SITE INSPECTION

Mossville
North of Highway 90
Sulphur and Westlake, Calcasieu Parish, Louisiana
LAN000607014

Prepared in cooperation with the
U.S. Environmental Protection Agency, Region 6

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SIGNATURE PAGE

______________________________________ ____________________
David Anderson — Date
Dynamac START Project Manager

______________________________________ ____________________
Debra Pandak — Date
Dynamac START Program Manager

______________________________________ ____________________
Brenda Nixon Cook — Date
U.S. Environmental Protection Agency
Site Assessment Manager

PROJECT CONTACTS

Brenda Nixon Cook
Site Assessment Manager
U.S. Environmental Protection Agency, Region 6
Superfund Division (6SF-TR)
1445 Ross Avenue; Suite 1200
Dallas, Texas 75202
(214) 665-7436

Debra Pandak
Program Manager
Dynamac START
1202 Executive Drive West
Richardson, TX 75081
(214) 575-3344 ex. 11

David Anderson
Project Manager
Dynamac START
1202 Executive Drive West
Richardson, TX 75081
(214) 757-3344 ex. 16

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ABBREVIATIONS AND ACRONYMS

µg/Kg	micrograms per kilogram
µg/L	micrograms per liter
AI	Areas of Investigation
AOI	Area of Interest
ATSDR	Agency for Toxic Substances and Disease Registry
bgs	below ground surface
CAA	Clean Air Act
CDD	chlorinated dibenzodioxin
CDF	chlorinated dibenzofuran
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CLP	Contract Laboratory Program
CRQL	Contract Required Quantitation Limit
DQO	Data Quality Objective
ELCR	Estimated Lifetime Cancer Risk
EPA	United States Environmental Protection Agency
ERT	Environmental Response Team
FEMA	Federal Emergency Management Agency
gpm	gallons per minute
GPS	Global positioning system
HpCDD	Heptachlorodibenzo-p-dioxin
HRS	Hazard Ranking System
Hwy	Highway
HxCDD	Hexachlorodibenzo-p-dioxin
HxCDF	Hexachlorodibenzofuran
IDW	Investigation Derived Waste
LA	Louisiana
LDEQ	Louisiana Department of Environmental Quality
LDHH	Louisiana Department of Health and Hospitals
LDOT	Louisiana Department of Transportation
MCL	Maximum Contaminant Level

MEAN	Mossville Environmental Action Now
mg/kg	Milligrams per Kilogram
msl	mean sea level
MS/MSD	Matrix Spike/Matrix Spike Duplicate
ng/kg	nanograms per kilogram
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
OCDD	Octachlorodibenzo-p-dioxin
ORP	oxidation reduction potential
PAH	polynuclear aromatic hydrocarbon
PARCC	Precision, accuracy, representativeness, comparability and completeness
PCB	polychlorinated biphenyl
PCD	polychlorinated dioxin
PDF	polychlorinated furan
PE	performance evaluation
PeCDD	Pentachlorodibenzo-p-dioxin
PeCDF	Pentachlorodibenzofuran
PEST	Pesticide
pg/g	Picograms per gram
pg/L	Picograms per Liter
ppb	Parts per billion
PPE	Probable point of entry
Ppm	Parts per million
ppq	Parts per quadrillion
ppt	Parts per trillion
PRG	Preliminary Remediation Goal
QA	Quality assurance
QA/QC	Quality assurance/quality control
QC	Quality control
QASP	Quality Assurance Sampling Plan
RCRA	Resource Conservation and Recovery Act
Rd	Road
RI/FS	Remedial Investigation/Feasibility Study

SAM	Site Assessment Manager
SARA	Superfund Amendments and Reauthorization Act
SDG	sample delivery group
SI	Site Inspection
SOP	Standard Operating Procedure
SSL	Soil Screening Level
START	Superfund Technical Assistance and Response Team
SVOC	Semi-volatile Organic Compound
TAL	Target Analyte List
TCDD	Tetrachlorodibenzo-p-dioxin; 2,3,7,8-tetrachlorodibenzo-p-dioxin
TCL	Target Compound List
TDD	Technical Direction Document
TDL	Target distance limit
TDS	Total dissolved solids
TEF	Toxicity Equivalency Factor
TEQ	Toxicity Equivalent Quotients
TPH	Total Petroleum Hydrocarbons
ug/kg	Micrograms per kilogram
VOC	volatile organic compound

