

Health Consultation

Review of 2011 Groundwater Monitoring Data

Gulf States Utilities Company
(a/k/a North Ryan Street Facility)
Lake Charles, Calcasieu Parish, Louisiana

CERCLIS NO. LAD985169317

**Prepared by the
Louisiana Department of Health and Hospitals**

JUNE 24, 2013

Prepared under a Cooperative Agreement with the
U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Agency for Toxic Substances and Disease Registry
Division of Community Health Investigations
Atlanta, Georgia 30333

Health Consultation: A Note of Explanation

A health consultation is a verbal or written response from ATSDR or ATSDR's Cooperative Agreement Partners 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 or ATSDR's Cooperative Agreement Partner which, in the Agency's opinion, indicates a need to revise or append the conclusions previously issued.

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Section of Environmental Epidemiology and Toxicology
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Table of Contents

List of Acronyms	iii
Summary	4
Statement of Issue and Purpose	6
Background	6
A. Site Description and History	6
B. Site Geology and Hydrogeology	8
Discussion	9
Data Used.....	9
Evaluation Process	10
Data Evaluation.....	11
Children’s Health Considerations	11
Conclusions.....	12
Recommendations.....	12
Public Health Action Plan	13
Report Preparation.....	14
References.....	15
APPENDIX A: Maps	17
APPENDIX B: Data Evaluation	21

List of Acronyms

ATSDR	Agency for Toxic Substances and Disease Registry
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, and xylenes
COC	contaminant of concern
CREG	Cancer Risk Evaluation Guide
CV	comparison value
DWF	Department of Wildlife and Fisheries
EMEG	Environmental Media Evaluation Guide
ft	feet
ft ²	square feet
GSU	Gulf States Utilities
GW SS	Groundwater Screening Standards
LDEQ	Louisiana Department of Environmental Quality
LDHH	Louisiana Department of Health and Hospitals
MCL	maximum contaminant level
MCLG	maximum contaminant level goal
MRL	minimal risk levels
NA	not available
ND	not detected
NPL	National Priorities List
OPH	Office of Public Health
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
ppb	parts per billion
RECAP	Louisiana Risk Evaluation/Corrective Action Program
RMEG	Reference dose Media Evaluation Guide
RSL	Regional Screening Level
SEET	Section of Environmental Epidemiology and Toxicology
SSI	Screening Site Investigation
US EPA	United States Environmental Protection Agency

Summary

Introduction

As part of its cooperative agreement with the ATSDR, the Louisiana Department of Health and Hospitals/Office of Public Health/Section of Environmental Epidemiology and Toxicology (LDHH/OPH/SEET) reviewed water data summarized in the “2011 Ground Water Monitoring Report: North Ryan Street/Lake Charles Manufactured Gas Plant Site”. SEET assessed this data to determine whether any contaminants remaining in the site’s groundwater or in adjacent water sources could pose harm to public health.

Conclusion

SEET has arrived at the following conclusions:

1. No pathway of exposure exists between the public and the shallow groundwater affected by contaminants at the GSU site; the shallow groundwater therefore poses no harm to public health.
2. Levels of contaminants detected in surface water sampled from the Calcasieu River next to the GSU site pose no harm to public health. However, some of the non-detected contaminants may still have been present at levels requiring further evaluation.
3. Levels of contaminants detected in groundwater sampled from the six city wells located near the site pose no harm to public health.

Basis for Decision

-
1. Contaminants in the shallow groundwater under the Gulf States Utilities (GSU) site are unlikely to migrate into the Calcasieu River or the deeper aquifers under the site because of the very low hydraulic conductivity measured in the shallow aquifers. The continuous clay layer under the site also impedes migration of site contaminants into deeper groundwater.
 2. No contaminants were detected in the surface water samples or the city well water samples at levels that would pose harm to public health. However, for some chemicals, samples were analyzed using method detection limits that were higher than the health-based comparison values used to screen the data. These contaminants may still have been present at levels requiring further evaluation.
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Next Steps

If future monitoring determines the hydrogeological conditions under the GSU site have changed, allowing contaminants in the shallow groundwater to migrate into the Calcasieu River or into the deeper aquifer being used as a public water supply, the shallow groundwater at GSU should be reevaluated for potential hazards to public health.

The use of more sensitive laboratory methods with lower detection limits would allow for a more complete evaluation of future water samples collected from the Calcasieu River adjacent to the GSU site.

If requested, SEET will be available to assess samples collected in further investigations or assessments performed at the GSU site.

The information produced within this public health consultation will be made available to the community members and stakeholders in Lake Charles, LA.

For More Information

If you have further concerns about the site, you can call ATSDR at 1-800-CDC-INFO and ask for information about the Gulf States Utilities site in Lake Charles, LA. Questions may also be directed to LDHH/OPH/SEET at 1-888-293-7020.

Statement of Issue and Purpose

As part of its 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 reviewed water data summarized in the most recent available groundwater monitoring report, the “2011 Ground Water Monitoring Report: North Ryan Street/Lake Charles Manufactured Gas Plant Site”. SEET assessed this data to determine whether any contaminants remaining in the site’s groundwater or in adjacent water sources could pose harm to public health.

Background

A. Site Description and History

The Gulf States Utilities (GSU) site (also known as the North Ryan Street Facility or the Lake Charles Manufactured-gas Plant Site) is located at 303 North Ryan Street, Lake Charles, Calcasieu Parish, Louisiana, 70601 (see Figure A-1). The site is bounded to the north by River Road and the Calcasieu River, to the east by North Ryan Street and lots zoned for industrial use, to the south by commercial businesses, to the southwest by a wastewater treatment plant and holding ponds, and to the west by cypress wetland owned by the City of Lake Charles [1].

From 1916–1932, this site was used as a manufactured gas (coal-gasification) plant. The facility was operated by the Lake Charles Gas Company until 1924, by the Lake Charles Electric Company in 1925, and by the Louisiana Electric Company, Inc. in 1926. In 1927, GSU purchased the site and took over operations. Gas production continued at the site until 1932, at which time the gas plant was dismantled. The Entergy Corporation purchased the Gulf States Utilities company in 1993, and GSU changed its name to Entergy Gulf States, Inc. in 1997. Entergy Gulf States presently operates and maintains a service center at the site [3].

The site includes a 16-acre “west service yard” and a 4-acre “east service yard”. The west service yard is currently used as a storage area and repair center. Until 1932, the tar byproducts generated during activities at the former gas plant were disposed of into a 6-acre marsh area (identified as the “exposed tar area”) located in the west service yard. After the plant ceased operations in 1932, the marsh served as a landfill for a variety of debris such as electrical equipment, electrical poles and appliances. By 1980, this area became full and was filled and covered with shells and soil [1, 3]. A nine foot tall chain link fence topped with razor wire is maintained around the perimeter of the western portion of the site, providing a barrier to human and animal access with active security and controlled entry to the property [2]. In contrast, the east service yard, which was previously used for storage, is unfenced and no longer in use. It has never been owned by Entergy [4].

Discovery of contamination at the GSU site occurred on July 20, 1988, when utility workers digging a trench along the site's northern fence line found an oily material leaking out of the side of the trench closest to the GSU facility. A more thorough investigation of the site by Louisiana Department of Environmental Quality (LDEQ) inspectors revealed a pit containing a black substance at the center of the western service yard. Three investigations by GSU to determine the extent of contamination at the site were carried out in December 1988, March 1989, and March 1990 [4, 5].

