with site-related bayou sediments and/or surface water are not expected to cause adverse health effects.

Additionally, SEET estimated the adult cancer risk for ingestion of and dermal contact with total PAH contaminated bayou sediments at the Anderson Island site. Benzo(a)pyrene (B(a)P) is classified by EPA as a probable human carcinogen. Carcinogenic risk was calculated by multiplying the adult exposure dose over a lifetime by the B(a)P cancer slope factor (SF) of $7.30 \text{ E}+00 \text{ (mg/kg/day)}^{-1}$ [8]. Evaluation of potential carcinogenic risk due to a lifetime (70 year) exposure to B(a)P equivalents using standard default values (100 mg of contaminated sediment ingested twice per week, 70 kg body weight) indicates that B(a)P equivalents at a maximum detected sediment concentration of 1.13 mg/kg presents a cancer risk of $3.2 \text{ E}-06$, or 3.2 excess cancers per 1,000,000 people. This is below EPA's predicted cancer rate of 1 excess cancer per 10,000 people (1×10^{-4}).

Evaluation of potential carcinogenic risk due to a lifetime (70 year) dermal exposure to B(a)P equivalents (twice weekly exposure, 70 kg body weight) indicates that B(a)P equivalents at a

maximum detected sediment concentration of 1.13 mg/kg presents a cancer risk of 5.8 E-06. This estimate is below the upper risk limit of 1 excess cancer per 10,000 people (1×10^{-4}).

Concentrations detected at each of the sampling locations were observed at levels resulting in a carcinogenic risk below that expected to present and unacceptable cancer risk. Acceptable risk represents an estimated one excess cancer in 10,000 (1×10^{-4}) people exposed for a lifetime of 70 years in duration. If ingestion of or dermal contact with sediments containing total PAHs were to occur, such contact poses no apparent public health hazard to residents.

Child Health Considerations

In communities faced with air, water, or food contamination, the many physical differences between children and adults demand special emphasis. Children could be at greater risk than adults from certain kinds of exposure to hazardous substances. Children play outdoors and sometimes engage in hand-to-mouth behaviors that increase their exposure potential. Children are shorter than adults; this means they breathe dust, soil, and vapors close to the ground. A child's lower body weight and higher intake rate results in a greater dose of hazardous substance per unit of body weight. If toxic exposure levels are high enough during critical growth stages, the developing body systems of children can sustain permanent damage. Finally, children are dependent on adults for access to housing, for access to medical care, and for risk identification. Thus adults need as much information as possible to make informed decisions regarding their children's health. It can be concluded from the data evaluations and the environmental pathway analyses that no health hazards specific to children are present related to noted site contaminants.

Conclusions

SEET evaluated sediment and surface water Phase I (SPI) and sediment Phase II (SPII) data collected from the Anderson Island site. Surface water samples were collected from each of the six bayous circumscribing the site, with none of the analyzed constituents being above health based comparison values. Additionally, if the swimming ordinance is adhered to, there are no exposure pathways present for contact with surface waters. Evaluations suggest that there is no apparent public health hazard related to surface water present at the site, and no public health hazard if ordinances are observed.

Bayou sediments were collected from 26 locations in bayous 1 thru 6 during the SPI, with an additional 11 locations in bayous 1, 2, and 6 during the SPII. Evaluation of potential carcinogenic risk to total PAH contaminated sediments suggests that there is no apparent public health hazard related to ingestion of or dermal contact with bayou sediments present at the site. Additionally, there has been no evidence of recreational usage of the bayous, and as mentioned, there is a swimming ordinance in place. If the ordinance is adhered to, there is no public health hazard related to contact with bayou sediments at the AI site. SEET recommends that the City of Shreveport post placards to inform the public of the ordinance.

Recommendations

SEET recommends that the City of Shreveport post placards at each of the bayous to inform the public of the swimming ordinance.

Public Health Action Plan

The information produced within this health consultation will be disseminated by SEET to the public repositories, community members and stakeholders within Caddo Parish, Louisiana.

