Health Consultation

ASSESSMENT OF MEDIA SAMPLED FROM THE
GENERAL CHEMICAL MONROE WORKS SITE

WEST MONROE, OUACHITA PARISH, LOUISIANA

EPA FACILITY ID: LAD001829589

SEPTEMBER 27, 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

Table of Contents

List of Acronyms

AST	aboveground storage tank
ATSDR	Agency for Toxic Substances and Disease Registry
cm^2	cubic centimeters
COC	contaminant of concern
CREG	Cancer risk evaluation guide
CV	comparison value
EMEG	Environmental media evaluation guide
EPA	Environmental Protection Agency
IRIS	Integrated Risk Information System
kg	kilograms
L/day	liters per day
LDEQ	Louisiana Department of Environmental Quality
LDHH	Louisiana Department of Health and Hospitals
LECR	lifetime excess cancer risk
MCl	maximum contaminant level
mg	milligrams
mg/day	milligrams per day
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MRL	Minimum Risk Level
MSSL	medium-specific screening level
NOAEL	no observed adverse effects level
OPH	Office of Public Health
RECAP	Louisiana Department of Environmental Quality's Risk Evaluation/Corrective Action Program
RfD	Reference Dose
RMEG	Reference dose media evaluation guide
SEET	Section of Environmental Epidemiology and Toxicology
SVOC	semi-volatile organic compound
TCLP	Toxicity Characteristic Leaching Procedure
ug/kg	micrograms per kilogram
ug/L	micrograms per liter
UST	underground storage tank
VOC	volatile organic compound

Summary and Statement of Issues

Responding to a complaint from an owner of a neighboring property, the Office of Environmental Assessment Division of the Louisiana Department of Environmental Quality (LDEQ) requested in October 2006 that the Superfund Division of the United Stated Environmental Protection Agency (U.S. EPA) conduct a removal assessment at the General Chemical Monroe Works site. The EPA On-Scene Coordinator for the site subsequently requested that the removal assessment samples be reviewed to determine if exposure to the site or to surrounding areas would pose an occupational or residential health hazard. Through a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR), the Louisiana Department of Health and Hospitals/Office of Public Health/Section of Environmental Epidemiology and Toxicology (LDHH/OPH/SEET) has developed the following health consultation to review the public health implications of exposure to any contaminants found in these samples.

Background and Site History

The General Chemical Monroe Works facility is located on a seven-acre parcel of land at 300 Central Street, West Monroe, Ouachita Parish, Louisiana. The site is bounded on the north by Black Bayou Canal, on the northwest and west by an unnamed tributary to the canal, and on the southeast by railroad tracks [1].

General Chemical acquired the property in 1940 to manufacture aluminum sulfate (alum), which is produced through the reaction of raw bauxite ore with sulphuric acid. General Chemical produced alum for use in water and wastewater treatment processes. Byproducts of the production process, which were not considered to be hazardous at the time, were discharged to two surface impoundments. Periodically accumulated mud was removed and disposed of at local landfill facilities. Rinse water from the impoundments was reused for process water. The alum plant operated continuously from 1941 until its closure in January 1993 [1].

In October 2006, workmen sampling stormwater at the Graphic Packaging International, Inc. site reported to LDEQ that an unnamed tributary to Black Bayou Canal had a strong sulfur odor. This canal forms the boundary between Graphic Packaging International, Inc. and General Chemical Monroe Works. LDEQ collected surface water and soil samples at the tributary. Analysis of the water sample showed trace amounts of volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), and a concentration of sulfates of 268 milligrams per liter (mg/L). The soil sample was found to contain 1,995.5 milligrams per kilogram (mg/kg) of aluminum and 161 mg/kg of sulfate [1].

The Office of Environmental Assessment Division of LDEQ requested that the Superfund Division of the U.S. EPA conduct a removal assessment at the site. The EPA collected a soil and solid waste sample from the bank of the unnamed tributary; aqueous and sediment samples from the unnamed tributary, Black Bayou Canal, and a process water recycling pit; and a background soil sample and liquid waste samples from an aboveground storage tank (AST) and an underground storage tank (UST) [1].

Subsequent to receiving the removal assessment data, the EPA On-Scene Coordinator for General Chemical Works, requested that the samples be reviewed to determine if exposure to contaminants from the site or its surrounding areas would pose an occupational or residential health hazard. The request was referred to LA DHH/OPH/SEET on June 5, 2007 and SEET completed the review on June 15, 2007.

Demographics

Approximately 11 residential homes are located within a ¼ mile radius of the General Chemical Monroe Works site, and a residential neighborhood is located within one mile north of the site [1]. At the time of the U.S. Census Bureau's Census 2000, the city of West Monroe's total population was 13,250. The largest ethnic group in the city was Caucasian (74.4%), followed by African-American (23.5%), American Indian or Alaskan Native (0.3%), and Asian (0.3%). One point five percent (1.5%) of the population identified themselves as Hispanic or Latino. Thirty-three point one percent (33.1%) of the population age 25 years or older in 2000 had earned at least a high school diploma. The median household income was $27,522.The primary occupation was in the fields of management, professional and related occupations (32.3%), followed by sales and office occupations (31.6%).

Discussion

Data Used

Judgmental sampling was used to determine where sampling would take place at the General Chemical Monroe Works site. In judgmental sampling, the number and location of samples collected is based on knowledge of the condition under investigation and on professional judgment. Grab sampling was implemented for all samples except those collected from the settling impoundments and from the solid waste material deposit area. These areas were sampled using composite sampling protocols [1]. Table A-1 in Appendix A lists the locations from which samples were collected. These locations are mapped in Figures A-1 and A-2. Contaminant concentrations detected in samples collected at the site are listed in Tables A-2 through A-4.