In October 1990, the United States Environmental Protection Agency (US EPA) began a Screening Site Investigation (SSI) to determine if Superfund involvement with the site was appropriate; the SSI was completed in September 1992 [6]. The site was proposed for inclusion on the National Priorities List (NPL) on February 13, 1995 but has not been listed as final on the NPL. In July 1997, GSU and EPA completed an Administrative Order on Consent to evaluate appropriate cleanup actions for residual contamination and groundwater at the site, making this an EPA enforcement-led project [1, 2, 6].

Tar byproducts have been identified as one of the key problems at the site. The contaminants of concern identified were polycyclic aromatic hydrocarbons (PAHs); polychlorinated biphenyls (PCBs); and benzene, toluene, ethylbenzene, and xylenes (BTEX) [2]. Three sources of contaminants were identified: the former manufactured-gas plant, two fuel oil pits used from 1900–1920, and the marsh previously used as a disposal area for tar byproducts and as a landfill. None of the disposal areas were contained; coal tar byproducts had been pumped directly into the marsh, the fuel oil had been stored in unlined earthen pits, and the landfill was covered with soil and shells to create a base for the storage yard. No records of waste type, amount, location, or capacity of the disposal areas were available. Fuel oil pits were located near the Calcasieu River in the northern area of the site. PCBs were found in areas associated with former landfill operations onsite. A storm water drain line used to transport coal tar from the site to the Calcasieu River was plugged in 1995 [2].

The selected remedy for site groundwater included monitored natural attenuation (natural breakdown) of groundwater contaminants at the site to confirm a decrease in contamination over time and monitoring surface water and drinking water supply wells to assure that contaminants do not exceed any regulatory or health-based risk levels [2]. Soil and sediment removal actions were also completed in multiple areas at the site.

On September 24, 2005, Hurricane Rita made landfall on the coast of southwestern Louisiana as a category 3 hurricane, with top winds of 120 miles per hour. Hurricane Rita caused flooding and property damage throughout Lake Charles, LA [7]. On August 22, 2006, SEET completed a public health assessment for the GSU site. SEET reviewed the data collected by LDEQ and EPA following Hurricane Rita and confirmed that remediation activities at the site were not disturbed by the hurricane. Under the land use restrictions placed on the GSU property, the GSU site and sediment or surface water from the nearby Calcasieu River were not expected to harm people's health. Shallow groundwater beneath the site contained elevated levels of PAHs and other contaminants, but since there was no flow of groundwater from the GSU site to public water supply wells, the site groundwater also posed no harm to public health [8].

B. Site Geology and Hydrogeology

The groundwater in the vicinity of GSU is located in shallow alluvial aquifers and in the deeper Chicot Aquifer. The depth to groundwater at the site ranges from approximately 2 to 6 ft bgs (feet below ground surface) [2]. Beneath the GSU site, the shallow aquifers are separated from the Chicot Aquifer by a continuous clay layer that extends across the site and under the riverbed. The clay impedes migration of site contaminants into deeper groundwater. The shallow groundwater has been reported to flow generally in a north to northwest direction toward the Calcasieu River, though groundwater flow away from the river has also been observed, depending on the time of day of water collection and tidal influences [2, 9]. However, the hydraulic conductivity (the ease with which the water saturated soil permits water movement) observed in the shallow aquifers is very low, in the range of 10^{-8} centimeters per second. This level of hydraulic conductivity would result in groundwater movement of about one foot every 100 years [10]. Movement of contaminants from these aquifers to the river or to deeper aquifers is unlikely.

The Lake Charles area uses the Chicot Aquifer as its major water source. The Chicot Aquifer's principal water bearing units are in sand beds known as the 200-foot, 500-foot, and 700-foot sands, corresponding with their depths below ground surface. The City of Lake Charles obtains its water supply from wells screened in either the 500- or 700-foot sands of the Chicot Aquifer [2].

Eleven groundwater monitoring wells have been installed on or near the site to monitor the shallow aquifers. A twelfth installation was plugged and abandoned after it was drilled through a sewer line. Six of the monitoring wells (MW-1 through MW-4, MW-8 and MW-9) monitor water in the pocket of sand (the "granular unit") under the site, four (MW-5, MW-7, MW-10, and MW-11) monitor shallow portions of the clay layer (the "cohesive unit"), and one (MW-6) monitors groundwater in the layer in which clay and sand are mixed together (the "discontinuous sand layer") [2].

GSU is located adjacent to the Greater Lake Charles Water Company. Three municipal water wells located on GSU property and screened in the 700-foot sands of the Chicot Aquifer system have been closed. Six city wells are located within 300 - 400 yards south of the site on Lake Charles Water Department property [2]. A total of 46 public supply wells are located within a 4-mile radius of the site; another 10 wells within this radius are identified as irrigation wells. In addition, 154 private domestic water wells are located within a 4-mile radius of the site, with the closest less than half a mile from the site boundaries (see Figure A-2). The majority of the domestic wells are screened in either the 200-foot or the 500-foot sands of the Chicot Aquifer system [11].

The Calcasieu River, which is within 60 feet of the GSU site, is the dominant surface water feature in the area. The river receives runoff from the site, which has historically flooded following heavy rains. The Calcasieu River is used for commercial purposes (industrial and shipping) as well as recreational purposes (fishing, swimming, and boating). Within the vicinity of the GSU site, the river is used for both recreational fishing and, to a small extent, commercial fishing [9].

Many industrial facilities (petrochemical, agrochemical, etc.) are located along the river. The lower Calcasieu River system has been impacted by industry waste discharged into

the river and its tributaries, and several contamination studies have been conducted within the Calcasieu Estuary.

Discussion

The remedial action chosen for contaminated groundwater at the GSU site involved the monitoring of groundwater on a quarterly basis (4 times a year) for a minimum of 3 years. This monitoring schedule was designed to evaluate changes in contaminant concentrations and to determine if contaminants with concentrations above the remedial action goals chosen for the site are migrating offsite. If decreases in contaminant concentrations were not evident after three years of monitoring, quarterly sampling was to continue for an additional 2 years, at which point the remedial action would be reassessed and appropriate actions taken. The data summarized in the 2011 Ground Water Monitoring Report represents the 6th year of quarterly monitoring [10]. The following assessment reviews data from this report.

Data Used

2011 Groundwater Monitoring Data

Figure A-3 displays all of the sampling locations for water samples collected during the 2011 sampling events.

Quarterly groundwater samples were collected from site monitoring wells during 4 sampling periods in March, May, September, and November 2011. During each sampling period, one sample was collected from each of 11 monitoring wells (along with a duplicate from monitoring well MW03 for quality control purposes) [10].

Groundwater samples were collected in September 2011 from 6 public water supply wells (city wells) on or near the Greater Lake Charles Water Company's G.H. West water plant, which is southwest of the GSU site [10].

Surface water samples were collected in September 2011 from 5 locations in the Calcasieu River adjacent to the GSU site [10].

Exposure Pathways

An exposure pathway consists of five elements: a source of contamination, transport through an environmental medium (air, water, or soil), a point of exposure, a route of human exposure (ingestion, dermal exposure, or inhalation), and a population. Completed pathways require that all five of these elements exist and that exposure to a contaminant has occurred in the past, is presently occurring, or will 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.

Groundwater sampled from On-site and Off-site Monitoring Wells

The continuous clay layer under the shallow aquifers onsite and the very low hydraulic conductivity measured in these aquifers make it unlikely that groundwater contaminants from the site will migrate into the public water supply or migrate offsite into the Calcasieu River [2, 9, 10]. The public would therefore not be exposed to groundwater from the GSU site.

