

Health Consultation

**CALCASIEU ESTUARY
SEDIMENT SAMPLE EVALUATION**

CALCASIEU PARISH, LOUISIANA

EPA FACILITY ID: LA0002368173

MARCH 9, 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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HEALTH CONSULTATION

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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

AT	averaging time
ATSDR	Agency for Toxic Substances and Disease Registry
BW	body weight
CF	conversion factor
cm	centimeter
COC	contaminant of concern
COPC	contaminant of potential concern
CREG	cancer risk evaluation guide for 1×10^{-6} excess cancer risk
CS	contaminant concentration in sediment
CSF	cancer slope factor
CVs	health-based comparison values
ED	exposure duration
EF	exposure frequency
EMEG	environmental media evaluation guide
EPA	United States Environmental Protection Agency
FI	fraction ingested
IR	ingestion rate
kg	kilogram
kg/mg	kilogram per milligram
km	kilometers
km ²	square kilometers
LDEQ	Louisiana Department of Environmental Quality
LDHH	Louisiana Department of Health and Hospitals
LOAEL	lowest-observed-adverse-effects level
mg/kg	milligrams per kilogram
mg/kg/day	milligrams per kilogram per day
MRL	minimum risk level
NPDES	National Pollutant Discharge Elimination System
OPH	Office of Public Health
PAH	polycyclic aromatic hydrocarbons
PCL	protective concentration level
PPG	Pittsburgh Plate Glass Company
RfD	reference dose
RBC	risk-based concentration
RI	remedial investigation
RMEG	reference dose media evaluation guide
SEET	Section of Environmental Epidemiology and Toxicology
TCDD	tetrachlorodibenzo- <i>p</i> -dioxin
TEF	toxicity equivalency factors
TEQ	toxicity equivalence quotient

Summary and Statement of Issues

In 1999, the U.S. Environmental Protection Agency (EPA) Region VI began a remedial investigation (RI) of the Calcasieu Estuary in Calcasieu Parish, Louisiana. The RI examined the potential human health and environmental effects resulting from uncontrolled releases of chemical contaminants into the estuary. During this investigation, sediment samples were analyzed for the presence of 235 chemicals. Based on levels present, 168 of these chemicals are considered to be contaminants of potential concern (COPCs), or contaminants that may increase human health risk or ecological risk. Residents of the area requested that a health consultation be performed to explain the results of the investigation in terms of human health risk. The Louisiana Department of Health and Hospitals/Office of Public Health/Section of Environmental Epidemiology and Toxicology (LDHH/OPH/SEET) performed the health consultation through a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). SEET staff reviewed the contaminant concentrations reported by EPA to determine whether contact with sediments in the area pose a threat to human health and to determine what further public health actions, if any, may be needed.

Background

Site Description and History

Located in the southwestern corner of Louisiana, the Calcasieu Estuary covers approximately 50 square kilometers (km²) of the Calcasieu River Basin (see Appendix A, Figure A-1) [1]. Saltwater migrates north into the estuary from the Gulf of Mexico via the Calcasieu River, and freshwater drains back toward the Gulf from the estuary via numerous inland water bodies. The estuary supports a diverse aquatic ecosystem surrounded by an industrialized city. The industrial development of the Calcasieu Estuary dates back to the late 1800s. Over time, several chemical manufacturing plants and petroleum refineries have been located along the estuary. Facility discharges and accidental releases have contributed to the contamination of sediments within the estuary, as have dredging, stormwater runoff, and urban and agricultural activities [1].

The three locations sampled for sediment contamination during the EPA RI were Bayou d'Inde, the Upper Calcasieu Estuary, and the Lower Calcasieu Estuary. These areas contain land used for commercial and industrial purposes, as well as rural and urban residential sites.

Bayou d'Inde, a major tributary of the Calcasieu River, includes 15 km of land located west of Lake Charles in the northern part of the estuary (see Appendix A, Figure A-2) [1]. The bayou is divided into four reaches and adjacent marshes:

- **Reach 1** extends from the Pittsburgh Plate Glass Company (PPG) canal to the ship channel; the adjacent Lockport Marsh lies at the merging point of this reach and the ship channel;
- **Reach 2** extends from the LA 108 highway to the PPG canal; a number of small marshes lie near this reach;
- **Reach 3** extends from Bayou d'Inde's merging point with Little Bayou d'Inde to LA 108; and

- **Reach 4** extends from the headwaters of the bayou to its merging point with Little Bayou d'Inde.

Reaches 1 through 3 are entirely industrial, while Reach 4 is rural residential and agricultural. Industries that had or have permits through the National Pollutant Discharge Elimination System (NPDES) to dispose material into Bayou d'Inde include PPG Industries, Citgo, Equistar (formerly OxyChem), Firestone, Westlake Polymers, CertainTeed Products, and Big Three Industries. Contaminants appear to enter the system primarily through industrial releases between Little Bayou d'Inde and LA 108 and near the LA 108 bridge; through unidentified releases to Maple Fork Bayou in Reach 2; and from industrial releases to the PPG Canal [1].