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Certification

This health consultation for Anderson Island was prepared by Louisiana Department of Health and Hospitals under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It was completed in accordance with approved methodology and procedure existing at the time the health consultation was initiated.

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The Division of Health Assessment and Consultation (DHAC), ATSDR, has reviewed this health consultation and concurs with its findings.

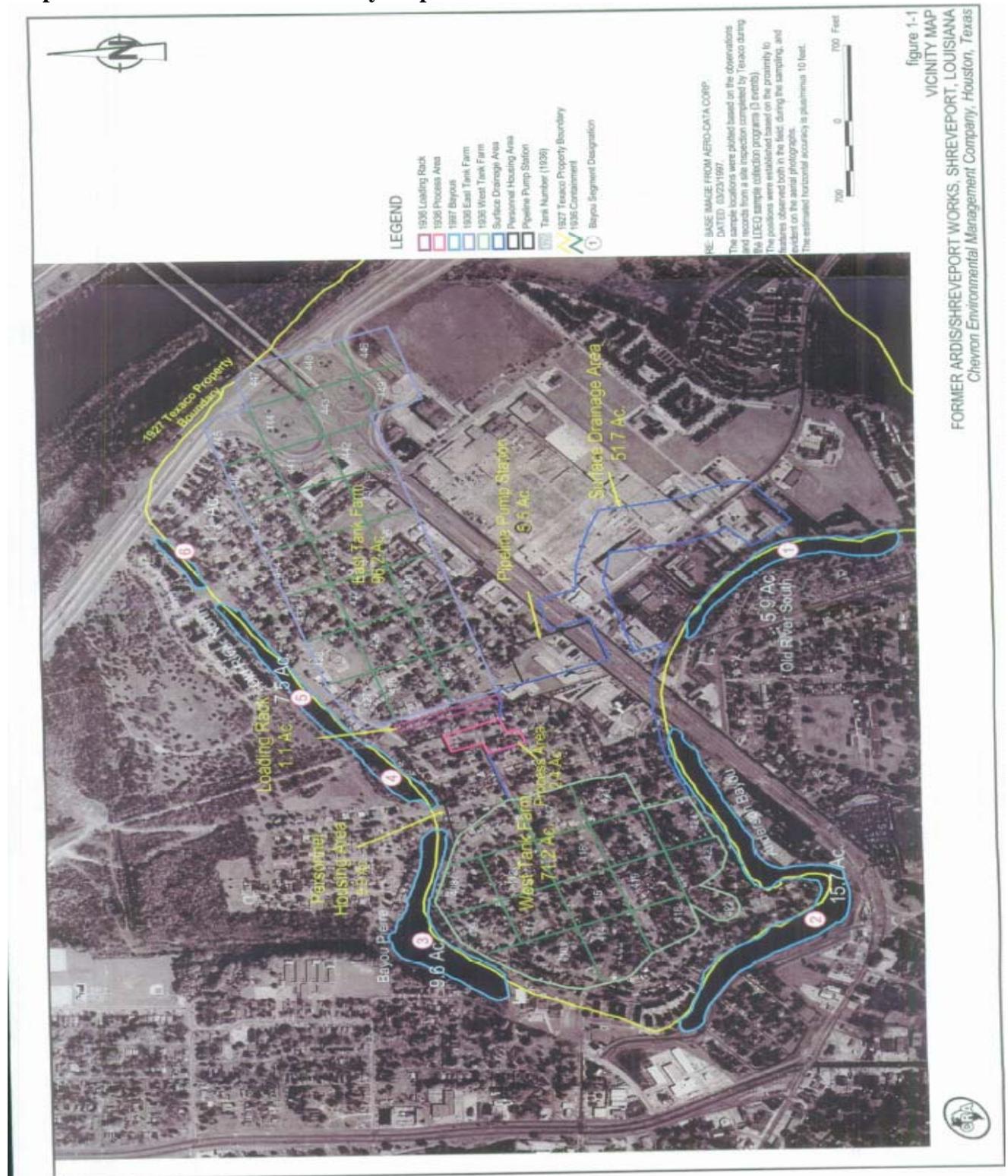
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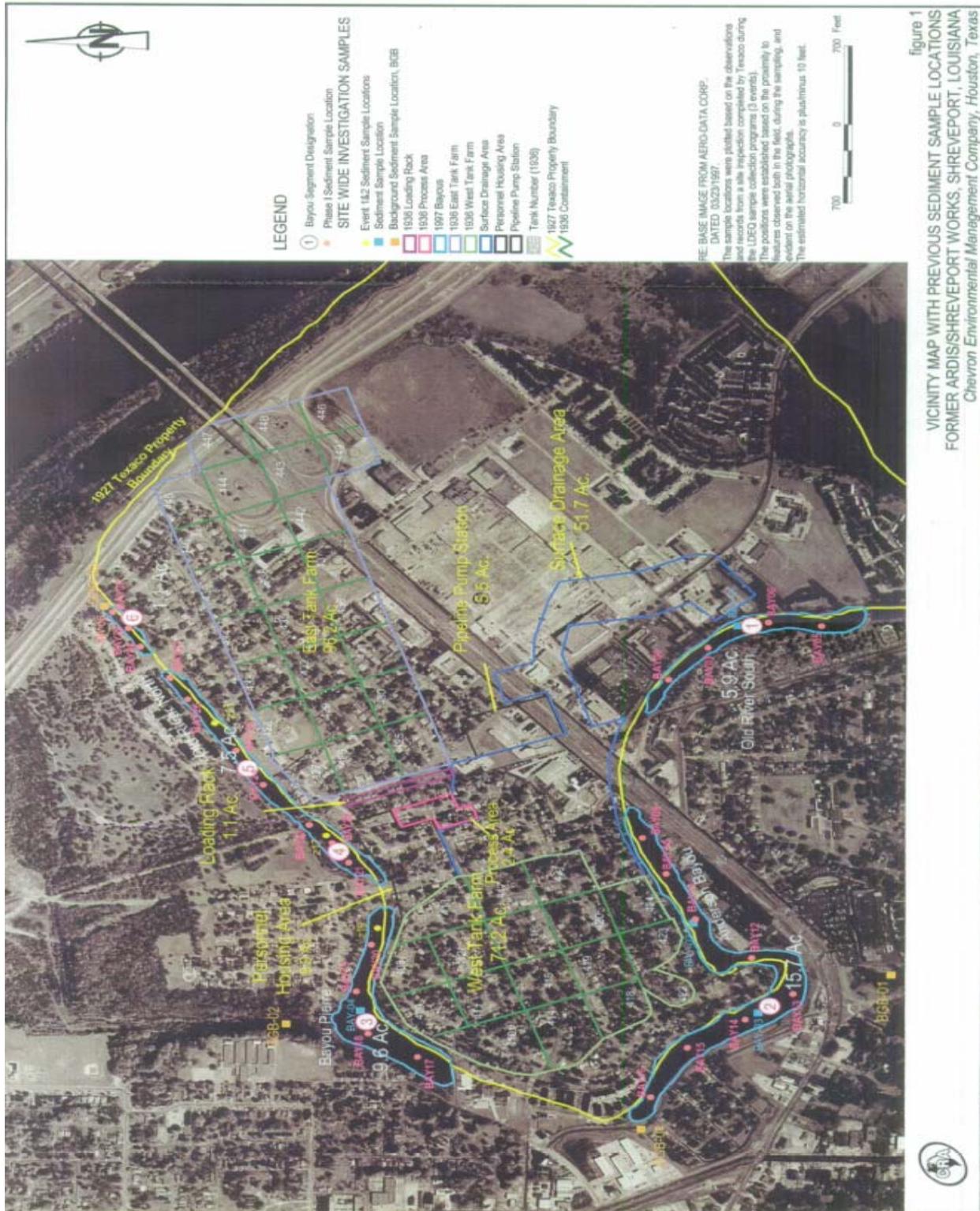
Appendix A: Maps