Surface water samples were collected from the Black Bayou Canal downstream and upstream, the site process water recycling system, and from portions of an unnamed tributary both onsite and upstream of the site. The sample collected from upstream in the unnamed tributary served as a background sample.

Sediment samples were collected from the Black Bayou Canal downstream, an onsite portion of the unnamed tributary, and the site process recycling system. Soil samples were collected at a leachate seep, from the bottom of two settling impoundments, and near an electrical substation. Aqueous waste samples were also collected from an onsite aboveground storage tank and an underground storage tank.

Exposure Pathways

Exposure to contaminants at the General Chemical Monroe Works site would most likely occur as occupational exposures. Much of the site is fenced in and is not accessible to the general

public. The unnamed tributary presents a potential source of non-occupational exposure for anyone involved in recreational activities in this area. However, the unnamed tributary is a small creek that does not have a reputation of being used for recreational activities. The tributary flows into Black Bayou Canal. Black Bayou Canal eventually outfalls into the Ouachita River, which is known as a site for recreational activity.

The probability of anyone obtaining drinking water from the unnamed tributary is very low. The city of West Monroe obtains its drinking water from local wells. There are no reported municipal wells within a one-mile radius of the site. West Monroe does not obtain drinking water from the Black Bayou Canal or the Ouachita River. The city of Monroe does obtain some of its drinking water from the Ouachita River; however, the city's water intakes are located upgradient of the General Chemical Monroe Works site and should therefore not be affected by the site [1].

Exposure via routine ingestion of water, sediment, or soil from the General Chemical Monroe Works site is not considered to be likely and was not considered in this assessment.

Evaluation Process

Appendix B describes the evaluation process used to determine whether contaminants detected at the General Chemical Monroe Works site posed any hazard to public health. Contaminant concentrations found within each water, sediment, or soil sample collected at the site were initially compared to health-based comparison values (CVs). These conservative screening values are only used to determine which environmental contaminants need further evaluation. CVs are not used to predict adverse human heath effects.

Contaminant concentrations that exceeded health-based CVs are listed in Tables B-1 through B-3. These contaminants of concern (COCs) were further evaluated by comparing estimated exposure doses to the appropriate health guidelines for each contaminant. The values used in estimating exposure doses are listed in Table B-4. Estimated exposure doses that exceeded health values are listed in Tables B-5 through B-8.

Samples collected from the aboveground and underground storage tanks were evaluated using Toxicity Characteristic Leaching Procedure (TCLP) regulatory limits. TCLP an analytical EPA methodology designed to simulate the mobility of contaminants present in solid and liquid wastes. Contaminants present in concentrations lower than the TCLP regulatory limits are classified as "nonhazardous".

Health Effects Evaluation

Surface Water: Ingestion

COCs sampled from surface water collected from the unnamed tributary, excluding arsenic and lead, were detected at levels below those found to pose adverse health effects. Lead was present in a concentration that exceeded the action level for drinking water. The action level is the maximum permissible level of 15 µg/L (15 micrograms of lead per liter of water) for a public water system. Because the tributary does not contribute to a public water system, the concentration of lead detected should pose no public health hazard.

Arsenic detected in the unnamed tributary background surface water sample would pose a public health risk if the tributary contributed to the public drinking water supply. For adults, arsenic levels detected at this sampling station were below those found to cause noncancer health effects such as keratosis (hardening of the skin), hyperpigmentation (darkening of the skin), or vascular problems [2]. However, chronic ingestion of water from this source could pose an increased cancer risk of 7.5E-04, or 75 excess tumors in a population of 100,000 people. Because the tributary is not believed to contribute to a public water system, the concentration of arsenic detected should pose no public health hazard. Contamination detected in this portion of the tributary cannot be attributed to the General Chemical Monroe Works site because the sample was taken from a portion of the tributary that is not impacted by the site.

Surface water sampled from upstream and downstream in the Black Bayou Canal did not contain COC concentrations that could pose public health hazards. COC concentrations were also below levels that could pose public health hazards in surface water samples taken onsite from the unnamed tributary.

Surface Water: Dermal

According to studies examining the absorption of inorganic lead through skin surfaces, dermal absorption of inorganic lead is substantially lower than oral absorption of inorganic lead. Therefore, the concentration of lead detected in the offsite portion of the unnamed tributary is not considered to pose a potential public health hazard [3].

Chronic dermal exposures to chromium-containing compounds can cause contact allergic dermatitis on the skin of sensitive individuals [4]. Dermal exposures estimated for the concentrations of chromium detected in water sampled from the site process water recycling system exceeded the health values established for chromium. However, the concentrations of chromium detected in samples from this system are lower than the no observed adverse effects level (NOAEL) of 2.5 mg/kg/day, the highest exposure found to cause no adverse health effects [5]. Individuals working around this system also would not undergo unprotected full-body exposure to this water every day. Occupational exposures to water from this system should pose no apparent public health hazard.

Sediment

Concentrations of COCs detected in sediments from the General Chemical Monroe Works site should pose no public health hazard under normal exposure conditions. Sediments containing high concentrations of Aroclor 1268 were sampled from the site process recycling system. Health values are not available for Aroclor 1268, but experimental evidence had shown that Aroclor 1268 has a much lower relative toxicity than the other PCB congener mixtures sampled from the site, including Aroclor 1254 [6,7]. Occupational exposures to sediments from the site process recycling system would also be very limited and should pose no apparent public health hazard.