Groundwater sampled from Offsite Public Supply Wells

Five of the six public supply wells from which groundwater was sampled in September 2011 are screened in the 500-ft sands, below the depths of the shallow groundwater at the GSU site. The remaining well is screened in the 700-foot sands of the Chicot Aquifer system [2]. Water pumped from these wells is treated before being distributed for public use, which may impact finished water contaminant levels. Exposure to water from these sources would occur through ingestion, dermal exposure, or inhalation of water vapor.

Surface Water sampled from the Calcasieu River

The Calcasieu River, from which the surface water samples were collected, lies within 60 feet of the GSU site. A Fish Consumption Advisory for the Calcasieu River Drainage Basin for fish-mercury was issued by LDEQ, the Department of Wildlife and Fisheries (DWF), and DHH in 2004, covering the area from Highway 26 to the Saltwater Barrier (located upstream of the GSU site), the West Fork Calcasieu River, Houston River, Hickory Creek, Beckwith Creek, English Bayou and Little River [12]. An LDEQ, Department of Natural Resources (DNR), and DHH Informational Health Advisory has also been in effect since 1993 for the area from the Saltwater Barrier to the Gulf of Mexico [8]. Nevertheless, the river is used for fishing as well as a range of other recreational purposes. The river is not used as a source of municipal drinking water. Exposure to surface water from the Calcasieu River occurs through incidental (accidental) ingestion or skin contact during fishing or other recreational activities.

Evaluation Process

The evaluation process used to assess potential public health hazards at the GSU site is described in Appendix B. The analytes assessed during the 2011 groundwater and surface water sampling events are listed in Table B-1.

Tables B-2 through B-7 list ranges of the analytes detected in the 2011 water samples. Contaminant concentrations were initially screened using media-specific health 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 health effects. Contaminant concentrations that exceeded CVs are identified as contaminants of concern (COCs) and are listed in bold red text.

Data Evaluation

Groundwater, Quarterly Sampling 2011

Tables B-2 through B-5 list in red the COCs that would require further evaluation if contaminants in groundwater at the GSU site could potentially migrate into the public water supply. However, the shallow site groundwater is not used for public consumption or domestic use, and the very low hydraulic conductivity measured in the shallow aquifers make it unlikely that contaminants will migrate into the deeper aquifers used for the public water supply or offsite into the Calcasieu River. Because no pathway of contaminant migration exists between the public and the shallow groundwater under the GSU site, the contaminants in the site's groundwater pose no harm to public health.

Surface Water and City Well Water, September 2011

No COCs were identified in the data collected from water sampled from the Calcasieu River or from water sampled from the six city wells in September 2011. Levels of the contaminants detected in water are below those of health concern.

A number of the contaminants reported as non-detects in the surface water and city well water data sets were measured using method detection limits that were higher than the health-based CVs used to screen these contaminants. These contaminants may have been present at concentrations that the screening process would identify as requiring further evaluation. These non-detects are not of concern in the water sampled from the city wells. Under the Safe Drinking Water Act, public drinking water supplies are strictly monitored using maximum contaminant levels (MCLs), which are standards set by the EPA based on the levels of contaminants in drinking water below which there is no known or expected risk to health (the maximum contaminant level goal, or MCLG).

Surface water (Calcasieu River water) nondetects that may have been present at concentrations requiring further evaluation included the following:

- DBCP (dibromochloropropane)
- 1,2,3-trichloropropane
- EDB (ethylene dibromide)
- benzo(a)pyrene
- dibenzo(a,h)anthracene

Children's Health Considerations

The physical differences between children and adults demand special emphasis in assessing public health hazards. 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.

Under current conditions, children would not be exposed to groundwater from the GSU site. Analytes detected in water from the Calcasieu River adjacent to the site and water from the city wells offsite should pose no harm to children's health; however, as previously stated, a number of the non-detected contaminants may have been present at levels requiring further evaluation.

Conclusions

SEET and ATSDR are committed to addressing the concerns of the citizens of Lake Charles about the risks involved in exposure to unsafe chemicals. Our agencies are committed to providing the public with the best science-based information available to keep them safe.

Having reviewed the data collected for the "2011 Ground Water Monitoring Report: North Ryan Street/Lake Charles Manufactured Gas Plant Site", SEET has arrived at the following conclusions:

- 1.No pathway of exposure exists between the public and the shallow on-site contaminated groundwater; therefore contaminated on-site groundwater poses no harm to public health.
- 2.Levels of contaminants detected in surface water sampled from the Calcasieu River next to the GSU site pose no harm to public health. However, some of the non-detected contaminants may still have been present at levels requiring further evaluation.
- 3.Levels of contaminants detected in groundwater sampled from the six city wells located near the site pose no harm to public health.

If you have further concerns about the site, you can call ATSDR at 1-800-CDC-INFO and ask for information about the Gulf States Utilities site in Lake Charles, LA. Questions may also be directed to LDHH/OPH/SEET at 1-888-293-7020.

Recommendations

If future monitoring determines the hydrogeological conditions under the GSU site have changed, allowing contaminants in the shallow groundwater to migrate into the Calcasieu River or into the deeper aquifer being used as a public water supply, the shallow groundwater at GSU should be reevaluated for potential hazards to public health.

The use of more sensitive laboratory methods with lower detection limits would allow for a more complete evaluation of future water samples collected from the Calcasieu River adjacent to the GSU site.

SEET will be available to assess samples collected in further investigations or assessments performed at or near the GSU site.

Public Health Action Plan

The information produced within this public health consultation will be disseminated to the community members and stakeholders in Lake Charles, LA.

Report Preparation

This Public Health Consultation for the “Gulf States Utilities Company (a/k/a North Ryan Street Facility) Review of 2011 Groundwater Monitoring Data” was prepared by the Louisiana Department of Health and Hospitals/Office of Public Health/Section of Environmental Epidemiology and Toxicology under a cooperative agreement with the federal Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with the approved agency methods, policies, procedures existing at the date of publication. Editorial review was completed by the cooperative agreement partner. ATSDR has reviewed this document and concurs with its findings based on the information presented.