Map 1. Anderson Island site vicinity map



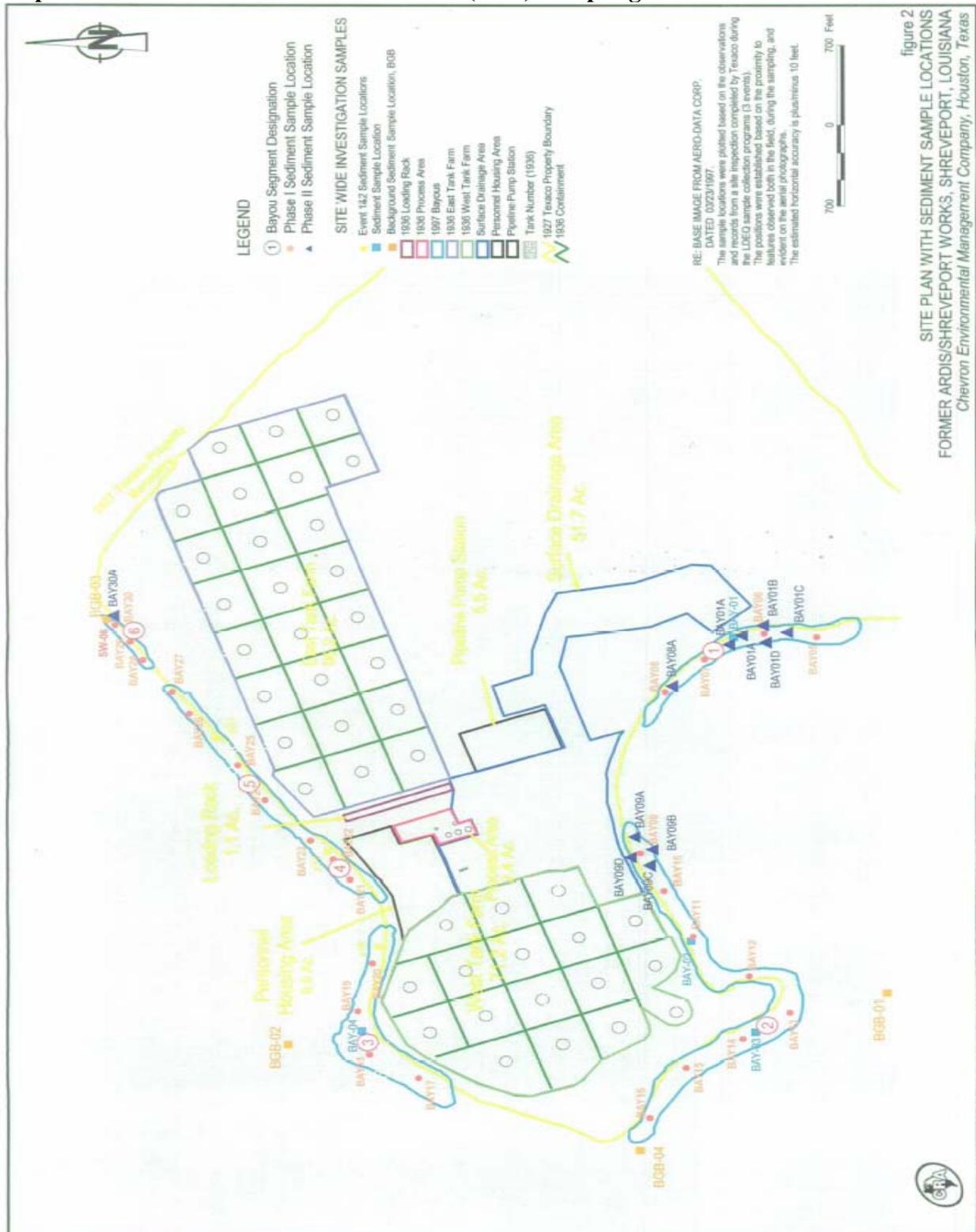
Source: Conestoga-Rovers & Associates Sediment Phase I Investigation Report, Former Ardis/Shreveport Works, AI 4399. March 2006.