Soil

Lead was detected in a concentration of concern in the soil sampled from the bank of the unnamed tributary near the leachate seep (Sample GC-SSW-01). This concentration exceeded screening guidelines set for bare soil by the Louisiana Department of Environmental Quality's Risk Evaluation/Corrective Action Program (RECAP) (400 ppm) and the EPA (400 ppm for play area). No standard health values exist for ingestion or dermal exposure to lead in soil. However, this sampling location, which is actually located on the opposite bank of the unnamed tributary from the position shown in Figure A-2, is not accessible to the public. Any occupational exposures at this location would be short term and intermittent, and therefore would not present a health hazard. Lead was detected in surface water sampled downstream from this tributary bank but was not present at concentrations of public health concern. Because of the low likelihood of routine exposure to this soil, the soil currently does not pose a potential human health risk.

Aqueous Wastes

None of the contaminants detected in the aboveground or underground storage tanks were present in levels that exceeded the TCLP regulatory limits. These contaminants do not currently pose a potential human health risk.

Cancer Health Effects Evaluation

The evaluation of the COCs for potential cancer-related health effects is detailed in Appendix B. Exposure to the COC concentrations detected at the General Chemical Monroe Works site will not result in an increased risk of developing cancer.

Child Health Considerations

The physical differences between children and adults demand special emphasis in assessing public health hazards. Children may be at greater risk than are adults from exposures to hazardous substances. Children play outdoors and engage in hand-to-mouth behaviors that increase their exposure potential. Children are shorter than are adults and 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.

Children would not be regularly exposed to the contaminated media within the General Chemical Monroe Works site. Therefore, exposures onsite, such as the site process water recycling system, were not under consideration for children. Offsite child exposures would only occur if water from the unnamed tributary is used as a domestic water source or if the tributary is regularly used for recreational purposes. As there is no evidence that the unnamed tributary is used for either purpose, SEET found no public health hazard for children at the General Chemical Monroe Works site.

Conclusions

Based on the limited data available, SEET found no apparent public health hazard onsite at General Chemical Monroe Works. Contaminants of concern were found in surface water that is not used as a domestic or recreational water source on a daily basis. Surface water and sediment from an on-site process recycling pit also contained contaminants that could pose a health hazard with daily exposures, but individuals working around this pit would not regularly be immersed in it without protective clothing or ingesting water or sediment from the pit. These conclusions are based only on the current land use and will not apply if land use changes in the future.

Recommendations

On June 15, 2007, SEET informed EPA of our findings and recommended that further sampling be performed. A number of of potential exposure pathways, such as groundwater underneath the site, were not sampled during the removal assessment. SEET recommends sampling of these pathways to develop a more complete picture of the potential impact of site COCs on workers and on the community. SEET also recommends further monitoring to ensure that the water from the tributary does not carry site contaminants to public water supply sources. If land use at the site changes in the future, the COCs will need to be re-evaluated using estimated exposures that are appropriate for the new land usage.

Public Health Action Plan

The information produced within this health consultation should be made available to the community members and stakeholders within Ouachita Parish, Louisiana.

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Certification

This Assessment of Media Sampled from the General Chemical Monroe Works Site public 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. The editorial review was conducted by the Cooperative Agreement Partner.

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

for Greg Ulrich for Alan Yarbrough
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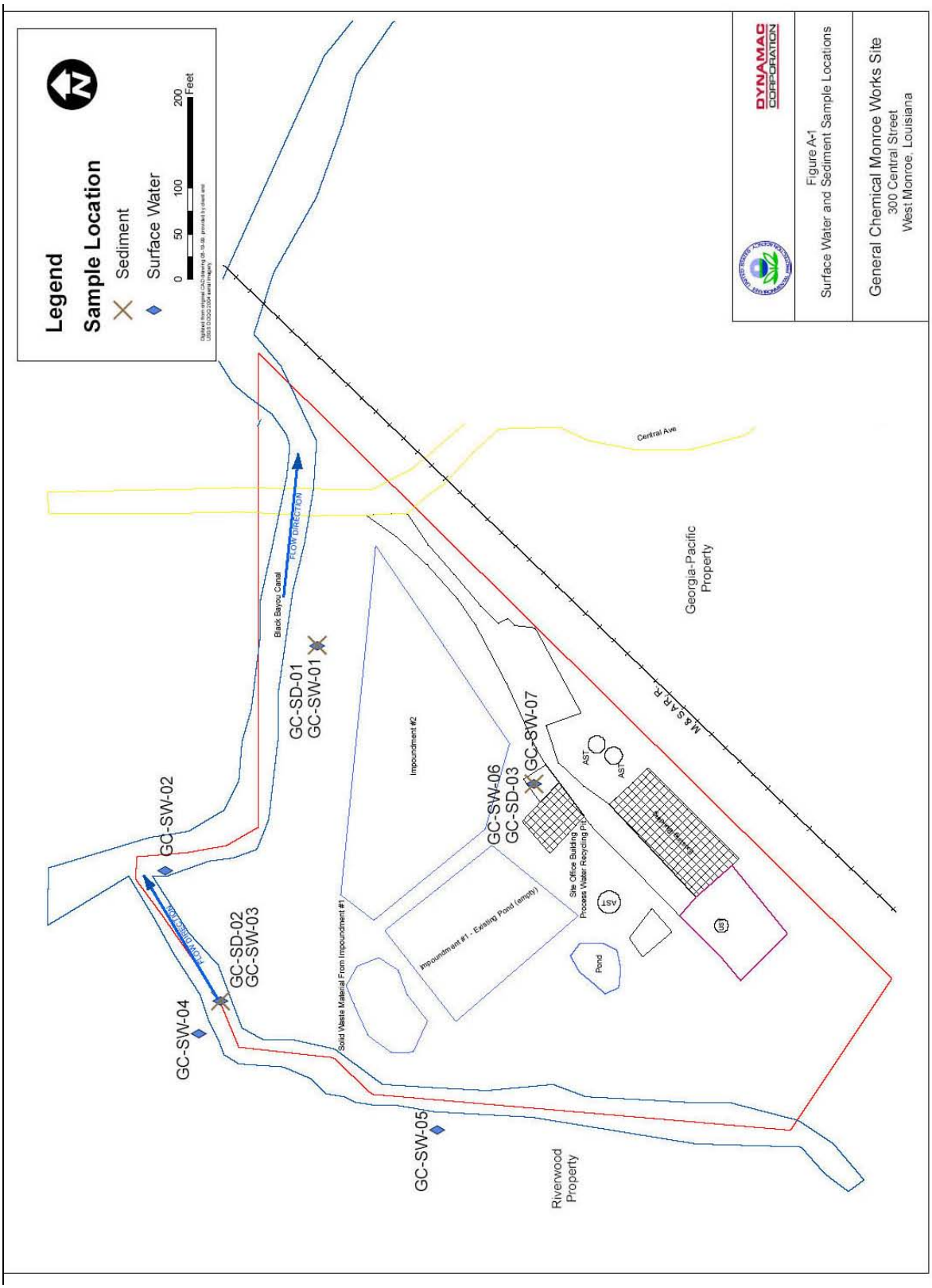
APPENDIX A: The General Chemical Monroe Works sampling stations