The *Upper Calcasieu* is a 25-km long area extending from the saltwater barrier north of Lake Charles on the Calcasieu River through Lake Charles to Coon Island Loop (see Appendix A, Figure A-3) [1]. Sediment samples were collected from four sections within this area:

1. *Below Clooney Loop*, which extends from the Coon Island Loop and the shallow lake covering much of Coon Island to the merging point of the Calcasieu River Ship Channel and the Clooney Island Loop. This area also includes Contraband Bayou.
2. *Clooney Loop*, which extends from the Clooney Island Loop to the merging point of the Calcasieu River Ship Channel and Lake Charles.
3. *Lake Charles*, which includes Lake Charles itself.
4. *North of Lake Charles*, which includes the Calcasieu River above the lake and the marsh areas surrounding this portion of the river.

Historic and current industries with NPDES permitted disposal into the Upper Calcasieu include Lyondell (formerly ARCO and Olin Chemicals), Conoco, and PPG.

The *Lower Calcasieu* is defined as the portion of the Calcasieu Estuary from the I-210 bridge just south of Coon Island Loop to the outlet of Moss Lake, a total distance of 11 km (see Appendix A, Figure A-4) [1]. This area encompasses Bayou Olsen, Moss Lake, Bayou Guy, Indian Marais Lagoon, an unnamed system of shallow lakes between Bayou Guy and Prien Lake, Prien Lake itself, and the portion of the Calcasieu River Ship Channel that runs parallel to these water bodies. The industries with potential to discharge into this portion of the estuary include Bridgestone Firestone, CitCon, Citgo, Conoco, Entergy, Himont, LA Pigment, Lake Charles Harbor, Lyondell, Montell, OxyChem/Equistar, PPG, and W.R. Grace.

Background sediment samples were also taken from reference areas that are relatively unaffected by industrial activities: Johnson's Bayou, Willow Bayou, Bayou Bois Connine, Bayou Choupique, and Grand Bayou, (see Appendix A, Figure A-5) [1]. These locations were selected for having similar sediment characteristics as the Calcasieu Estuary study area, but with minimal sediment contamination [1].

Demographics

Calcasieu Parish is considered to be part of the Lake Charles metropolitan area. Census 2000 results recorded a population of 183,577. The largest ethnic group in the parish at that time was

Caucasian (73.6%), followed by African-American (24.0%), Asian (0.6%), and Native American (0.3%).

Ninety-three percent (93.0%) of the population age 25 years or older in 2000 had earned at least a high school diploma. The median household income was \$35,372, with 15.4% of persons living below the poverty level. The largest employers were the educational, health, and social services industry; followed by the manufacturing industry; the retail trade industry; the art, entertainment, recreation, accommodation, and food services sector; and the construction industry [1, 2].

Discussion

Data Used

The data used in this evaluation came from two phases of sediment sampling performed during EPA's RI of the Calcasieu Estuary. Samples were reviewed through a data validation process to ensure data quality and usability. The data evaluation included tests for precision, accuracy, completeness, and a measure of how well the data represented actual conditions within the estuary. Data gathered from the remedial investigation were determined usable through this data evaluation process and in compliance with EPA's environmental investigation quality assurance guidelines [1].

Exposure Pathways

The Calcasieu Estuary receives runoff and wastewater discharges from several industrial facilities. These discharges, plus accidental releases of organic and inorganic chemicals, pollutants from urban and agricultural activities, and stormwater runoff, have historically contributed to the contamination of sediments within the estuary waters. Direct skin contact with these contaminated sediments is possible if an individual wades in the estuary or if these sediments are resuspended by dredging or similar underwater activities. However, it is unlikely that an individual would spend a significant amount of time with a large area of bare skin in contact with contaminated sediments.

The probability of pica behavior (eating significant amounts of soil or sediment) is low in the Calcasieu Estuary because the sediments are underwater and not easily accessible. However, anyone who swallows water during recreational aquatic activities may incidentally ingest minute quantities of resuspended sediments. Incidental sediment ingestion was estimated for the period of May through October. The Louisiana Department of Environmental Quality (LDEQ) defines this as the period of primary contact recreation, the months during which body immersion in natural waters is most likely to occur in Louisiana [3]. SEET used this period of 184 days to calculate potential health risks for recreational exposures, estimated at 5 hours per day.

Evaluation Process

A total of 693 sediment samples were collected from the Calcasieu Estuary during the RI. The process by which the possible health effects of sediment contaminants in the Calcasieu Estuary

were evaluated is summarized here and described in detail in Appendix B. Samples labeled as *nondetects* were excluded from the evaluation.

Contaminants sampled for included dioxins, metals, polycyclic aromatic hydrocarbons (PAHs), pesticides and polychlorinated biphenyls, herbicides, semivolatile organic compounds, and volatile organic compounds. Dioxins and PAHs were evaluated as mixtures of compounds with similar mechanisms of toxicity using toxicity equivalency factors (TEFs), as outlined in Appendix B [4–6]. All other contaminants were individually evaluated.

Contaminant concentrations found within each sediment sample were first compared to health-based comparison values (CVs). These conservative screening values are only used to select environmental contaminants for further evaluation. CVs are not used to predict adverse human health effects.

Contaminant concentrations that exceeded the health-based CVs are listed by sampling area in Appendix C, Tables C-1 through C-3. They include antimony, arsenic, lead, barium, iron, mercury, PAHs, Aroclor 1254, beta-benzenehexachloride (beta-BHC), bis(2-ethylhexyl)phthalate, and hexachlorobenzene. These contaminants of concern (COCs) were further evaluated by comparing estimated exposure doses to the appropriate health guidelines for each chemical. Concentrations of lead, for which no health guideline is available, were evaluated using EPA's screening level for lead (see Appendix B). If the exposure dose for a chemical was less than the health guideline or screening level for that chemical, adverse health effects were considered to be unlikely. If the exposure dose was greater, then it was compared to known health effect levels identified in ATSDR's toxicological profile for that chemical.