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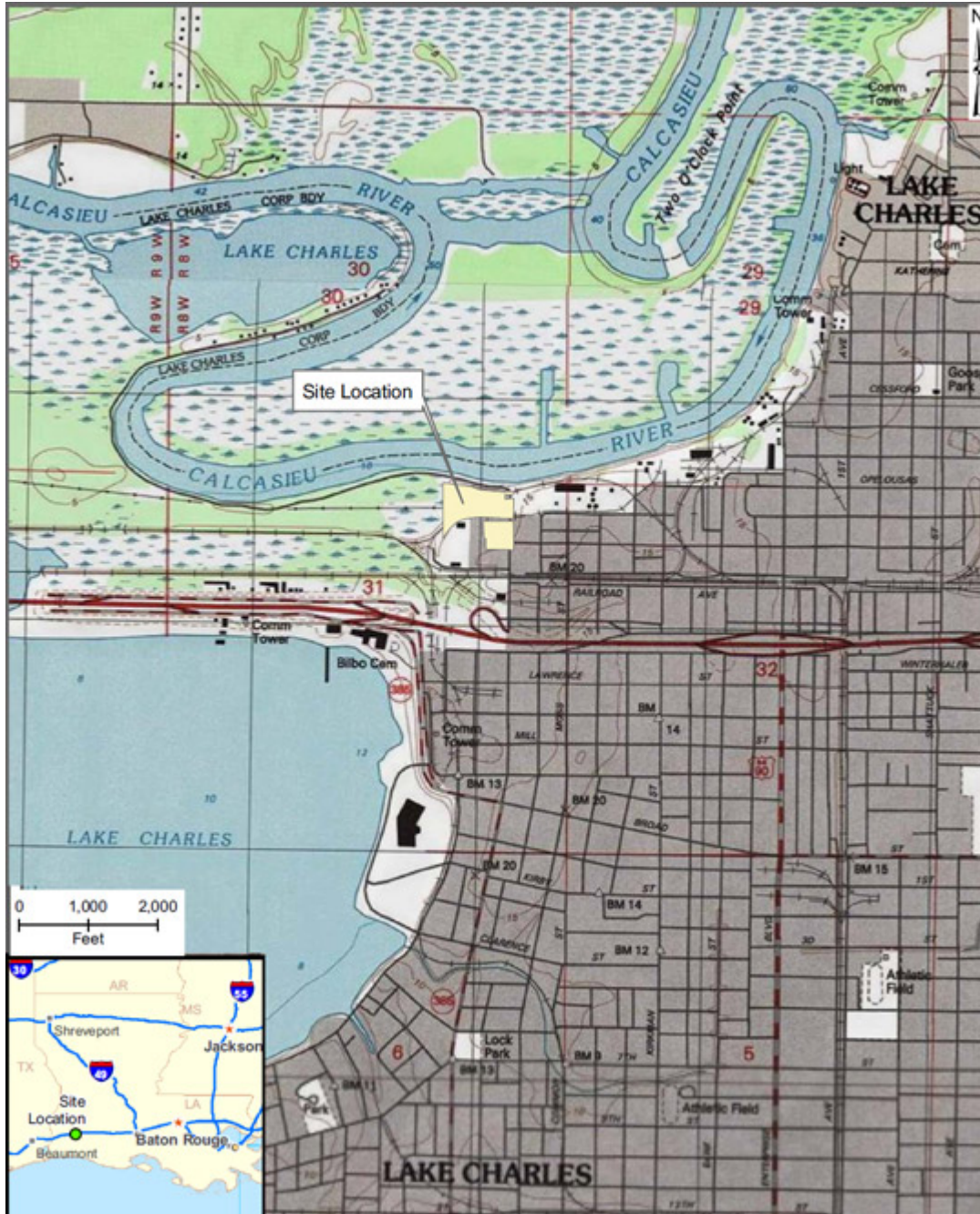
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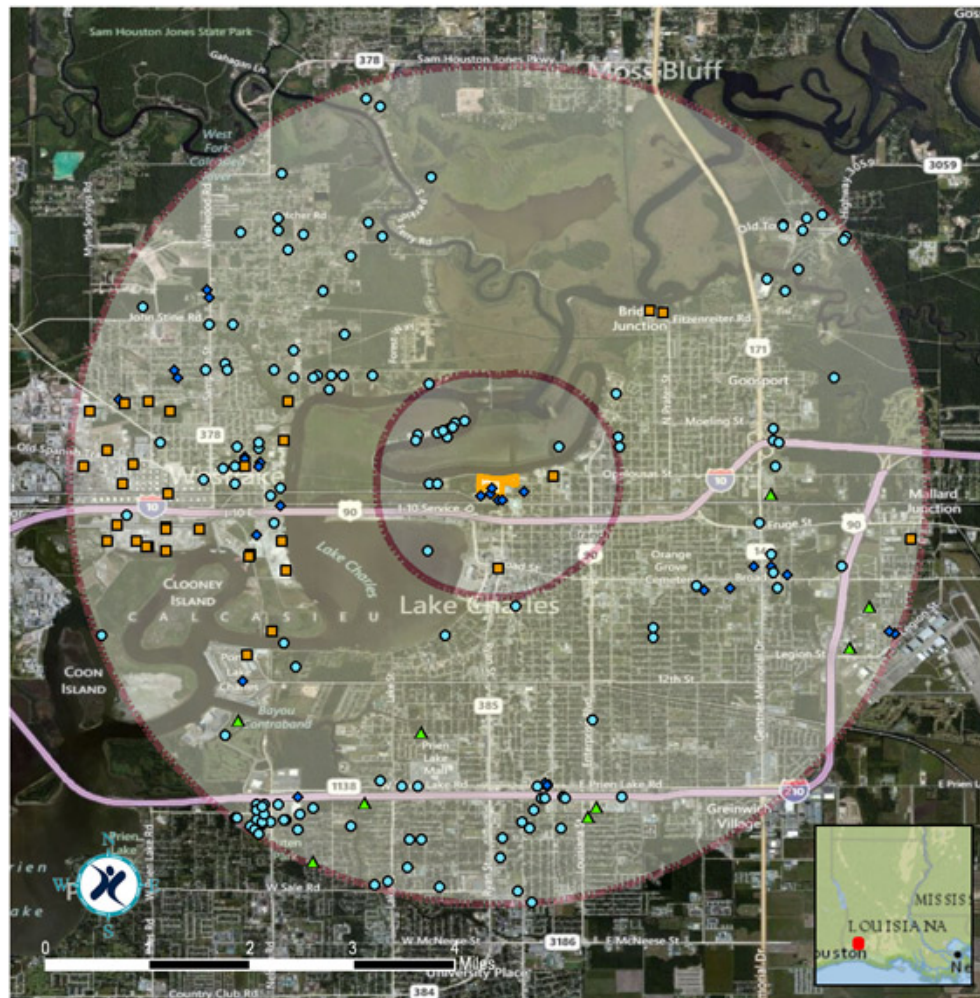
APPENDIX A: Maps

Figure A-1: Location of Gulf States Utilities site, Lake Charles, LA




Adapted from: United States Environmental Protection Agency Region 6. Action Memorandum: North Ryan Street Site, Lake Charles, Calcasieu Parish, Louisiana. Accessed 2 Oct 2012 at: <http://www.epa.gov/region6/6sf/pdffiles/nryanam.pdf>

Figure A-2: Domestic, public, irrigation, and industrial wells located within a one- to four-mile radius of the Gulf States Utilities site



Legend





 Gulf States Utilities, Calcasieu Parish
Proposed NPL Site

 1 and 4 mile buffers

Active wells within 1 and 4 miles

Count shown in parenthesis

Use Description

-  domestic (140)
-  industrial; industrial chemical manufacturing; industrial petroleum refining (34)
-  institution public supply; municipal public supply; rural public supply (31)
-  irrigation; livestock (9)