1 INTRODUCTION

The Dynamac Corporation (Dynamac) Superfund Technical Assessment and Response Team (START) was tasked by the United States Environmental Protection Agency (EPA) Region 6 under Technical Direction Document (TDD) No. TO-0009-09-08-01, to conduct a Site Investigation (SI) at the Mossville site located in Sulphur and Westlake, Calcasieu Parish, Louisiana. This SI was conducted under authority of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and the Superfund Amendments and Reauthorization Act of 1986 (SARA). The purpose of this investigation was to collect information concerning conditions at the Mossville site sufficient to assess the threat posed to human health and the environment and to determine the need for additional investigation under CERCLA or other authority, and, if appropriate, support site evaluation using the Hazard Ranking System (HRS) for proposal to the National Priorities List (NPL).

Completion of the SI included reviewing existing site information, determining regional characteristics, collecting receptor information within the range of site influence, executing a sampling plan, and producing this report. The report is organized as follows:

- Section 1, Introduction – authority for performance of this work, goals for the project, and summary of the report contents;
- Section 2, Background – site description, site operations and waste characteristics, and a summary of investigation locations;
- Section 3, Field Activities and Analytical Protocol – Summary of the field effort;
- Section 4, Quality Assurance/Quality Control (QA/QC) – Summary of the laboratory data;
- Section 5, Analytical Results Evaluation – Discussion of results reporting criteria.
- Section 6, Background Samples – Discussion of background sample locations and analytical results;
- Section 7, Potential Sources – Discussion of site sources, sample locations, and analytical results;

- Section 8, Migration/Exposure Pathways and Receptors – Discussion of the migration/exposure pathways, sample locations, and analytical results;
- Section 9, Summary and Conclusions – summary of the investigation and recommendation for the site based on the information gathered during the investigation;
- Section 10, References – Alphabetical listing of the references cited throughout the text;
- Appendix A, Photographic Documentation – Photographs taken during the sampling event and site visit;
- Appendix B, Chain-of-Custody Forms – forms documenting sample chain-of-custody for the sampling event;
- Appendix C, Data Validation Memoranda – laboratory results and quality assurance evaluation for all samples;
- Appendix D, Global Positioning System (GPS) Coordinates – latitude and longitude coordinates of sample locations;
- Appendix E, Access Agreements;
- Appendix F, Drinking Water Receptor Calculations; and
- Appendix G, Chronology of Events, Mossville, Calcasieu Parish, Louisiana.

2 SITE BACKGROUND

This section describes the background of the site including location, description, ownership history, operations and source characteristics, previous investigations, and a summary of the site investigation locations.

2.1 SITE LOCATION

Site Name: Mossville

CERCLIS ID No.: LAN000607014

Location: Sulphur and Westlake, Calcasieu Parish, Louisiana

Latitude: 30.248590^{o}N

Longitude: 93.304523^{o}W

Legal Description: There are over 1,600 properties within the Mossville Area of Interest (AOI).

Congressional District: Louisiana 7th.

Site Owner: Multiple owners.

Site Contact: See the access agreements (Appendix E) for contact information for the individual property owners.

2.2 SITE DESCRIPTION

The AOI in Mossville consists of residential communities located west and northwest of the concentration of chemical plants in Westlake and northern Lake Charles, Louisiana (Figures 1 and 2). The site is predominately residential, with areas of woodlands and a few commercial properties/businesses (Figure 2). The AOI encompasses the properties along Old Spanish Trail/Burton Road (Rd.), Prater Rd., Evergreen Rd., and LA 108N Cities Service Highway (Hwy.). The area is roughly bounded by the KCS Railroad tracks on the south, VCM Plant Rd. on the east, Junius Rd. on the west, and Village Orphanage on the north. Old Spanish Trail/East Bruton Rd. passes thru the Mossville AOI, providing the primary access to the area

(Figures 1 and 2). The AOI is approximately 1.5 square miles in size, measured from the topographic maps (Ref. 5). The latitude and longitude measurements were made at the Rigmaiden Recreation Center which is located in the central area of the AOI.