In addition to acute risks assessed for applicable contaminants, SEET estimated the cancer risk for all contaminants identified as carcinogens. EPA's range of acceptable cancer risk levels is from 1 excess cancer per 10,000 people to 1 excess cancer per 1,000,000 people exposed for a lifetime (1×10^{-4} – 1×10^{-6}) [7].

Health Effects Evaluation

Accidental ingestion of sediment during recreation within the Calcasieu Estuary would pose no apparent health risk. Exposure doses estimated for the COCs identified in the estuary sediments are lower than the established health guideline values for these contaminants and are therefore unlikely to cause adverse health effects. Sediment lead concentrations that exceeded EPA's screening level were highly localized and not representative of overall lead levels measured throughout these areas of the estuary. The average lead concentrations for these areas fall below the screening level and present no risk to human health.

Cancer Health Effects Evaluation

The Calcasieu Estuary sediment COCs evaluated for cancer health effects were the dioxins, alpha-BHC, beta-BHC, gamma-BHC (lindane), Aroclor 1254, Aroclor 1260, hexachlorobutadiene, and hexachlorobenzene. The calculation of lifetime cancer risks for exposure to these contaminants is discussed in Appendix B. The estimated lifetime cancer risks

for recreational exposure to sediments in all sampled areas of the estuary do not exceed EPA's upper limit of acceptable cancer risk levels of 1 excess cancer per 10,000 people exposed for a lifetime (1.00×10^{-4}).

Child Health Considerations

In communities faced with air, water, or food contamination, the many physical differences between children and adults demand special emphasis. Children could be at greater risk than are adults from certain kinds of exposure to hazardous substances. Children play outdoors and sometimes engage in hand-to-mouth behaviors that increase their exposure potential. Children are shorter than are adults; this means they breathe dust, soil, and vapors close to the ground. A child's lower body weight and higher intake rate result 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 is unlikely that children younger than 6 years would be exposed to the sediments under consideration in this health consultation. SEET evaluated the potential public health hazard to children ages 6–17 years who might play within the Calcasieu Estuary water bodies under study. SEET found no public health hazard to children under these conditions.

Conclusions

Evaluation of the sediment sampled by EPA during its remedial investigation suggests that there is no apparent public health hazard from recreational exposures to sediments from the Calcasieu Estuary.

Recommendations

There are no recommendations to be made at this time regarding Calcasieu Estuary sediments. LDHH/OPH/SEET will examine future Calcasieu Estuary data as needed.

Public Health Action Plan

The information produced within this health consultation should be disseminated to the community members and stakeholders within Calcasieu Parish, Louisiana.

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1. US Environmental Protection Agency. Calcasieu Estuary remedial investigation: Lake Charles, Louisiana. Draft remedial investigation report. Prepared by CDM; Cambridge, Massachusetts. EPA contract No. 68-W5-0022, work assignment No. 941-RICO-06ZZ. 2002 Nov.
2. US Census Bureau. Calcasieu Parish, Louisiana QuickFacts. Generated by Rosalind M. Green, using state and county QuickFacts search engine. Accessed 3 May 2004 at URL: <http://quickfacts.census.gov/qfd/states/22/22019.html>.
3. Louisiana Department of Environmental Quality (LDEQ). Fish consumption and swimming advisories: Human health protection through fish consumption and swimming advisories in Louisiana (10 June 2003 update). Accessed 3 May 2004 at URL: <http://www.deq.state.la.us/surveillance/mercury/fishadvi.htm>.
4. Agency for Toxic Substances and Disease Registry. Health consultation for Calcasieu Parish (Calcasieu Estuary). Atlanta: US Department of Health and Human Services; 1998 Oct 16.
5. Agency for Toxic Substances and Disease Registry. Toxicological profile for chlorinated dibenzo-p-dioxins (update). Atlanta: US Department of Health and Human Services; 1998 Dec.
6. Agency for Toxic Substances and Disease Registry. Toxicological profile for polycyclic aromatic hydrocarbons. Atlanta: US Department of Health and Human Services; 1995 Aug.
7. US Environmental Protection Agency. Guidelines for carcinogen risk assessment. EPA/630/P-03/001A. Washington, DC: US Environmental Protection Agency; 2003 Feb.

Certification

This Sediment Sample Evaluation, Calcasieu Estuary, 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.