Water wells data source: Louisiana DNR SONRIS, October 2012

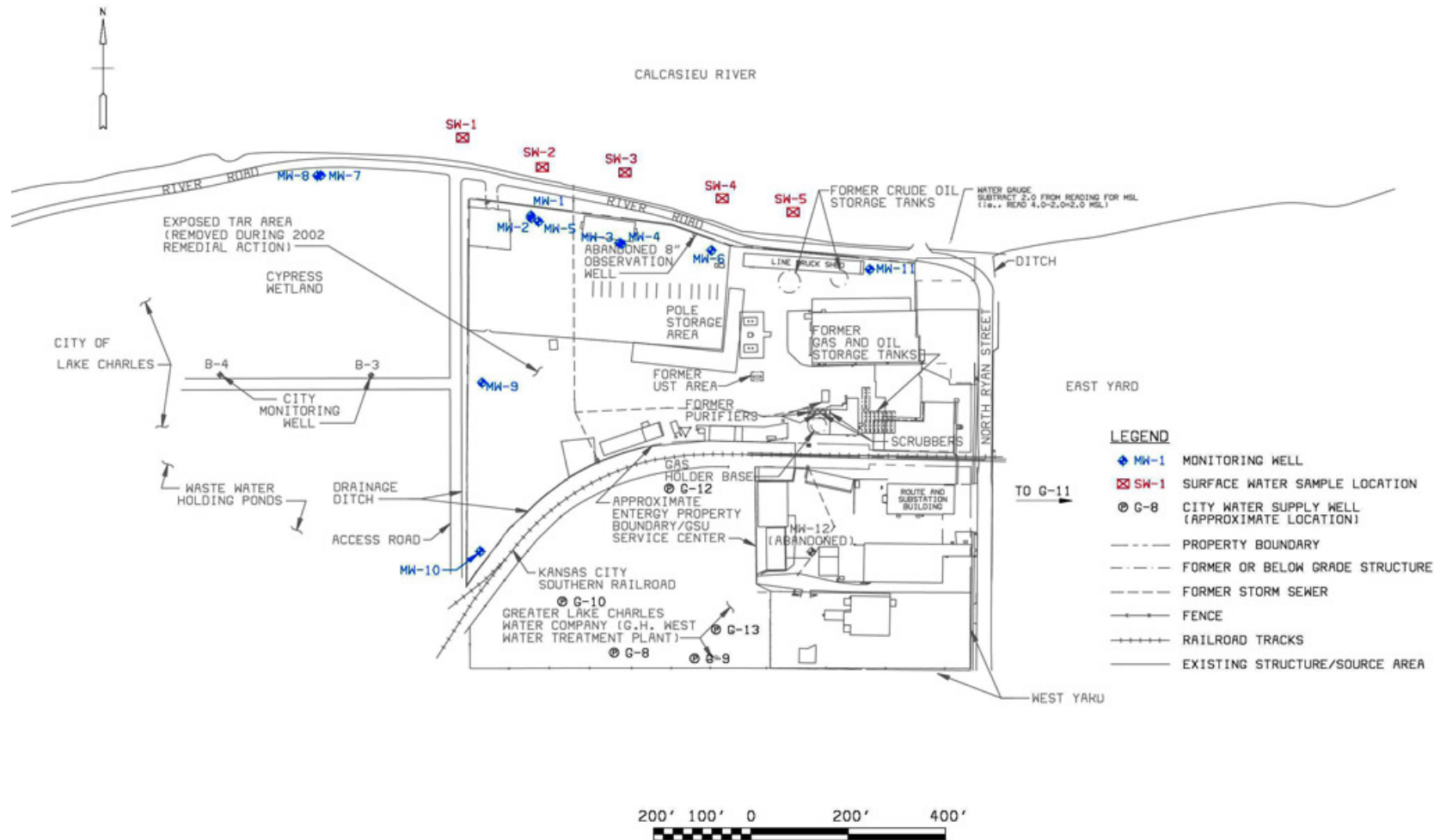
Mapping software: ESRI ArcMap 10

Imagery: Microsoft Virtual Earth

Map Produced October 24, 2012 by the Louisiana Department of Health and Hospitals (LDHH), Section of Environmental Epidemiology & Toxicology (SEET).

LDHH SEET cannot guarantee the accuracy of the information contained on this map and expressly disclaims liability for errors and omissions in its contents.

Figure A-3: Sample locations sampled during the Gulf States Utilities 2011 Groundwater Monitoring events



Adapted from: Black & Veatch. 2011 Ground Water Monitoring Report: North Ryan Street/Lake Charles Manufactured Gas Plant Site. Prepared for Entergy Gulf States Louisiana, LLC. Mar 2012.

APPENDIX B: Data Evaluation

Screening Process

The comparison of environmental data with ATSDR comparison values (CVs) is one of the first steps in the health assessment process. CVs are chemical and media-specific concentrations in air, soil, and drinking water that are used by ATSDR health assessors and others to identify environmental contaminants at hazardous waste sites that require further evaluation. CVs incorporate assumptions of daily exposure to the chemical and a standard amount that someone may likely take into their body each day. CVs are conservative and non-site specific. CVs are based on health guidelines with uncertainty or safety factors applied to ensure that they are adequately protective of public health.

The results of this screening step give health assessors an understanding of the priority contaminants at a site. When a contaminant is detected at a concentration less than its respective CVs, exposure is not expected to result in health effects and it is not considered further as part of the health assessment process. **It should be noted that contaminants detected at concentrations that exceed their respective CVs, do not necessarily represent a health threat.** Instead, the results of the CV screening identify those contaminants that warrant a more detailed, site-specific evaluation to determine whether health effects may occur. CVs are not intended to be used as environmental clean-up levels.

CVs can be based on either carcinogenic or non-carcinogenic effects. Cancer-based CVs are calculated from the U.S. Environmental Protection Agency's (EPA) oral cancer slope factor (CSF) or inhalation unit risk (IUR). CVs based on cancerous effects account for a lifetime exposure (70 years) with a calculated excess lifetime cancer risk of 1 extra case per 1 million exposed people. Non-cancer values are calculated from ATSDR's Minimal Risk Levels (MRLs), EPA's Reference Doses (RfDs), or EPA's Reference Concentrations (RfCs). When a cancer and non-cancer CV exists for the same chemical, the lower of these values is used in the data comparison for public health protectiveness.

Table B-1 lists the chemicals assessed during the 2011 groundwater and surface water sampling events. Tables B-2 through B-7 list the ranges chemicals detected in the water samples. The following comparison values were used in the evaluation of these samples:

Environmental Media Evaluation Guides (EMEGs) represent concentrations of substances in water, soil, and air to which humans may be exposed during a specified period of time (acute, intermediate or chronic) without experiencing non-cancerous adverse health effects. EMEGs have been calculated using MRLs and default exposure assumptions. The default exposure assumptions account for variations in water and soil ingestion between adults and children.

Reference dose Media Evaluation Guides (RMEGs) were developed by ATSDR for soil and drinking water using EPA's reference doses (RfDs) and default exposure assumptions. EPA's reference concentrations (RfCs) serve as RMEGs for air exposures. Like EMEGs, RMEGs represent concentrations of substances (in water, soil, and air) to which humans may be exposed without experiencing non-cancerous, adverse health effects. RfDs and RfCs consider lifetime exposures; therefore, RMEGs apply to chronic exposures.

Cancer Risk Evaluation Guides (CREGs) are media-specific comparison values that are used to identify concentrations of cancer-causing substances that are unlikely to result in a significant increase of cancer rates in an exposed population. ATSDR develops CREGs using EPA's cancer slope factor (CSF) or inhalation unit risk (IUR), a target risk level (10^{-6}), and default exposure assumptions. The target risk level of 10^{-6} represents a calculated risk of 1 excess cancer cases in an exposed population of 1 million. At this time, CREGs are available only for adult exposures.

Regional Screening Levels (RSLs) are estimated contaminant concentrations in a media at which noncarcinogenic or carcinogenic health effects are unlikely. RSLs are considered by the EPA to be protective for humans (including sensitive groups) over a lifetime.

Maximum Contaminant levels (MCLs) are defined in the Safe Drinking Water Act as "the maximum permissible level of a contaminant in water which is delivered to any user of a public water system." MCLs are enforceable standards set by the Environmental Protection Agency (EPA) and are based closely on the levels of contaminants in drinking water below which there is no known or expected risk to health (the maximum contaminant level goal, or MCLG).

The comparison values listed above are conservative values used to screen drinking water and are based on the assumption of daily ingestion of liters of water. Ingestion of water from monitoring wells is unlikely to occur, and ingestion of water from the Calcasieu River (surface water) is expected to occur in very small quantities, if it occurs at all.