2.3 SITE OWNERSHIP HISTORY

There are over 1,600 properties within the AOI, the majority of the properties are privately owned. In the Bel Air Subdivision, the easternmost portion of the Mossville AOI, bounded by Rigmaiden Rd., Old Spanish Trail Rd., VCM Plant Rd., and 7th/8th Street, the majority of the lots (295 of 329) are currently owned by Sasol North America (Ref. 6). The lots were purchased by Condea Vista (which became Sasol) between 1998 and 2004 as part of a buyout from a class action lawsuit (Ref 7, p. 23). The majority of the structures were removed by 2004 (Ref. 8). Access to many of the streets in this area are blocked. Brush and trees have overgrown the vacant lots. A limited number of the lots appear to be used for residences or horse barns. Lots west of the Bel Air Subdivision are in use as private residences.

Industrial development in the Lake Charles area began after the discovery of petroleum and gas reserves in the area in the 1920's (Ref. 9, p. 9). Chemical plants/refineries operated by Georgia Gulf, Sasol North America, and ConocoPhillips are located adjacent to the eastern boundary of the Mossville AOI (Ref.10). Other industrial facilities southeast of Mossville include Air Liquide, Arch Chemicals Corp., BioLab, CertainTeed Products, Lyondell Chemical Co., Matheson Tri-Gas Inc., Olin Chemical Co., TDC-LLC, Air Products and Chemicals Inc., Praxair Inc., PPG Industries, Tessenderlo Kerley Inc., and Tetra Chemicals (Figure 3, Ref. 10). The Entergy Roy S. Nelson power plant is located north-northeast of Mossville (Ref. 11, p. ii).

2.4 SITE OPERATIONS AND SOURCE CHARACTERISTICS

Mossville is a residential community; there is no direct regulatory involvement by either the EPA or Louisiana Department of Environmental Quality (LDEQ). The surrounding industrial facilities operate under Clean Air Act (CAA) and National Pollution Discharge Elimination System (NPDES) permits, and solid wastes are regulated under the Resource Conservation and Recovery Act (RCRA).

2.4.1 Areas of Investigation

Mossville is a residential community located adjacent to an industrial area of Lake Charles. The areas of investigation (AI) within the Mossville AOI consist of soil potentially contaminated by deposition from air emissions from nearby chemical plants. Residents of the community have expressed concerns regarding the long term exposure to industrial chemicals that may have migrated from the surrounding plants. These chemicals may include: 1,1-dichloroethane, 1,2-dichloroethene, 1,1-dichloropropene, 1,1,2-trichloroethene, 1,1,2,2-tetrachloroethane, 1,2-dibromo-2-chloropropane, 1,2-dichloroethane, cis-1,2-dichloroethene, trans-1,2-dichloroethene, 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, 1,2,4-trichlorobenzene, 1,2,3-trichloropropane, 2-chlorotoluene, 4-chlorotoluene, benzene, chlorobenzene, chloroethane, chloroform, ethyl benzene, isopropylbenzene, naphthalene, tetrachloroethene, trichloroethene, toluene, o-xylene, m,p-xylene, and vinyl chloride (Refs. 12, 13, 15, and 16). Dioxins and furans are also released from the plants per their Toxic Release Inventories. A limited number of soil samples have been collected during Agency for Toxic Substances and Disease Registry (ASTDR) Exposure Investigations; however, chemical analysis of collected samples was limited to dioxins and furans. Dioxins have been detected in soil samples within the Mossville AOI; however, dioxin concentrations are generally within the range of samples collected within other areas of Calcasieu Parish, and may not be elevated in comparison to the natural background levels (Ref. 21).

Groundwater contamination has been documented in various aquifers/zones at the Sasol North America, Georgia Gulf, and ConocoPhilips facilities, including the “10 foot” sand, “20 foot” sand, “50 foot” sand, “80 foot” sand and “200 foot” sand units (Ref. 12; Ref. 13; Ref. 14; Ref. 15; Ref. 16) (Figure 4). Natural groundwater flow is typically to the south or southwest, however regional flow is often impacted by the proximity of the bayous and rivers, as well as by tidal actions, especially within the shallowest zones (Ref. 13, pp. 3-5). Based on the typical flow, the Sasol and Georgia Gulf facilities would be the most likely contributors to potential groundwater contamination in the AOI. Since the ConocoPhillips facility is downgradient of the AOI, it is not likely to contribute to groundwater contamination. Plumes from the SASOL facility which underlie the AOI contain 1,2-dichloroethane, 1,1-dichloroethene, 1,1,2-trichloroethane, trichloroethene, 1,1-dichloroethane and vinyl chloride (Ref. 12, Ref 13). Active groundwater contamination remediation programs are currently in operation at both the Sasol and ConocoPhillips facilities. Pumping for these remediation programs has also impacted groundwater flow directions, in some cases reversing the natural flow from the south to the north.