Alan Yarbrough

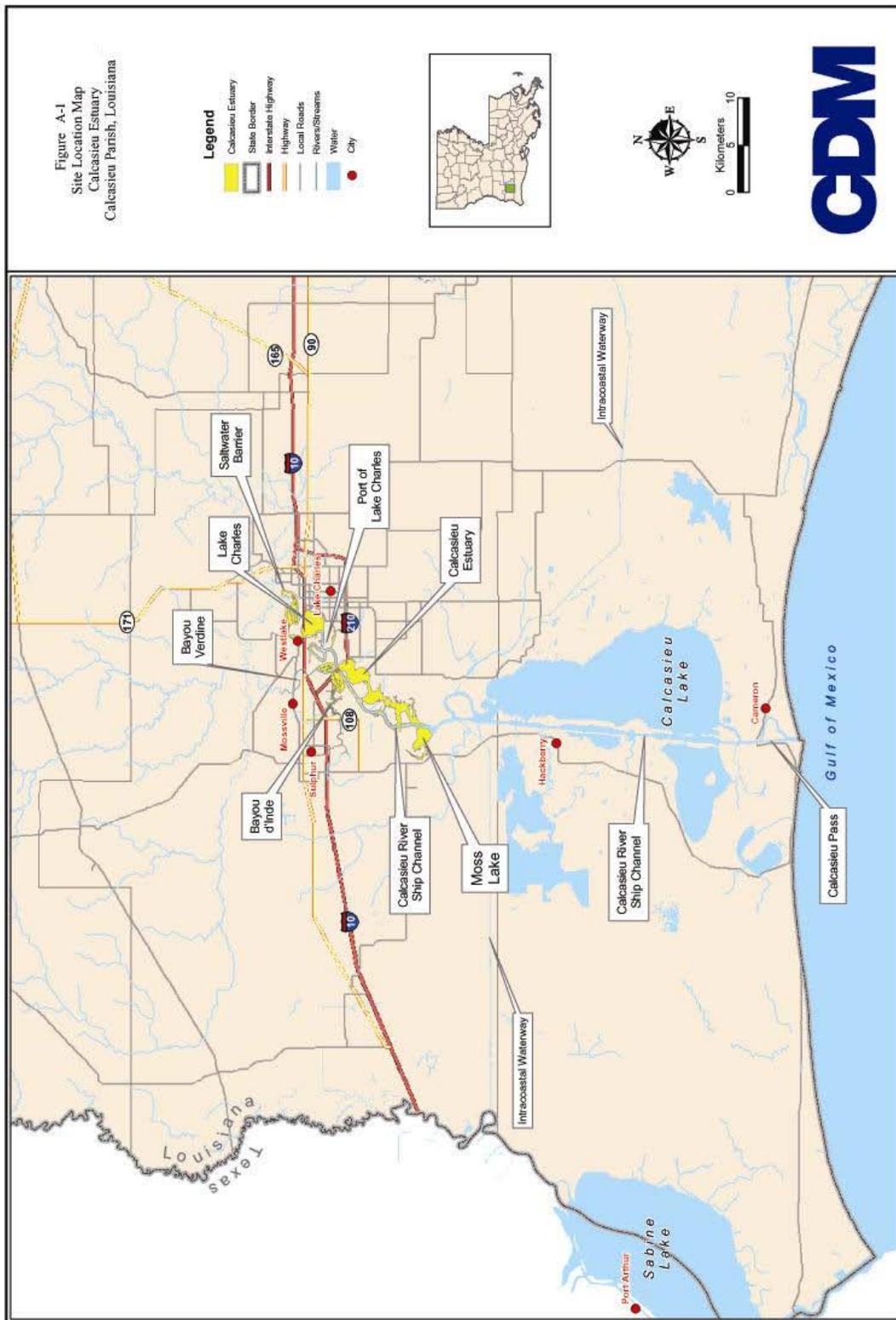
Technical Project Officer, Division of Health Assessment and Consultation