Map 2. Anderson Island Sediment Phase I (SPI) Sampling Stations



Source: Conestoga-Rovers & Associates Sediment Phase II Investigation Report, Former Ardis/Shreveport Works, AI 4399. December 2006.

Map 3. Anderson Island Sediment Phase II (SPII) Sampling Stations



Source: Conestoga-Rovers & Associates Sediment Phase II Investigation Report, FormerArdis/Shreveport Works, AI 4399. December 2006.

Appendix B: Evaluation Process

Screening Process

Comparison values were initially used to determine which samples needed to be closely evaluated. Comparison values are media-specific concentrations of chemicals that are used by health assessors to select environmental contaminants for further evaluation. Comparison values are not used as predictors of adverse health effects. The comparison values used in the evaluation of Anderson Island are listed below:

ATSDR's Reference Media Evaluation Guides (RMEGs), and Environmental Media Evaluation Guides (EMEGs), Cancer Risk Evaluation Guide (CREG), EPA's Maximum Contaminant Levels (MCLs) and LDEQ's Risk Evaluation Corrective Action Program (RECAP) Management Option 3 (MO-3) were used as CVs in this document.

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.

MCLs are enforceable drinking water regulations created by the Safe Drinking Water Act (SDWA), which are protective of public health.

Lastly, RECAP MO-3 represents constituent concentrations in media that are protective of human health and the environment under site-specific conditions.

It should be noted that SEET compared constituents detected in surface water to drinking water standards, because surface water standards were not available. This provides an additional level of protection, as drinking water standards are more conservative, as they assume a greater degree of human exposure. Additionally, SEET utilized residential soil regulations to compare detected sediment concentrations, as sediment specific regulations were also unavailable.

Cancer risk comparison values used in this health consultation are based on ATSDR's CREG and EPA's chemical specific cancer slope factors (SF). CREGs are media-specific CVs used to identify concentration of cancer-causing substances that are unlikely to result in an increase of cancer rates in an exposed population. SF's represent an estimated lifetime risk of one excess cancer in 10,000 (1×10^{-4}) people exposed for a lifetime of 70 years in duration.

B-1: Equation variables for calculation of a sediment ingestion cancer risk dose

Variable	Value Used
C = Contaminant Concentration	Chemical specific (mg/kg)
IR = Intake Rate	100 mg/day
CF = Conversion Factor	10 ⁻⁶ kg/mg
EF = Exposure Factor (unitless)	0.28
BW = Bodyweight	70 kg
SF = Cancer Slope Factor	benzo(a)pyrene = 7.3 mg/kg/day ⁻¹ [12]

The sediment ingestion cancer risk can be estimated as follows:

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

Where:

ID_s = Sediment ingestion cancer risk

C = Contaminant concentration (mg/kg)

IR = Sediment intake rate (mg/day)

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

BW = Bodyweight (kg)

CF = Conversion factor (10⁻⁶ 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)⁻¹

B-2: Equation variable for calculation of a sediment dermal cancer risk dose

Variable	Value Used
C = Concentration in Sediment	Chemical-specific (mg/kg)
CF = Conversion Factor	10 ⁻⁶ kg/mg
SA= Skin Area Exposed	19,400 cm ²
A = Sediment Adherence Concentration	0.07 mg/cm ²
AF = Absorption Factor	0.13 (unitless)
EF = Exposure Factor	0.28 (unitless)
BW= Bodyweight	70 kg
SF = Cancer Slope Factor	benzo(a)pyrene = 7.3 mg/kg/day ⁻¹

The sediment dermal cancer risk can be estimated as follows:

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

Where:

DD_s = Sediment dermal cancer risk

C = Contaminant concentration (mg/kg)

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

SA= Skin area exposed

A = Sediment adherence concentration (mg/cm²)

AF = Absorption factor (unitless)

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

BW = Body weight (kg)

SF = Cancer slope factor (mg/kg/day)⁻¹