Table A-1: Sampling locations at the General Chemical Monroe Works site

Medium	Sample ID	Sample Location
Surface water	GS-SW-01	Black Bayou Canal, downstream
	GS-SW-02	Black Bayou Canal, upstream
	GS-SW-03	Unnamed tributary - onsite, near a metal staircase
	GS-SW-04	Unnamed tributary - onsite, northwest of Settling Impoundment 1
	GS-SW-05	Unnamed tributary - offsite, background sample
	GS-SW-06	Site process water recycling system
	GS-SW-07	Duplicate of GS-SW-06
Sediment	GC-SD-01	Black Bayou Canal, downstream
	GC-SD-02	Unnamed tributary - onsite, near a metal staircase
	GC-SD-03	Site process recycling system
Soil	GC-SSW-01	At the leachate seep
	GC-SSW-02	Bottom of Settling Impoundment 1
	GC-SSW-03	Stockpiled waste material from Settling Impoundment 1
	GC-SSW-04	Duplicate of GC-SSW-02
	GC-SS-BKG	Easement of an onsite electrical substation
	GC-SB-01-0-2	0-2 feet below ground surface, Settling Impoundment 2
	GC-SB-01-2-5	2-5 feet below ground surface, Settling Impoundment 2
	GC-SB-01-5-8	5-8 feet below ground surface, Settling Impoundment 2
Aqueous waste	GC-AST-02	Aboveground storage tank 2
	GC-UST-01	Underground storage tank 1



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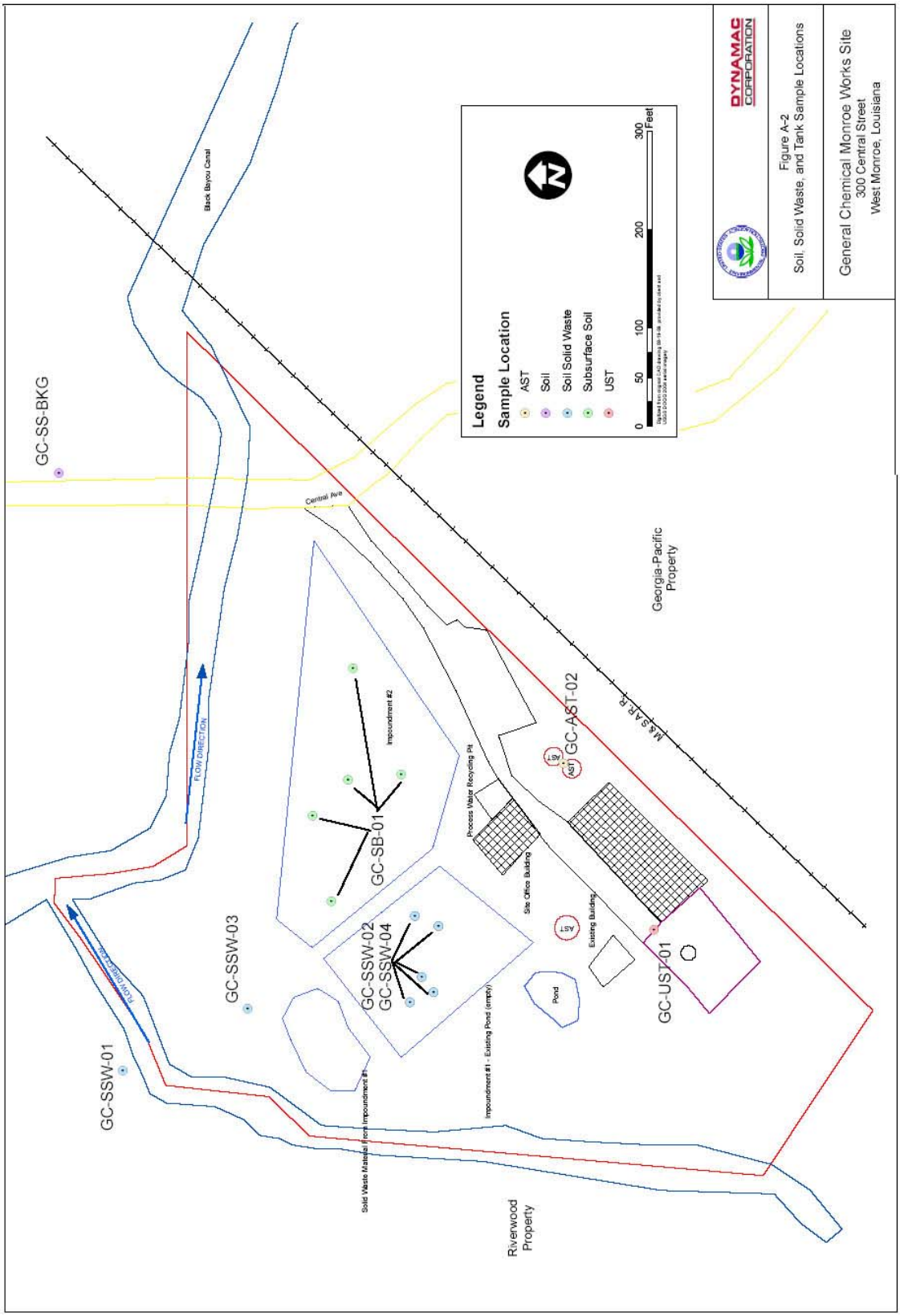