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

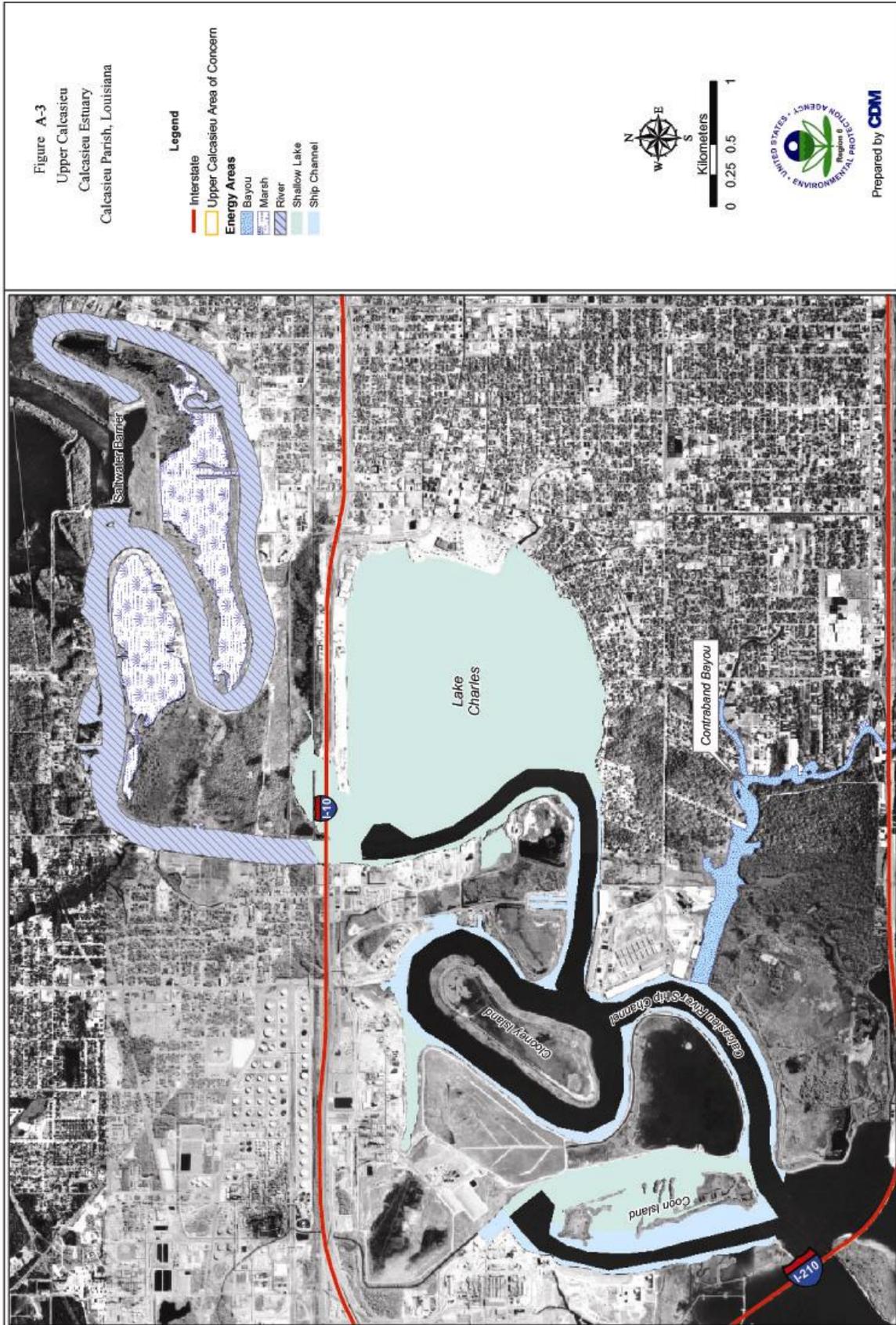
Roberta Erlwein

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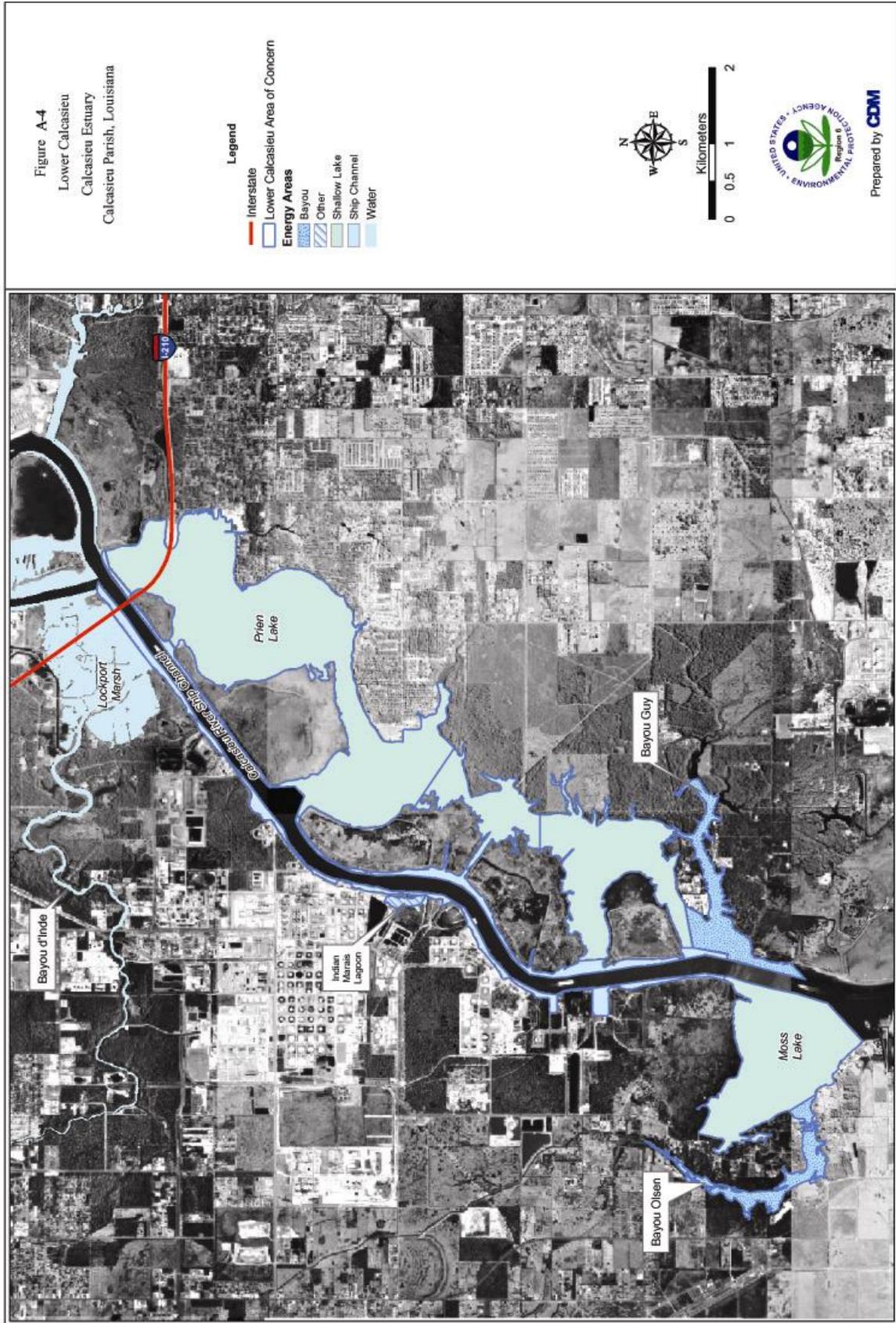
Appendix A: Maps of the Calcasieu Estuary Sampling Area