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

If a contaminant was not detected in any of the water samples, it was excluded from the tables. For conservative screening purposes, the non-detects (the contaminants that were not detected at concentrations above the method detection limit) that are listed in the tables were assessed using a value of half the method detection limit (the lowest limit measureable by the laboratory methodology used for sample analysis). Contaminants fitting this description are marked with an "ND".

Sulfate, sulfide, carbon dioxide, total organic carbon (TOC), and methane were measured as part of the analysis of the chosen remedial action for the site, monitored natural attenuation. Monitored natural attenuation analysis monitors the effectiveness of the naturally occurring processes which reduce the concentrations of contaminants dissolved in groundwater to levels that are not harmful to human health or the environment [17]. Though these analytes were included in the water sample data, health-based CVs are not used to assess these parameters.

There were no comparison values available with which to evaluate tert-butylbenzene; p-cymene; isopropyl ether; 1,1-dichloropropene; 2,2-dichloropropane; and benzo(ghi)perylene.

Table B-1: Contaminants assessed in water samples collected during the 2011 Gulf Coast Utilities groundwater sampling events

Nitrate *	Benzene, 1,2,4-trimethyl
Nitrate plus Nitrite (as N) *	DBCP (Dibromochloropropane)
Sulfate *	1,2,3-Trichloropropane
Sulfide *	tert-Butylbenzene
TOC *	Benzene, 1-methylethyl (Cumene)
Arsenic	p-Cymene
Barium	Ethylbenzene
MN (Manganese) *	Styrene
Total Manganese *	n-Propylbenzene
Fe (Iron) *	n-Butylbenzene
Total Iron *	p-Chlorotoluene (4-Chlorotoluene)
Beryllium	p-Dichlorobenzene (1,4-Dichlorobenzene)
Carbon tetrachloride	EDB (Ethylene dibromide, 1,2-dibromoethane)
Acetone	1,2-Dichloroethane
Chloroform	Methyl isobutylketone (MIBK)
Benzene	Isopropyl Ether
1,1,1-trichloroethane	Benzene, 1,3,5-trimethyl
Methyl bromide (Bromomethane)	Bromobenzene
Methyl chloride (Chloromethane)	Toluene
Methylene bromide (Dibromomethane)	Chlorobenzene
Chlorobromomethane (Bromochloromethane)	n-Hexane
Chloroethane (Ethyl Chloride)	1,2,4-Trichlorobenzene
Vinyl chloride	Dibromochloromethane
Methylene chloride	Tetrachloroethylene
Carbon disulfide	sec-Butylbenzene
Bromoform	1,3-Dichloropropane
Bromodichloromethane	cis-1,2-Dichloroethylene
1,1-Dichloroethane	Ethene, 1,2-dichloro-, E (cis-1,2-dichloroethene)
1,1-Dichloroethylene	m-Dichlorobenzene (1,3-Dichlorobenzene)
Trichlorofluoromethane	1,1-Dichloropropene
Dichlorodifluoromethane	2,2-Dichloropropane
1,2-Dichloropropane	2-Hexanone
Methyl ethyl ketone (2-Butanone)	1,1,1,2-Tetrachloroethane
1,1,2-Trichloroethane	Xylene (total)
Trichloroethylene	Methyl tert-butyl ether
1,1,2,2-Tetrachloroethane	cis-1,3-Dichloropropene
1,2,3-Trichlorobenzene	trans-1,3-Dichloropropene
Hexachlorobutadiene	Benzo(a)pyrene
o-Chlorotoluene (2-Chlorotoluene)	Dibenzo(a,h)anthracene
o-Dichlorobenzene (1,2-Dichlorobenzene)	

Gulf States Utilities 2011 Groundwater

Benzo(a)anthracene
Acenaphthene
Phenanthrene
Fluorene
Naphthalene
Anthracene
Pyrene
Benzo(ghi)perylene
Indeno(1,2,3-cd)pyrene

Benzo(b)fluoranthene
Fluoranthene
Benzo(k)fluoranthene
Acenaphthylene
Chrysene
Methane *
Carbon Dioxide *

* = Not included in analysis of surface water or city well water samples

Table B-2: Ranges of analytes detected in groundwater sampled from monitoring wells at the Gulf States Utilities site in March 2011

(Contaminant concentrations exceeding their screening values are listed in bold red)

Contaminant	Range of concentrations detected (ppb [*])		Sample source, Maximum	CV [†] (ppb)	CV reference
	Minimum	Maximum			
Nitrate	ND (3 [‡])	814	MW07	16,000	Child RMEG [§]
Nitrate plus Nitrite (as N)	ND (4)	829	MW07	10,000	MCL ^{**}
Arsenic	ND (2.5)	85	MW10	0.023	CREG ^{††}
Barium	ND (0.11)	1940	MW07	2000	Child Chronic EMEG ^{‡‡}
MN (Manganese)	750	4310	MW07	500	Child RMEG
Total Manganese	760	4350	MW07	500	Child RMEG
Fe (Iron)	12,400	156,000	MW07	11000	RSL ^{§§}
Total Iron	12,600	156,000	MW07	11000	RSL
Beryllium	ND (0.11)	4.1	MW07	20	Child Chronic EMEG
Chloroform	ND (0.062)	12.1	MW04	100	Child Chronic EMEG
Benzene	ND (0.049)	2120	MW06	0.64	CREG
Hexachlorobutadiene	ND (0.347)	568	MW06	0.45	CREG
Naphthalene	ND (0.052)	7200	MW06	200	Child RMEG
Benzene, 1,2,4-trimethyl	ND (0.08)	128	MW06	15	RSL
Benzene, 1-methylethyl	ND (0.058)	27.9	MW06	1,000	Child RMEG
Ethylbenzene	ND (0.18)	791	MW06	1000	Child RMEG
n-Propylbenzene	ND (0.069)	0.948	MW03	530	RSL
Benzene, 1,3,5-trimethyl	ND (0.053)	46.2	MW06	87	RSL
Toluene	ND (0.078)	559	MW06	200	Child Int. ^{***} EMEG
Chlorobenzene	ND (0.055)	29.2	MW06	200	Child RMEG
Tetrachloroethylene	ND (0.21)	68.6	MW06	5	Child RMEG

Gulf States Utilities 2011 Groundwater

Xylene (total)	ND (0.123)	669	MW06	2,000	Child Chronic EMEG
Benzo(a)pyrene	ND (0.043)	100	MW06	0.0048	CREG
Dibenzo(a,h)anthracene	ND (0.026)	18	MW06	0.0029	RSL
Benzo(a)anthracene	ND (0.033)	152	MW06	0.029	RSL
Acenaphthene	ND (0.022)	497	MW06	6000	Child Int. EMEG
Phenanthrene	ND (0.026)	1130	MW06	180	RECAP GW SS ^{†††}
Fluorene	ND (0.033)	523	MW06	400	Child RMEG
Naphthalene	ND (0.052)	4380	MW06	200	Child RMEG
Anthracene	ND (0.024)	245	MW06	100,000	Child Int. EMEG
Pyrene	ND (0.024)	609	MW06	300	Child RMEG
Benzo(ghi)perylene	ND (0.034)	109	MW06	NA ^{†††}	NA
Indeno(1,2,3-cd)pyrene	ND (0.019)	65	MW06	0.029	RSL
Benzo(b)fluoranthene	ND (0.019)	95.1	MW06	0.029	RSL
Fluoranthene	ND (0.015)	367	MW06	400	Child RMEG
Benzo(k)fluoranthene	ND (0.026)	45.8	MW06	0.29	RSL
Acenaphthylene	ND (0.058)	254	MW06	100	RECAP GW SS
Chrysene	ND (0.018)	150	MW06	2.9	RSL