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Table A-2: Surface water contaminant concentrations from General Chemical Monroe Works

Contaminant (ug/L*)	SW-01	SW-02	SW-03	SW-04	SW-05	SW-06	SW-07
VOCs†							
Acetone	3.9 J‡	5.5	40.5	3.3 J	5	4.6 J	5 U§
Toluene	2 U	2 U	2.9	.99 J	2 U	2 U	2 U
Metals:							
Aluminum	5660	6850	177	270	23300	55 U	55 U
Antimony	5 U	5 U	5 U	5 U	72.3	5 U	5 U
Arsenic	5 U	5 U	5 U	5 U	18.2	51.6	37.8
Barium	48.2	65	112	92	30.2	5 U	5 U
Beryllium	1 U	1 U	1 U	1 U	1 U	24.2	22.6
Cadmium	1 U	1 U	1 U	1 U	76.6	1 U	1 U
Calcium	8680	12300	48700	37300	401000	1 U	1 U
Chromium	5 U	6	5 U	5 U	86.1	43100	39900
Cobalt	5 U	5 U	5 U	5 U	105	5 U	5 U
Copper	7.8	8.2	9	17.2	667	25 U	25 U
Iron	3790	4760	731	421	56900	135	100 U
Lead	3.1	4.4	12.3	20.5	5.2	3 U	3 U
Magnesium	2180	3400	8130	1780	4540	796	737
Manganese	91.9	177	181	30.9	32.7	33.4	25.8
Mercury (mg/L**)	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
Nickel	10 U	10 U	10 U	10 U	1450	10 U	10 U
Potassium	1460	1900	564	978	1500000	5 U	5 U
Selenium	5 U	5 U	5 U	5 U	192	1570	1410
Silver	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Sodium	28400	29800	90000	19100	19500000	2520	2340
Thallium	2 U	2 U	2 U	2 U	2 U	5 U	5 U
Vanadium	10 U	10 U	10 U	10 U	18.6	2 U	2 U
Zinc	41.5	44.8	57.6	94.9	282	10 U	10 U
Cyanide:							
Cyanide	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Sulfates:							
Sulfate as SO4 (mg/L)	29	33	84	44	33	92	99

* ug/L=micrograms per liter

†VOCs = volatile organic compounds

‡A designation of J denotes a sample in which this contaminant concentration was detected above the method detection limit but below the laboratory reporting limit. These concentrations are considered estimates.

§A designation of U denotes a sample in which this contaminant was not detected. The concentration listed is the lowest detection limit possible for the analytical method used.

** mg/L=milligrams per liter

Table A-3: Sediment contaminant concentrations from General Chemical Monroe Works

Contaminant	SD-01	SD-02	SD-03
Metals (mg/kg) [*]:			
Aluminum	17700	11200	114000
Antimony	1.5 U[†]	1.1 U	1.8 U
Arsenic	4.3	2.7	2.6
Barium	141	142	797
Beryllium	0.73 U	0.57 U	0.91 U
Cadmium	0.73 U	0.57 U	3.7
Calcium	730 U	1490	6120
Chromium	29.8	35.7	145
Cobalt	7.3 U	5.7 U	9.1 U
Copper	21	18.3	12.1
Iron	11400	8410	4170
Lead	43.8	115	107
Magnesium	2120	1010	910 U
Manganese	60	57.2	20.6
Mercury	0.025 U	0.021 U	0.39
Nickel	9.2	6.1	7.3 U
Potassium	1410	570	910 U
Selenium	1.5 U	1.1 U	1.8 U
Silver	1.5 U	1.1 U	1.8 U
Sodium	730 U	570 U	910 U
Thallium	2.9 U	2.3 U	3.7 U
Vanadium	24.4	19.2	69.5
Zinc	55.5	99.2	58.8
Cyanides:			
Cyanide	0.4 U	0.3 U	0.5 U
Sulfates:			
Sulfate as SO4	31	26	8380
VOCs[‡] (ug/kg) [§]:			
Acetone	88.0 U	49.0 U	78.0 U
Ethylbenzene	8.8 U	4.9 U	5.6 J [**]
Isopropylbenzene	8.8 U	4.9 U	3.8 J
Toluene	8.8 U	4.9 U	4.4 J
SVOCs[††](ug/kg):			
Benzo(a)anthracene	260.0 U	222.0 U	330.0 J
Benzo(b)fluoranthene	260.0 U	220.0 U	589
Benzo(k)fluoranthene	260.0 UJ	220.0 UJ	228.0 J
Chrysene	260.0 U	220.0 U	689
Dimethyl Phthalate	260.0 U	220.0 U	464
Bis(2-ethylhexyl) Phthalate	1890	220.0 U	1850
Fluoranthene	260.0 U	220.0 U	629
Phenanthrene	260.0 U	220.0 U	643

Contaminant	SD-01	SD-02	SD-03
Pyrene	260.0 U	220.0 U	2670
PCBs‡‡(ug/kg):			
Aroclor 1254	26.0 U	45	3080.0 J
Aroclor 1260	26	12.9 J	6850.0 J
Aroclor 1268	26.0 U	22.0 U	3350.0 J

* mg/kg=milligrams per kilogram

† A designation of U denotes a sample in which this contaminant was not detected. The concentration listed is the lowest detection limit possible for the analytical method used.