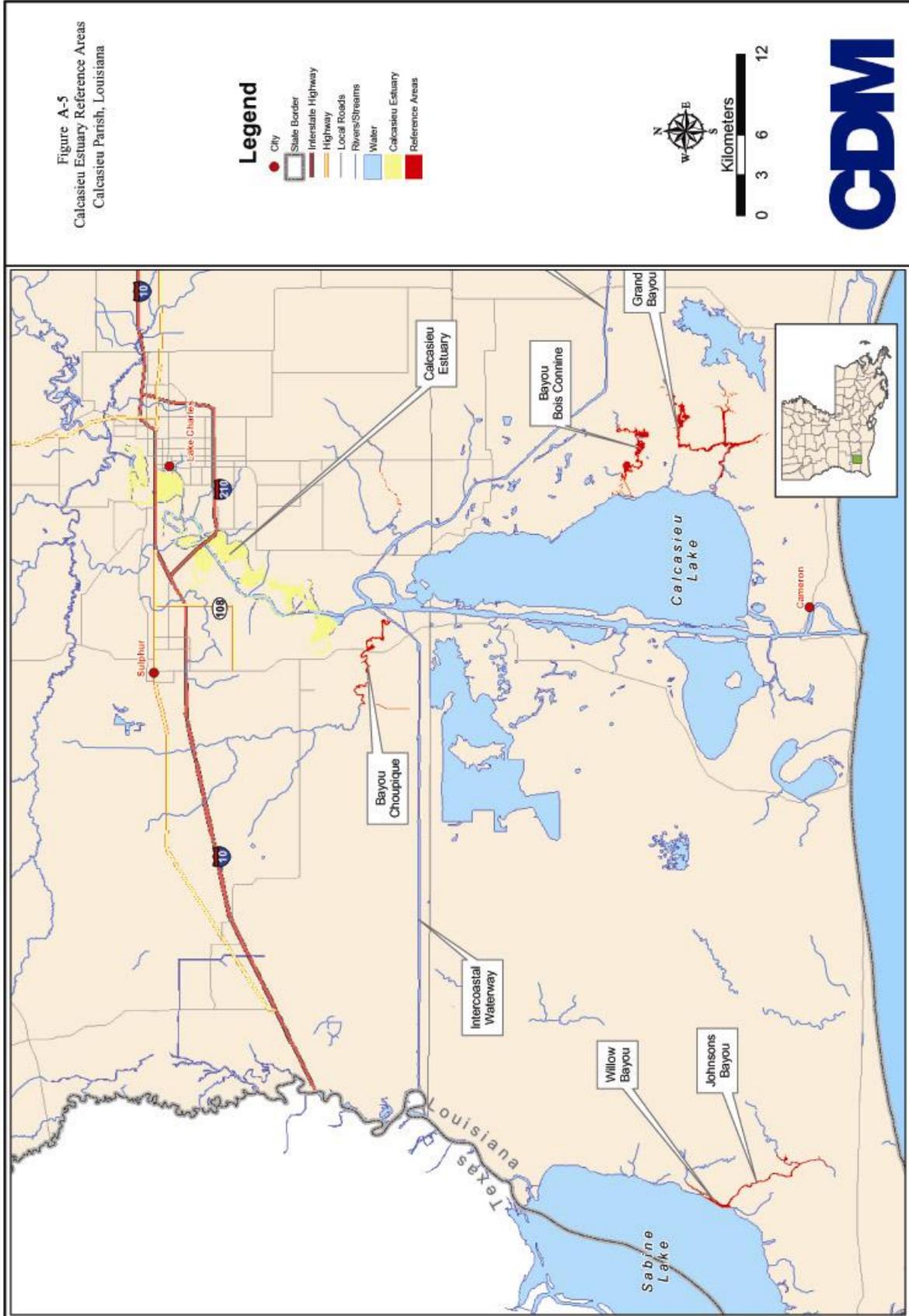
Site Location Map, Calcasieu Estuary Remedial Investigation, Calcasieu Parish, Louisiana. Figure 1-1. In: US Environmental Protection Agency. Calcasieu Estuary Remedial Investigation: Lake Charles, Louisiana. Draft Remedial Investigation Report. Prepared by CDM, Cambridge, Massachusetts. EPA Contract No. 68-W5-0022, Work Assignment No. 941-RICO-06ZZ. November 2002.



Upper Calcasieu Energy Areas and Reaches, Calcasieu Estuary Remedial Investigation, Calcasieu Parish, Louisiana. Figure 9-1. In: US Environmental Protection Agency. Calcasieu Estuary Remedial Investigation: Lake Charles, Louisiana. Draft Remedial Investigation Report. Prepared by CDM, Cambridge, Massachusetts. EPA Contract No. 68-W5-0022, Work Assignment No. 941-RICO-06ZZ. November 2002.