Allegations have also been made by residents that wastes were deposited in various areas within the AOI, including ponds and other discrete areas. EPA solicited input from residents during public meetings held on January 21 and April 12, 2010, allowing residents to identify the possible disposal locations on maps.

2.5 PREVIOUS INVESTIGATIONS

Appendix G is a timeline of investigation activities conducted in Mossville. In 1997, EPA requested that ATSDR conduct a health consultation on samples provided by a resident of Calcasieu Parish (Ref. 17, p. 2). Blood samples from eleven residents living in the Mossville/Bayou d'Inde area, one composite (pooled) blood sample reportedly from 100 individuals, nine sediment samples from unspecified locations, and one composite biota (clam) sample from the north beach on Lake Charles were collected as part of the study (Ref. 17, p.2). Samples were analyzed for polychlorinated dioxins and furans (PCD and PCF) and for nine polychlorinated biphenyl (PCB) congeners (Ref. 17, p. 2). Three of the eleven individual blood samples had 2,3,7,8-tetrachlordibenzo-p-dioxin (TCDD), Toxicity Equivalency Quotients (TEQs), or TEQs+PCBs greater than the reference ranges utilized in the study (Ref. 17, p. 6). The pooled composite blood sample also had TCDD and TEQ concentrations greater than the reference values (Ref. 17, p. 6). Sediment concentrations ranged from 0.0027 to 2.958 parts per billion (ppb) dry weight. The one sediment sample exceeding one ppb was collected on the north shore of Bayou D'Inde (Ref. 17, p. 5). The concentration of dioxin TEQ of the clam sample was 0.24 parts per trillion (ppt), wet weight, which did not exceed concentrations in samples collected from reference locations (Ref. 17, pp. 5, 7). ATSDR concluded that the dioxin concentrations in the sediments and clams did not present a public health hazard. ATSDR concluded that the dioxin levels in the three blood samples were higher than the reference ranges and recommended additional investigation to determine the source (Ref. 17, p. 10).

Based on the analytical results of the 1997 samples, ATSDR conducted an Exposure Investigation in 1998, collecting blood samples from 28 residents, four surface soil (0-3 inches below ground surface [bgs]) samples from three residences, two chicken egg samples and one breast milk sample (Ref. 7, p. 3). Samples were analyzed for dioxins and PCBs (Ref. 7, p. 3). The ATSDR discussion indicates that the samples were collected primarily from the Bel Air Subdivision, immediately adjacent to the SASOL chemical plant along VCM Plant Road (Ref. 7, p. 4). Samples were analyzed for the dioxins, furans and PCBs with TCDD-like activity (Ref. 7, pp. 4-5). TEQ concentrations in the blood samples ranged from 3.8 to 188 ppt on a lipid adjusted basis. Median and mean TCDD-TEQs for the samples exceeded the 95^{th} percentile of a comparison population (Ref. 7, pp. 6). Soil sample concentrations ranged from 0.0006 to 0.028 ppb, however the lowest concentration sample may not be representative of the soil since it was collected from a location where sand had been placed over the native soil (Ref. 7, p. 11). The breast milk sample contained 13.5 ppt of TCDD-TEQ on a lipid-adjusted basis. The eggs contained 1.76 - 2.09 picogram/gram (pg/g) of TCDD-TEQ on a lipid-adjusted basis (Ref. 7, p. 11). ATSDR concluded that the blood levels of the residents participating in the study were elevated and that older residents (greater than 47 years of age) were the most likely to have elevated levels, however the blood levels were unlikely to be associated with known clinical health effects (chloracne or elevated liver enzyme levels). Dioxin TEQ levels in the breast milk sample were not considered to be elevated, and the soil and egg concentrations were not at levels of health concern.

In May 1999, the Louisiana Department of Health and Hospitals (LDHH) District 5 office, under a grant from the USEPA, collected samples from the Mossville Public Water System for analysis for dioxins and furans. Samples were collected based on the elevated dioxin levels found in the previous ATSDR blood survey to determine if drinking water was a source. Dioxin and furans were not detected in the samples at concentrations above the quantitation limit of 10 pg/L (parts per qualdrillion [ppq]), which is less than the health based standard of 30 ppq (Ref. 74, p. 1).