‡ VOCs=volatile organic compounds

§ ug/kg=micrograms per kilogram

** A designation of J denotes a sample in which this contaminant concentration was detected above the method detection limit but below the laboratory reporting limit. These concentrations are considered estimates.

†† SVOCs=semivolatile organic compounds

‡‡PCBs=polychlorinated biphenyls

Table A-4: Soil contaminant concentrations from General Chemical Monroe Works

Contaminant (mg/kg*)	SSW-01	SSW-02	SSW-03	SSW-04	SS-BKG	SB-01-0-2	SB-01-2-5	SB-01-5-8
Metals:								
Aluminum	37900	22100	15900	19800	12900	15100	37300	27400
Antimony	6.7 U†	1.3 U	1.4 U	1.3 U	1.2 U	1.1 U	1.1 U	1.6 U
Arsenic	17.4	2.9	2.9	2.9	3.3	2.1	1.8	5.9
Barium	6600	328	224	388	124	64.4	3730	688
Beryllium	0.67 U	0.63 U	0.68 U	0.64 U	0.7	0.53 U	0.57 U	0.82 U
Cadmium	0.8	0.63 U	0.68 U	0.64 U	0.61 U	0.53 U	0.57 U	0.82 U
Calcium	7500	630 U	1450	640 U	2500	553	570	820 U
Chromium	1910	23.9	29.7	21.2	16.8	15.4	30.7	8.6
Cobalt	6.9	6.3 U	6.8 U	6.4 U	6.1 U	5.3 U	5.7 U	8.2 U
Copper	2280 J‡	7.7 J	10.3 J	6.7 J	11.5 J	5.6	11.1	7.8
Iron	38300	13800	10000	13000	10900	9990	3090	1680
Lead	10500	25.4	65	21.1	23.4	13	33.7	83.4
Magnesium	1810	1060	1360	915	2570	1270	570 U	820 U
Manganese	434	38.5	380	37.7	161	30.9	9.9	174
Mercury	0.32	0.065	0.6	0.065	.019 U	0.033	0.056	0.78
Nickel	130	7.4	6.6	6.4	9.3	5.6	4.5 U	6.6 U
Potassium	929	795	1070	736	1690	639	570 U	1080
Selenium	3.8	1.3 U	1.4 U	1.3 U	1.2 U	1.1 U	1.1 U	15.9
Silver	11.9 J	1.3 U	1.4 U	1.3 U	1.2 U	1.1 U	1.1 U	1.6 U
Sodium	3790	630 U	680 U	640 U	610 U	530	570	820 U
Thallium	2.7 U	2.5 U	2.7 U	2.5 U	2.4 U	2.1 U	2.3 U	4 U
Vanadium	34.3	39.2	35.7	39.5	22.6	24.2	62.4	18.8
Zinc	5730	30.3	49.7	26	68.4	23.9	10.8	17.2
Cyanide:								
Cyanide	0.4 U	0.3 U	0.4 U	0.3 U	0.3 U	0.3 U	0.3 U	0.5 U
Sulfates:								
Sulfate As SO4	311	93.3	29 U	76.7	24 U	32.8	318	646
VOCs (ug/kg§):								
Benzene	2.6 J	2.0 J	8.2 U	5.8 U	5.5 U	5.1 U	12.0 U	9.6 U
Toluene	9.2	6.0 J	8.2 U	5.8 U	5.5 U	5.1 U	12.0 U	9.6 U
m,p-Xylene	4.2 J	11.0 U	16.0 U	12.0 U	11.0 U	10.0 U	25.0 U	19.0 U
o-Xylene	2.1 J	5.6 U	8.2 U	5.8 U	5.5 U	5.1 U	12.0 U	9.6 U
PCBs (ug/kg):								
Aroclor 1254	102	21 U	24 U	23 U	31.5	20 U	233	30 U
Aroclor 1260	121	31	40	9.7 J	74.4	20 U	145	30 U

* mg/kg=milligrams per kilogram

† A designation of U denotes a sample in which this contaminant was not detected. The concentration listed is the lowest detection limit possible for the analytical method used.

‡ A designation of J denotes a sample in which this contaminant concentration was detected above the method detection limit but below the laboratory reporting limit. These concentrations are considered estimates.

§ ug/kg=micrograms per kilogram

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 screen environmental contaminants for further evaluation. These values are not used as predictors of adverse health effects. The comparison values used in the evaluation of samples collected from the General Chemical Monroe Works site 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 2007.

Human Health Medium-specific screening levels (MSSLs) are estimated contaminant concentrations at which noncarcinogenic or carcinogenic health effects are unlikely. MSSLs are established by EPA Region 6.

Maximum contaminant levels (MCLs) are the maximum permissible level of a contaminant in water which will ultimately be delivered to a public water system. MCLs are established by the EPA's Office of Ground Water and Drinking Water.

When no health-based comparison value was available for a contaminant, screening was based on the Louisiana Department of Environmental Quality's Risk Evaluation/Corrective Action Program (RECAP) value. *RECAP values* are concentrations at or above which remediation of a medium (soil, sediment, or water) should occur.

Tables B-1 through B-3 list the contaminants that were identified through the screening process as needing further consideration. These contaminants are identified as contaminants of concern (COCs).