* ppb =parts per billion

† CV=comparison value

‡ ND = not detected; value in parentheses is the method detection limit

§ RMEG = Reference dose Media Evaluation Guide

** MCL = Maximum Contaminant Level

†† CREG = Cancer Risk Evaluation Guide

†† EMEG = Environmental Media Evaluation Guide

§§ RSL = Regional Screening Level

*** Int. = Intermediate

††† RECAP GW SS = Louisiana Department of Environmental Quality's Risk Evaluation/Corrective Action Program Groundwater Screening Standards

††† NA = Not applicable

Table B-3: Ranges of analytes detected in groundwater sampled from monitoring wells at the Gulf States Utilities site in May 2011

(Contaminant concentrations exceeding their screening values are listed in bold red)

Contaminant	Range of concentrations detected (ppb [*])		Sample source, Maximum	CV [†] (ppb)	CV reference
	Minimum	Maximum			
Nitrate	ND (3 [‡])	46	MW07	16,000	Child RMEG [§]
Nitrate plus Nitrite (as N)	ND (3)	53	MW07	10,000	MCL ^{**}
Arsenic	ND (2.5)	62	MW11	0.023	CREG ^{††}
Barium	22	1460	MW07	2000	Child Chronic EMEG ^{‡‡}
MN (Manganese)	640	5860	MW10	500	Child RMEG
Total Manganese	640	5830	MW10	500	Child RMEG
Fe (Iron)	710	67,300	MW06	11000	RSL ^{§§}
Total Iron	710	65,600	MW06	11000	RSL
Beryllium	ND (0.11)	0.74	MW05	20	Child Chronic EMEG
Acetone	ND (0.322)	1.15	MW05	20000	Child Int. ^{***} EMEG
Chloroform	ND (0.062)	26.9	MW06	100	Child Chronic EMEG
Benzene	ND (0.049)	2550	MW06	0.64	CREG
Naphthalene	ND (0.175)	6490	MW06	200	Child RMEG
Benzene, 1,2,4-trimethyl	ND (0.08)	118	MW06	15	RSL
Benzene, 1-methylethyl	ND (0.058)	28.4	MW06	1,000	Child RMEG
p-Cymene	ND (0.175)	0.487	MW03	NA ^{†††}	NA
Ethylbenzene	ND (0.18)	791	MW06	1000	Child RMEG
n-Propylbenzene	ND (0.069)	1.63	MW03	530	RSL
Benzene, 1,3,5-trimethyl	ND (0.053)	34.1	MW06	87	RSL
Toluene	ND (0.078)	595	MW06	200	Child Int. EMEG
Xylene (total)	ND (0.123)	668	MW06	2,000	Child Chronic EMEG

Gulf States Utilities 2011 Groundwater

Benzo(a)pyrene	ND (0.044)	17.7	MW06	0.0048	CREG
Dibenzo(a,h)anthracene	ND (0.027)	2.38	MW06	0.0029	RSL
Benzo(a)anthracene	ND (0.034)	18.8	MW06	0.029	RSL
Acenaphthene	ND (0.022)	204	MW06	6000	Child Int. EMEG
Phenanthrene	ND (0.026)	198	MW06	180	RECAP GW SS ^{†††}
Fluorene	ND (0.033)	133	MW06	400	Child RMEG
Naphthalene	ND (0.052)	4500	MW06	200	Child RMEG
Anthracene	ND (0.024)	34.1	MW06	100,000	Child Int. EMEG
Pyrene	ND (0.025)	71.9	MW06	300	Child RMEG
Benzo(ghi)perylene	ND (0.034)	8.49	MW06	NA	NA
Indeno(1,2,3-cd)pyrene	ND (0.019)	6.29	MW06	0.029	RSL
Benzo(b)fluoranthene	ND (0.019)	9.1	MW06	0.029	RSL
Fluoranthene	ND (0.016)	39.6	MW06	400	Child RMEG
Benzo(k)fluoranthene	ND (0.026)	6.58	MW06	0.29	RSL
Acenaphthylene	ND (0.059)	43.7	MW06	100	RECAP GW SS
Chrysene	ND (0.0189)	17.3	MW06	2.9	RSL

* ppb =parts per billion

† CV=comparison value

‡ ND = not detected; value in parentheses is the method detection limit

§ RMEG = Reference dose Media Evaluation Guide

** MCL = Maximum Contaminant Level

†† CREG = Cancer Risk Evaluation Guide

‡‡ EMEG = Environmental Media Evaluation Guide

§§ RSL = Regional Screening Level

*** Int. = Intermediate

††† NA = Not applicable

‡‡‡ RECAP GW SS = Louisiana Department of Environmental Quality's Risk Evaluation/Corrective Action Program Groundwater Screening Standards

Table B-4: Ranges of analytes detected in groundwater sampled from monitoring wells at the Gulf States Utilities site in September 2011
(Contaminant concentrations exceeding their screening values are listed in bold red)

Contaminant	Range of concentrations detected (ppb [*])		Sample source, Maximum	CV [†] (ppb)	CV reference
	Minimum	Maximum			
Nitrate	ND (3 [‡])	37	MW07	16,000	Child RMEG [§]
Nitrate plus Nitrite (as N)	ND (3)	51	MW07	10,000	MCL ^{**}
Arsenic	ND (2.5)	40	MW11	0.023	CREG ^{††}
Barium	230	2190	MW07	2000	Child Chronic EMEG ^{‡‡}
MN (Manganese)	630	6,550	MW10	500	Child RMEG
Total Manganese	670	6,600	MW10	500	Child RMEG
Fe (Iron)	ND (38)	86,600	MW07	11000	RSL ^{§§}
Total Iron	440	88,200	MW07	11000	RSL
Beryllium	ND (0.11)	1.5	MW07	20	Child Chronic EMEG
Acetone	ND (0.322)	3.14	MW05	20000	Child Int. ^{***} EMEG
Benzene	ND (0.049)	1920	MW06	0.64	CREG
Methyl chloride	ND (0.076)	0.48	MW05	190	RSL
Naphthalene	ND (0.175)	6390	MW06	200	Child RMEG
Benzene, 1,2,4-trimethyl	ND (0.08)	98.1	MW06	15	RSL
Benzene, 1-methylethyl	ND (0.058)	21.7	MW06	1,000	Child RMEG
p-Cymene	ND (0.175)	0.519	MW09	NA ^{†††}	NA
Ethylbenzene	ND (0.18)	721	MW06	1000	Child RMEG
n-Propylbenzene	ND (0.069)	2.79	MW04	530	RSL
n-Butylbenzene	ND (0.068)	0.203	MW03 (duplicate)	780	RSL
Benzene, 1,3,5-trimethyl	ND (0.053)	30.6	MW06	87	RSL
Toluene	ND (0.078)	449	MW06	200	Child Int. EMEG