Beginning in 1999, EPA conducted a Remedial Investigation/Feasibility Study (RI/FS) of the Calcasieu Estuary, to "address threats to human health and the environment related to uncontrolled releases of organic and inorganic chemicals to the estuary" (Ref. 18, p. 1). The study area extended from the saltwater barrier north of Lake Charles to Moss Lake, and included both Bayou Verdine and Maple Fork Bayou, which receive surface drainage from the AOI (Ref. 18, p. 1). Objectives of the RI/FS included identification of contaminants of potential concern within the estuary, conduct a statistically-based sediment and surface water program to support reporting and risk assessments, determine and evaluate contaminant gradients in the sediments, collect biota samples to characterize potential impacts of selected fauna, and assess the risk to human health and ecological receptors (Ref. 18, p. 2). While Bayou Verdine is a source of contamination to the Upper Calcasieu Estuary, the upper reaches of the bayou which pass through the AOI were determined to be relatively un-impacted by industry (Ref. 18, p. 24). Contaminants detected in water and sediment samples from Bayou Verdine included polynuclear aromatic hydrocarbons (PAHs), volatile organic compounds (VOCs), dioxins and metals. Maple Fork originates in the western portion of the AOI and flows south to its confluence with Bayou d' Inde (Ref. 18, p. 60). Sampling during the RI/FS did not extend into the AOI, although elevated levels of contaminants (dioxins, PAHs, PCBs and metals) were detected downstream (Ref. 18. pp. 19-20). There are no major contaminant sources in Maple Fork Bayou (Figure 4). The lower reaches of Bayou Verdine are being addressed by Conoco-Phillips and Sasol under Superfund authority with EPA oversight. The West Ditch area was addressed under a time-critical removal action in 2002 that removed high concentrations of VOCs in Bayou Verdine. On October 12, 2010, a consent decree that will require Conoco-Phillips and Sasol to address PAH contamination in the lower reaches of Bayou Verdine was lodged in federal district court. The consent decree requires the companies to perform clean-up work of hazardous substances along Bayou Verdine (estimated to cost $10 million) and to reimburse government response costs of approximately $4.5 million (Ref. 75).

ATSDR conducted Health Consultations using the contaminants of concern from the surface water and sediment samples collected during the RI/FS (Ref. 19; Ref. 20). For the water, ATSDR concluded that: “there is no public health hazard involved with skin contact or ingestion of water in the Calcasieu Estuary during recreational exposure” (Ref. 19, p. 4). ATSDR also concluded that: “Residential exposure to these waters is unlikely because the estuary does not serve as the Parish’s main water source” (Ref. 19, p. 5). For the sediments, ATSDR concluded: “that there is no apparent public health hazard from recreation exposures to sediments from the Calcasieu Estuary” (Ref. 20, p. 5).

In 2001, ATSDR conducted a Follow-Up Exposure Investigation in the Mossville area (Ref. 21). Included in this investigation were blood serum samples from five of the eleven persons who provided blood samples in 1997, and 17 of the 28 persons who provided blood samples in the 1998 exposure investigation. In addition, 20 soil (19 locations), 18 indoor dust, 14 attic dust and three water wells samples were collected, as well as nine vegetable/fruit/nut samples produced in the area and eight fish caught by area residents (Ref. 21, p. 2-3). Only two of the soil, indoor dust and attic dust sample locations were within the Mossville AOI; the remaining locations were located throughout the general Lake Charles area (Ref. 21). Three of the soil sample locations were located in communities outside of the Lake Charles area, and served as background locations (Ref. 21). There were no water well samples collected within the Mossville AOI as part of this study (Ref. 21). Samples were analyzed for dioxins and PCBs (Ref. 21, p. 3). Lipid-adjusted serum total dioxin TEQs for the blood samples ranged from 4.1 to 245.2 ppt (Ref. 21, p. 11). Total dioxin TEQs for the soil samples ranged in concentration from 0.09 to 19.26 ppt (Ref. 21, p. 13). Concentrations in the two soil samples collected within the AOI were 1.22 ppt and 6.47 ppt (Ref. 12). Total dioxin TEQs for the indoor dust samples ranged from 0.26 to 83.13 ppt (Ref. 21, p. 13), with concentrations in the two samples collected within the AOI at 8.44 ppt and 8.85 ppt (Ref. 21, p. 21). Total dioxin TEQs for the attic dust samples ranged from 0.32 to 922.77 ppt (Ref. 21, p. 13), with concentrations in the two samples collected within the AOI at 16.63 ppt and 143.35 ppt (Ref. 21). Dioxins were not detected in the well water samples (Ref. 21, p. 13). ATSDR concluded that blood dioxin concentrations were elevated in many of the participants, although the concentrations had decreased between their initial and follow-up samplings. Older residents were more likely to have elevated blood dioxin levels, attributable to historical exposures. Blood dioxin concentrations are unlikely to produce the known clinical health effects of chloracne and elevated liver enzymes (Ref. 21, p. 38). Dioxin concentrations in surface soil, indoor dust, well water and the homegrown produce were not at levels of concern (Ref. 21, p. 38).