AOC and Energy Areas, Lower Calcasieu AOC, Calcasieu Estuary Remedial Investigation, Calcasieu Parish, Louisiana. Figure 10-1. In: US Environmental Protection Agency. Calcasieu Estuary Remedial Investigation: Lake Charles, Louisiana. Draft Remedial Investigation Report. Prepared by CDM, Cambridge, Massachusetts. EPA Contract No. 68-W5-0022, Work Assignment No. 941-RICO-06ZZ. November 2002.



Calcasieu Estuary RI Reference Areas, Calcasieu Estuary Remedial Investigation, Calcasieu Parish, Louisiana. Figure 2-7. In: US Environmental Protection Agency. Calcasieu Estuary Remedial Investigation: Lake Charles, Louisiana. Draft Remedial Investigation Report. Prepared by CDM, Cambridge, Massachusetts. EPA Contract No. 68-W5-0022, Work Assignment No. 941-RICO-06ZZ. November 2002.

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 Calcasieu Estuary sediment samples are listed below:

Environmental media evaluation guides (EMEGs) are estimated contaminant concentrations at which noncarcinogenic health effects are unlikely. They are calculated from the Agency for Toxic Substances and Disease Registry's (ATSDR) minimal risk levels (MRLs).

Reference dose media evaluation guides (RMEGs) are estimated contaminant concentrations at which noncarcinogenic health effects are unlikely. They are calculated from the U.S. Environmental Protection Agency's (EPA) reference dose (RfD).

Cancer risk evaluation guides (CREGs) are estimated contaminant concentrations that would be expected to cause no more than one additional excess cancer in 1 million exposed persons over a lifetime. CREGs are calculated from EPA's cancer slope factors (CSFs).

Risk-based concentrations (RBCs) are estimated contaminant concentrations in a media at which noncarcinogenic or carcinogenic health effects are unlikely. The RBCs used in this health consultation were last updated in April 2004.*

Sediment protective concentration levels (sediment PCLs) are health-based comparison values developed by the Texas Natural Resource Conservation Commission.†

* Agency for Toxic Substances and Disease Registry. Health assessment for former Nansemond Ordnance Depot; Suffolk, Virginia. Atlanta: US Department of Health and Human Services; 2004 Feb 19.

† Texas Natural Resource Conservation Commission. Protective concentration level tables. Texas Risk Reduction Program. Austin: Texas Commission on Environmental Quality; 2004 Mar. Accessed at URL: <http://www.tnrcc.state.tx.us/permitting/remed/techsupp/pcls0404.xls.exe>.

Table B-1: Equation variables for sediment ingestion dose, Calcasieu Estuary, Louisiana, 1999.

Variable	Value used
CS = Concentration in sediment	Chemical-specific (mg/kg)
IR _c = Ingestion rate child (1–6 years)	200 mg/day †
IR _a = Ingestion rate adult	100 mg/day †
CF = Conversion factor	1.00E-6 kg/mg †
FI = Fraction ingested from contaminated source	1 (unitless)
EF = Exposure frequency	Recreational: 5 hours/day (estimated) 184 days/year §
ED = Exposure duration	4 years (1–6 years) 7 years (6–8 years) 10 years (9–11 years) 13 years (12–14 years) 16 years (15–17 years) 44 years (18–70 years)
BW = Body weight **	
child 1–6 years	18.2 kg
child 6–8 years	26.0 kg
child 9–11 years	37.9 kg
child 12–14 years	52.3 kg
child 15–17 years	62.8 kg
adult (>18 years)	70.0 kg
AT = Averaging time	Recreational: 24 hours/day x 365 days/year x ED †

† US Environmental Protection Agency. Risk assessment guidance for Superfund. Volume I: Human health evaluation manual (Part A). Interim final. Washington, DC: US Environmental Protection Agency; 1989. EPA/540/1-89/002.

§ Louisiana Department of Environmental Quality (LDEQ). 1999. Human health protection through fish consumption and swimming advisories in Louisiana. Baton Rouge: Louisiana Department of Environmental Quality; 1999 Feb.

** US Environmental Protection Agency. Exposure factors handbook. Washington, DC: US Environmental Protection Agency; 1997. EPA/600/P-95/002.

‡‡ Agency for Toxic Substances and Disease Registry. Health consultation for Calcasieu Parish (Calcasieu Estuary). Atlanta: US Department of Health and Human Services; 1998 Oct 16.

Noncancer Health Effects

Exposure doses were estimated for incidental consumption of sediments under recreational exposure conditions. Doses for the majority of contaminants were calculated using the arithmetic mean of the contaminant concentrations measured in each sampling area. Dioxins were evaluated as mixtures of compounds with similar mechanisms of toxicity. A toxicity equivalency factor (TEF) was used to weight each dioxin's relative toxicity compared to 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD), one of the most toxic and most studied of the dioxins. Multiplying the actual concentration of each dioxin by its TEF produced a toxicity equivalence quotient (TEQ). The sum of dioxin TEQs within each sampling area was used to evaluate the health effects of the dioxin mixtures present^{††§§}.

In the same manner, polycyclic aromatic hydrocarbon (PAH) TEQs for each sampling area were calculated using TEFs which weighted each PAH by its relative toxicity compared to benzo(a)pyrene^{***}.