Gulf States Utilities 2011 Groundwater

Xylene (total)	ND (0.123)	595	MW06	2,000	Child Chronic EMEG
Benzo(a)pyrene	ND (0.043)	14.4	MW06	0.0048	CREG
Dibenzo(a,h)anthracene	ND (0.026)	0.782	MW06	0.0029	RSL
Benzo(a)anthracene	ND (0.033)	17.9	MW06	0.029	RSL
Acenaphthene	ND (0.022)	179	MW06	6000	Child Int. EMEG
Phenanthrene	ND (0.026)	204	MW06	180	RECAP GW SS ^{†††}
Fluorene	ND (0.033)	112	MW06	400	Child RMEG
Naphthalene	ND (0.052)	1810	MW06	200	Child RMEG
Anthracene	ND (0.024)	54.9	MW06	100,000	Child Int. EMEG
Pyrene	ND (0.024)	68.9	MW06	300	Child RMEG
Benzo(ghi)perylene	ND (0.034)	4.52	MW06	NA	NA
Indeno(1,2,3-cd)pyrene	ND (0.019)	4.91	MW06	0.029	RSL
Benzo(b)fluoranthene	ND (0.019)	11.4	MW06	0.029	RSL
Fluoranthene	ND (0.015)	44.3	MW06	400	Child RMEG
Benzo(k)fluoranthene	ND (0.026)	3.61	MW06	0.29	RSL
Acenaphthylene	ND (0.058)	50.3	MW06	100	RECAP GW SS
Chrysene	ND (0.018)	18.1	MW06	2.9	RSL

* ppb =parts per billion

† CV=comparison value

‡ ND = not detected; value in parentheses is the method detection limit

§ RMEG = Reference dose Media Evaluation Guide

** MCL = Maximum Contaminant Level

†† CREG = Cancer Risk Evaluation Guide

‡‡ EMEG = Environmental Media Evaluation Guide

§§ RSL = Regional Screening Level

*** Int. = Intermediate

††† NA = Not applicable

††† RECAP GW SS = Louisiana Department of Environmental Quality's Risk Evaluation/Corrective Action Program Groundwater Screening Standards

Table B-5: Ranges of analytes detected in groundwater sampled from monitoring wells at the Gulf States Utilities site in November 2011
(Contaminant concentrations exceeding their screening values are listed in bold red)

Contaminant	Range of concentrations detected (ppb [*])		Sample source, Maximum	CV [†] (ppb)	CV reference
	Minimum	Maximum			
Nitrate	ND (3 [‡])	58	MW11	16,000	Child RMEG [§]
Nitrate plus Nitrite (as N)	ND (2)	68	MW11	10,000	MCL ^{**}
Arsenic	ND (3.5)	45	MW11	0.023	CREG ^{††}
Barium	22	2,180	MW07	2000	Child Chronic EMEG ^{‡‡}
MN (Manganese)	570	6,740	MW10	500	Child RMEG
Total Manganese	600	7,080	MW10	500	Child RMEG
Fe (Iron)	ND (27)	83,900	MW07	11000	RSL ^{§§}
Total Iron	520	81,300	MW07	11000	RSL
Chloroform	ND (0.062)	27.3	MW06	100	Child Chronic EMEG
Benzene	ND (0.049)	2,100	MW06	0.64	CREG
Naphthalene	ND (0.175)	7,330	MW06	200	Child RMEG
Benzene, 1,2,4-trimethyl	ND (0.08)	115	MW06	15	RSL
Benzene, 1-methylethyl	ND (0.058)	23.6	MW06	1,000	Child RMEG
Ethylbenzene	ND (0.18)	767	MW06	1000	Child RMEG
n-Propylbenzene	ND (0.069)	1.62	MW09	530	RSL
Benzene, 1,3,5-trimethyl	ND (0.053)	39	MW06	87	RSL
Toluene	ND (0.078)	541	MW06	200	Child Int. ^{***} EMEG
Xylene (total)	ND (0.123)	579	MW06	2,000	Child Chronic EMEG
Benzo(a)pyrene	ND (0.045)	517	MW06	0.0048	CREG
Dibenzo(a,h)anthracene	ND (0.028)	40.2	MW06	0.0029	RSL
Benzo(a)anthracene	ND (0.035)	638	MW06	0.029	RSL

Gulf States Utilities 2011 Groundwater

Acenaphthene	ND (0.023)	1260	MW06	6000	Child Int. EMEG
Phenanthrene	ND (0.027)	3090	MW06	180	RECAP GW SS ^{†††}
Fluorene	ND (0.034)	1640	MW06	400	Child RMEG
Naphthalene	ND (0.054)	6620	MW06	200	Child RMEG
Anthracene	ND (0.025)	930	MW06	100,000	Child Int. EMEG
Pyrene	ND (0.025)	1800	MW06	300	Child RMEG
Benzo(ghi)perylene	ND (0.035)	228	MW06	NA ^{†††}	NA
Indeno(1,2,3-cd)pyrene	ND (0.02)	204	MW06	0.029	RSL
Benzo(b)fluoranthene	ND (0.02)	344	MW06	0.029	RSL
Fluoranthene	ND (0.016)	1180	MW06	400	Child RMEG
Benzo(k)fluoranthene	ND (0.027)	128	MW06	0.29	RSL
Acenaphthylene	ND (0.061)	1020	MW06	100	RECAP GW SS
Chrysene	ND (0.019)	439	MW06	2.9	RSL

* ppb =parts per billion

† CV=comparison value

‡ ND = not detected; value in parentheses is the method detection limit

§ RMEG = Reference dose Media Evaluation Guide

** MCL = Maximum Contaminant Level

†† CREG = Cancer Risk Evaluation Guide

†† EMEG = Environmental Media Evaluation Guide

§§ RSL = Regional Screening Level

*** Int. = Intermediate

††† RECAP GW SS = Louisiana Department of Environmental Quality's Risk Evaluation/Corrective Action Program Groundwater Screening Standards

††† NA = Not applicable

Table B-6: Ranges of analytes detected in surface water sampled from the Calcasieu River near the Gulf States Utilities site in September 2011

Contaminant	Range of concentrations detected (ppb [*])		Sample source, Maximum	CV [†] (ppb)	CV reference
	Minimum	Maximum			
Barium	67	82	SW-2	2000	Child Chronic EMEG [‡]
Acetone	1.22	1.27	SW-3	20000	Child Int. [§] EMEG
Naphthalene	ND (0.175 ^{**})	0.979	SW-1	200	Child RMEG ^{††}
Phenanthrene	ND (0.026)	0.332	SW-2	180	RECAP GW SS ^{‡‡}
Anthracene	ND (0.024)	0.169	SW-2	100,000	Child Int. EMEG
Pyrene	ND (0.024)	0.185	SW-2	300	Child RMEG
Fluoranthene	ND (0.015)	0.113	SW-2	400	Child RMEG

* ppb =parts per billion

† CV=comparison value

‡ EMEG = Environmental Media Evaluation Guide

§ Int. = Intermediate

** ND = not detected; value in parentheses is the method detection limit

†† RMEG = Reference dose Media Evaluation Guide

‡‡ RECAP GW SS = Louisiana Department of Environmental Quality's Risk Evaluation/Corrective Action Program Groundwater Screening Standards

Table B-7: Ranges of analytes detected in water sampled from city wells near the Gulf States Utilities site in September 2011

Contaminant	Range of concentrations detected (ppb [*])		Sample source, Maximum	CV [†] (ppb)	CV reference
	Minimum	Maximum			
Barium	210	360	G-10	2000	Child Chronic EMEG [‡]
Pyrene	ND (0.024 [§])	0.041	G-8	300	Child RMEG ^{**}
Fluoranthene	ND (0.015)	0.055	G-8	400	Child RMEG

* ppb =parts per billion

† CV=comparison value

‡ EMEG = Environmental Media Evaluation Guide

§ ND = not detected; value in parentheses is the method detection limit

** RMEG = Reference dose Media Evaluation Guide