In 2001 and 2002, ATSDR conducted a study of the serum dioxin levels of residents in Calcasieu Parish (Ref. 9), targeting the industrial corridor around the Calcasieu Estuary, a buffer zone surrounding the industrial corridor, and an outer ring of towns approximately six miles from the corridor (Ref. 9, pp. 13-14). Results were compared to the results from Lafayette Parish, located east of Calcasieu Parish (Ref. 9, p. 14). ATSDR concluded that the mean serum dioxin TEQ levels of residents of Calcasieu and Lafayette Parishes were similar (Calcasieu Parish 16.7 ppt male, 23.0 ppt female; Lafayette Parish 20.5 ppt male, 20.1 ppt female), and that dioxin levels increased with age and length of residence (age 15 to 29 - 8.4 ppt, age 30 to 44 - 14.3 ppt, age 45 to 59 - 18.7 ppt, age >60 - 36.9 ppt) (Ref. 9, pp. 21-22, 30). Residents of both parishes had similar mean serum dioxin TEQ levels versus a combined data set developed for comparison. Residents in the industrial corridor also had similar serum dioxin concentrations as the residents in the two zones further from the plant sites (industrial corridor -19.7 ppt male, 19.3 ppt female; industrial buffer - 15.7 ppt male, 25.8 ppt female; outer ring - 19.1 ppt male, 15.1 ppt female) (Ref. 9, p. 30). ATSDR concluded that levels among the youngest age group were not elevated, suggesting that no unusual dioxin exposure is currently occurring. ATSDR also concluded that the dioxin congener profile is similar in both parishes (Ref. 9, p. 21).

In September 2006, Mossville Environmental Action Now (MEAN), The Subra Company, and Advocates for Environmental Human Rights released “Industrial Sources of Dioxin Poisoning in Mossville – A Report on the Facts that Governmental Agencies Have Hidden”, which was revised in July, 2007 (Ref. 11). This document provides an alternate interpretation of the results from the ATSDR studies.

On August 21, 2009, groundwater samples were collected from five locations within the Mossville distribution system and analyzed for volatile and semi-volatile organics and total metals (Ref. 72). Metals were detected in the drinking water samples; however, concentrations did not exceed the National Primary Drinking Water Maximum Contaminant Levels (MCL) (Ref. 73, Ref. 76). Low concentrations of trihalomethanes were detected in the samples (Ref. 72). Trihalomethanes are found in treated water supplies (Ref. 73, p. 3).

2.6 SI PLANNING

2.6.1 Community Involvement

Community involvement in the SI has been extensive, beginning with a meeting held with the community on January 21, 2010 to discuss the planned assessment of the community. A basic explanation of the Superfund process was presented to the community and the community was asked to provide input. ATSDR conducted a series of health related workshops for the Mossville community in March and April of 2010. The draft Preliminary Assessment and draft sampling plan were posted on EPA web site for the community to review and on April 13, 2010, a meeting was held by EPA in the community to discuss the draft of the Preliminary Assessment, to provide the community with an overview of the proposed sampling plan, an opportunity to comment on the sampling plan and to provide locations of areas of interest within the community to be sampled. Solicitation of access agreements to properties for sampling were initiated during this meeting. Mossville Environmental Action Now (MEAN) assisted in obtaining access agreements for residential. The EPA SAM hosted an informal question and answer session with the residents on April 26, 2010, prior to the field sampling that began that week. On June 30, 2010, EPA held a conference call with community representatives to discuss the problems with the dioxin data and outlined their plans for re-sampling. On August 2, 2010, letters detailing the results of the April sampling were sent by EPA to the owners of the properties samples, as well as a fact sheet indicating the need for the re-sampling for dioxin analysis. On August 16, 2010, EPA held a meeting in the community to discuss the results of the April sampling in regards to the Superfund Site Assessment process and preliminary results of the evaluation of the Mossville Water System, indicating that chemically, the water produced by the system was safe to drink.