The following equation was used to calculate the exposure doses:

$$\text{Sediment Ingestion Exposure Dose (mg/kg/day)} = \frac{\text{CS} \times \text{IR} \times \text{CF} \times \text{FI} \times \text{EF} \times \text{ED}}{\text{BW} \times \text{AT}}$$

Table B-1 lists the variables of the exposure dose formula and their corresponding values. The calculated exposure doses were then compared to the appropriate health guideline values. Health guideline values are doses below which adverse health effects are unlikely. These values are based on valid toxicological studies with appropriate safety factors built in to account for uncertainty such as that caused by differences in human sensitivities and animal to human differences. The health guideline values used in the evaluation of Calcasieu Estuary sediment samples are listed below.

A *reference dose* (RfD) is an estimated daily lifetime exposure to a hazardous substance that is not likely to cause adverse noncancer health effects to human populations. RfDs are developed by EPA and may be found at <http://www.epa.gov/iris>.

^{§§} Agency for Toxic Substances and Disease Registry. Toxicological profile for chlorinated dibenzo-*p*-dioxins (update). Atlanta: US Department of Health and Human Services; 1998 Dec.

^{***} Agency for Toxic Substances and Disease Registry. Toxicological profile for polycyclic aromatic hydrocarbons. Atlanta: US Department of Health and Human Services; 1995 Aug.

A *minimum risk level* (MRL) is an estimated daily human exposure to a hazardous substance that is not likely to cause adverse noncancer health effects over a specified duration of exposure. Developed by the ATSDR, MRLs are not intended to be used as predictors of adverse health effects. MRLs may be found at <http://www.atsdr.cdc.gov/mrls.html>.

Concentrations of lead, for which no health guideline is available, were evaluated in comparison with the EPA screening level for lead. This value of 400 milligrams per kilogram (mg/kg) represents a conservative estimate for a residential soil lead level that would be protective of public health based on soil ingestion by children^{†††}.

Calculation of Carcinogenic Risk

Because of the uncertainties involved in estimating carcinogenic risk, ATSDR employs a weight-of-evidence approach in evaluating all relevant carcinogenic data, describing carcinogenic risk in words as well as in numeric terms.^{†††} The estimated risk of developing cancer resulting from exposure to the contaminants within the sediment was calculated by multiplying the exposure dose over a 70-year (lifetime) period by EPA's *cancer slope factor* (CSF; available at <http://www.epa.gov/iris>). The results estimate the worst-case maximum increase in the risk of developing cancer after exposure to the contaminant. This estimation is accurate within one order of magnitude; a calculated cancer risk of 2 excess cancers per 10,000 people might actually be 2 excess cancers per 1,000 people or 2 excess cancers per 100,000 people.

^{†††} Agency for Toxic Substances and Disease Registry. Case studies in environmental medicine: lead toxicity. Atlanta: US Department of Health and Human Services; 2000 ATSDR Publication No.: ATSDR-HE-CS-2001-0001.

^{††††} Agency for Toxic Substances and Disease Registry. Cancer policy framework. Atlanta: US Department of Health and Human Services; 1993.

Appendix C: Sediment Contaminants of Concern (COCs) in the Calcasieu Estuary Sampling Area

Table C-1: Sediment Contaminants of Concern in Bayou d'Inde

COC	Concentration Range (mg/kg)		Sediment CV (mg/kg)	CV reference
	Low	High		
Metals				
Barium	45.3	23,200	400	child RMEG*
Iron	ND [†]	28,300	23,000	child RMEG
Lead	ND	902	400	EPA [‡] Screening Level
Mercury	ND	93.9	34	PCL [§]
Polycyclic Aromatic Hydrocarbons (PAH)				
PAH TEQ	8.80E-05	6.93	8.70E-02	RBC [¶]
Pesticides/Polychlorinated Biphenyls				
Aroclor-1254	ND	1.3	1.00	child EMEG ^{**}
Beta-BHC	ND	4.80E-01	3.50E-01	RBC
Semivolatile Organic Compounds				
Bis(2-ethylhexyl)phthalate	ND	80	46	RBC
Hexachlorobenzene	ND	24	3	child EMEG

*Reference media evaluation guide

[†]Contaminant not detected

[‡]Environmental Protection Agency

[§]Protective concentration level

[¶]Risk-based concentration

^{**}Environmental media evaluation guide

Table C-2: Sediment Contaminants of Concern in Lower Calcasieu

COC	Concentration Range (mg/kg)		Sediment CV (mg/kg)	CV reference
	Low	High		
Metals				
Antimony	ND*	22.2	20	child RMEG [†]
Arsenic	ND	29.6	20	child EMEG [‡]
Iron	453	28,000	23,000	RBC [§]
Lead	1.5	793	400	EPA [¶] Screening Level
Polycyclic Aromatic Hydrocarbons (PAH)				
PAH TEQ	5.40E-05	84.2	8.70E-02	RBC
Semivolatile Organic Compounds				
Bis(2-ethylhexyl)phthalate	ND	120	46	RBC

* Contaminant not detected

[†]Reference media evaluation guide[‡]Environmental media evaluation guide[§]Risk-based concentration[¶]Environmental Protection Agency**Table C-3: Sediment Contaminants of Concern in Upper Calcasieu**

COC	Concentration Range (mg/kg)		Sediment CV (mg/kg)	CV reference
	Low	High		
Metals				
Iron	ND*	25,000	23,000	child RMEG [†]
Polycyclic Aromatic Hydrocarbons (PAH)				
PAH TEQ	6.30E-5	2.72	8.70E-02	RBC [‡]

* Contaminant not detected

[†]Reference media evaluation guide[‡]Risk-based concentration