Table B-1: Contaminants of Concern (COCs) detected in surface water at the General Chemical Monroe Works site

COC	Concentration Range (µg/L*) Low	High	CV † (µg/L)	Drinking Water CV reference
Aluminum	55 U‡	23,300	10,000	child EMEG§
Antimony	5 U	72.3	4	child RMEG**
Arsenic	5 U	51.6	3	child EMEG
Beryllium	1 U	24.2	20	child EMEG
Cadmium	1 U	76.6	2	child EMEG
Chromium	5 U	43,100	30	child RMEG
Cobalt	5 U	105	100	child int EMEG
Copper	7.8	667	100	child int.†† EMEG
Iron	100 U	56,900	11,000	MSSL‡‡
Lead	3.0 U	20.5	15	MCL§§ action level
Nickel	10 U	1,450	200	child RMEG
Selenium	5 U	1,570	50	child EMEG
Thallium	2 U	5 U	2	MCL

* ug/L=micrograms per liter
†CV=comparison value
‡A designation of U denotes a sample in which this contaminant was not detected. The concentration listed is the lowest detection limit possible for the analytical method used.
§EMEG=Environmental media evaluation guide
** RMEG=Reference dose media evaluation guide
††int. = intermediate
‡‡MSSL=medium-specific screening level (EPA Region 6)
§§MCL=maximum contaminant level

Table B-2: Contaminants of Concern (COCs) detected in sediment at the General Chemical Monroe Works site

COC	Concentration Range (µg/kg*) Low	High	CV† (µg/kg)	CV reference (based on ingestion)
Benzo(a)anthracene	222 U‡	330	220	RBC§
Benzo(b)fluoranthene	220 U	589	220	RBC
Aroclor 1254	26 U	3,080	2,000	child int** EMEG††
Aroclor 1260	12.9	6,850	110	RECAP‡‡
Aroclor 1268	22	3,350	110	RECAP
COC	**Concentration Range (mg/kg§§) Low**	**High**	**CV (mg/kg)**	**CV reference**
Aluminum	11,200	114,000	50,000	child EMEG
Arsenic	2.6	4.3	0.5	CREG
Thallium	2.3 U	3.7 U	0.55	RECAP

* ug/kg =micrograms per kilogram
†CV=comparison value
‡A designation of U denotes a sample in which this contaminant was not detected. The concentration listed is the lowest detection limit possible for the analytical method used.
§RBC=Risk-based concentration
** int. = intermediate
††EMEG=Environmental media evaluation guide
‡‡RECAP=Louisiana Department of Environmental Quality's Risk Evaluation/Corrective Action Program
§§mg/kg=milligrams per kilogram
§§CREG=Cancer risk evaluation guide

Table B-3: Contaminants of Concern (COCs) detected in soil at the General Chemical Monroe Works site

COC	Concentration Range (µg/kg*) Low	High	CV† (µg/kg)	CV reference (based on ingestion)
Aroclor 1260	9.7	145	110	RECAP‡
COC	**Concentration Range (mg/kg§) Low**	**High**	**CV (mg/kg)**	**CV reference (based on ingestion)**
Arsenic	1.8	17.4	0.5	CREG**
Chromium	8.6	1,910	200	child RMEG††
Copper	5.6	2,280	500	child int.‡‡ EMEG§§
Lead	13	10,500	400	RECAP
Thallium	2.1 U***	4 U	0.55	RECAP

* ug/kg =micrograms per kilogram
†CV=comparison value
‡RECAP=Louisiana Department of Environmental Quality's Risk Evaluation/Corrective Action Program
§mg/kg=milligrams per kilogram
**CREG=Cancer risk evaluation guide
††RMEG=Reference dose media evaluation guide
‡‡int. = intermediate
§§ EMEG=Environmental media evaluation guide
***A designation of U denotes a sample in which this contaminant was not detected. The concentration listed is the lowest detection limit possible for the analytical method used.

Noncancer Health Effects

Exposure doses for contaminants identified as COCs were estimated using ATSDR's dose calculation equations. Dermal and ingestion doses for recreational exposures were calculated for off-site samples.Ooccupational doses were calculated for samples collected within the site boundaries.. The default values used in calculating the exposure doses are listed in Table B-4. The equations used to estimate ingestion and dermal exposures are as follows:

Ingestion Exposure Dose Equation:

$$ED = (C)\,(IR)\,(EF)\,(CF) / (BW)$$

where C= Contaminant concentration

IR= Ingestion Rate

EF= Exposure Factor = 1

CF= Conversion Factor= 10^{-06}

BW= Body Weight

Table B-4: Default values used to estimate incidental ingestion and dermal exposure doses for contaminants of concern at the General Chemical Monroe Works site

Ingestion: Intake Rate For incidental ingestion (accidental swallowing)	**Children**	**Adults**
Surface Water	100 ml/day*	200 ml/day
Sediment	200 mg/day†	100 mg/day
Soil	200 mg/day	100 mg/day
Dermal: Skin Surface Area (100% exposed)		
for Surface Water	7110 cm^2‡	16,900 cm^2
for Sediment and Soil	8,750 cm^2	19,400 cm^2
Dermal: Recreational Exposure Time	3 hours/day§ 184 days/year	3 hours/day 184 days/year
Dermal: Occupational Exposure Time	not applicable	8 hours/day 260 days/year
Dermal: Total Soil/Sediment Adherence	1750 mg	1358 mg
Weight:		
for Ingestion Exposures	30kg**	70 kg
for Dermal Exposures	30 kg	70 kg

* ml/day = liters per day
† mg/day = milligrams per day
‡ cm2 = cubic centimeters
§ Estimates the average amount of time a person would engage in "body to water contact" recreational activities during the warmer months of May through October.
**kg = kilograms

Water Dermal Exposure Dose Equation:

ED= (C) (P) (SA) (ET) (CF) / (BW)

where C= Concentration

P= Permeability Coefficient

SA= Skin Surface Area

ET= Exposure Time

CF= Conversion Factor= E^{-06}

BW= Body Weight

Soil and Sediment Dermal Exposure Dose Equation:

ED= (C) (A) (AF) (EF) (CF) / (BW)

where C= Concentration

A= Total Soil Adhered

AF= Bioavailability Factor

EF= Exposure Factor= $\frac{hours}{day} X \frac{days}{year} = \frac{hours}{24\ hours} X \frac{days}{365\ days}$

CF= Conversion Factor= E-06

BW= Body Weight

Chemical-specific bioavailability factors were used to determine how much of each contaminant would be absorbed. The following bioavailability factors were used to estimate dermal absorption at General Chemical Monroe Works:

arsenic	0.03
metals	0.01
PCBs	0.06
PAHs	0.13

The polycyclic aromatic hydrocarbons (PAHs) were evaluated using toxicity equivalency factors (TEFs). TEFs weight each PAH's relative toxicity in comparison to benzo(a)pyrene, one of the most toxic and most studied of the PAHs. Multiplying the concentration of each PAH by its TEF produced a toxicity equivalence quotient (TEQ). The sum of PAH TEQs in each sample was used to evaluate the noncancer health effects of the PAHs[*†].

The estimated exposure doses were compared to the appropriate health guideline values, which are doses below which adverse health effects are unlikely. These values are based on valid toxicological studies. The health guideline values used in the evaluation of General Chemical Works samples are listed below:

> A *reference dose* (RfD) is an estimated daily lifetime exposure to a substance that is unlikely to cause adverse noncancer health effects to human populations. RfDs may be found in the EPA's Integrated Risk Information System (IRIS) at http://www.epa.gov/iris.

[*] 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.

[†] 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.

> A *minimum risk level* (MRL) is an estimated daily human exposure to a 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.

Tables B-5 through B-8 list the estimated exposure doses that exceeded the health guideline values. When this occurred, each dose was compared to the *no-observed-adverse-effects level* (NOAEL) or *lowest-observed-adverse-effects level* (LOAEL) for that contaminant. The NOAEL is the lowest level of continuous exposure to a contaminant that has been observed to cause no adverse health effects. The LOAEL is the lowest level of continuous exposure to a contaminant that has been observed to result in adverse health effects.

Calculation of Carcinogenic Risk

Some of the contaminants detected at the General Chemical Monroe Works site are recognized as potential cancer-causing agents. These contaminants include arsenic, the polycyclic aromatic hydrocarbons (PAHs), and the Aroclors. To determine whether concentrations of these contaminants found at the site would increase an individual's risk of developing cancer, SEET estimated the lifetime excess cancer risk (LECR) for each of these contaminants. The LECR represents the increase in the probability of an individual developing cancer as a result of being exposed to a contaminant over a lifetime.

Because of the uncertainties involved in estimating carcinogenic risk, ATSDR employs a weight-of-evidence approach in describing carcinogenic risk, using words as well as numeric terms.[‡] Cancer risks were calculated by multiplying each exposure dose over a 70-year (lifetime) period by EPA's *cancer slope factor* (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. Therefore, 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. The risk above which cancer may potentially be due to an external cause rather than to population variation is 10^{-4} or 1 excess cancer per 10,000 people.

[‡] Agency for Toxic Substances and Disease Registry. Cancer policy framework. Atlanta: US Department of Health and Human Services; 1993.

Table B-5: Contaminant of Concern (COC) ingestion doses exceeding health values in surface water at the General Chemical Monroe Works site

Contaminant (ug/L*)	Health Guidelines (mg/kg/day†)	from sample site SW-04 (mg/kg/day)	from sample site SW-05 (mg/kg/day)
Lead	No Health Guidelines Available		
child ingestion ED:		1.3 E-03	
adult ingestion ED:		5.9 E-04	

* ug/L = micrograms per liter
† mg/kg/day = milligrams per kilogram per day
‡ RfD = reference dose
§ ED = exposure dose

Table B-6: Contaminant of Concern (COC) dermal exposure doses exceeding health values in surface water at the General Chemical Monroe Works site

Contaminant (ug/L*)	Health Guidelines (mg/kg/day†)	sample site SW-04 (mg/kg/day)	sample site SW-06 (mg/kg/day)	sample site SW-07 (mg/kg/day)
Chromium	RfD** = 3 E-03			
adult dermal occupational ED§:			1.2 E-02	1.1 E-02
Lead	No Health Guidelines Available			
child dermal ED:		7.3 E-06		
adult dermal ED:		7.5 E-06		

* ug/L = micrograms per liter
† mg/kg/day = milligrams per kilogram per day
‡ MRL = minimum risk level
§ ED = exposure dose
** RfD = reference dose

Table B-7: Contaminant of Concern (COC) dermal exposure doses exceeding health values in sediment sampled from the General Chemical Monroe Works site

Contaminant (ug/kg[*])	**Health Guidelines (mg/kg/day[†])**	**sample site SD-03 (mg/kg/day)**
Aroclor 1268	No Health Guidelines Available	
adult dermal occupational ED[‡]:		9.4 E-07

[*] ug/kg = micrograms per kilogram
[†] mg/kg/day = milligrams per kilogram per day
[‡] ED = exposure dose

Table B-8: Contaminant of Concern (COC) ingestion doses exceeding health values in soil sampled from the General Chemical Monroe Works site

Contaminant (mg/kg[*])	**Health Guidelines (mg/kg/day[†])**	**sample site SSW-01 (mg/kg/day)**
Lead	No Health Guidelines Available	
adult occupational ingestion ED:		1.5 E-02
adult occupational dermal ED:		4.9 E-04

[*] mg/kg = milligrams per kilogram
[†] mg/kg/day = milligrams per kilogram per day
[‡] ED = exposure dose