2.6.2 SUMMARY OF SI INVESTIGATION LOCATIONS

In order to obtain representative soil samples from the entire AOI, EPA solicited access agreements from property owners during public meetings held on January 21 and April 12, 2010; through mailings; and with the assistance of MEAN. The AOI was divided into sixteen blocks. Approximately three locations, with access agreements, within each block were selected for soil sampling. Areas that the public alleged to have received wastes were also targeted for sampling. Due to residents' concern regarding the quality of the water provided by the water district, sampling was conducted at the wells providing water to the system, as well as at several residences and monitoring taps within the system. Fish sampling from the ponds was added after the public indicated that residents catch and consume fish from the ponds. Comments received on the EPA Quality Assurance Sampling Plan (QASP) for the EPA schedule sampling event in Mossville resulted in soil gas sampling being added. Soil gas sampling was added at residences in the vicinity of the known groundwater plume to assess possible impact of the contaminated groundwater.

EPA Region 6 START conducted sampling at residences/properties and from the water system within the Mossville AOI from April 26 to May 1, 2010. START was accompanied during the sampling by Brenda Nixon Cook, EPA Site Assessment Manager (SAM), Beverly Negri, EPA Community Involvement and Bill Little, EPA Community Involvement. Sampling teams were accompanied by representatives of MEAN and by industry representatives. Groundwater samples were collected from the two public supply wells and from two residential wells. Water samples were collected from five monitoring taps on the distribution system, and from 34 residences served by the water system. Surface water and sediment samples were collected from three ponds in the AOI. Soil samples were collected from 45 properties within the AOI. Soil gas samples were collected at 5 properties between May 12 and May 19, 2010. Three water samples were collected from residential properties on May 12 and 13, 2010. A single fish sample was collected by START on May 20, 2010. Aqueous and solid Performance Evaluation (PE) samples were provided to the dioxin and furan analytical laboratory. Dioxin and furan results from the sampling effort were rejected during Quality Assurance (QA) review due to improper laboratory documentation procedures.

EPA Region 6 START conducted re-sampling for dioxin and furan analysis on August 16 through August 20, 2010. START was accompanied during the sampling by EPA representatives Brenda Nixon Cook, Beverly Negri, and Bill Little. Sampling teams were accompanied by representatives of MEAN and by industry representatives. Groundwater samples were collected from the two public supply wells. Water samples were collected from five monitoring taps on the distribution system and from eight residences on the water system. Surface water and sediment samples were collected from the three ponds. Soil samples were collected from 49 properties, including 6 properties not previously sampled. Additional samples were collected at two properties previously sampled to further characterize the properties. Owners of three properties sampled in April declined to participate in the re-sampling effort. Split samples were provided to MEAN from five of the properties. PE samples were provided to the analytical laboratory. The following table lists the samples collected by analysis and matrix.

Table 1 - Number of Samples Collected

Matrix/ Analysis	Groundwater	Municipal Water	Residential Water	Surface Water	Sediment	Soil	Fish	Soil Gas	QC
Metals	6	5	36	4	4	50	1	0	0
VOC	6	5	36	4	4	50	0	10	2
SVOC	6	5	36	4	4	50	0	0	0
Pest	6	5	36	4	4	50	1	0	0
PCB	6	5	36	4	4	50	1	0	0
Dioxins	8	11	16	4	8	111	1	0	5
Coliforms	5	5	39	4	0	0	0	0	0

Table 2 lists all of the samples that were collected during the two sampling events.

3 FIELD ACTIVITIES AND ANALYTICAL PROTOCOL

The QASP for Mossville, Sulphur-Westlake, Calcasieu Parish, Louisiana for the Mossville AOI was developed by the Dynamac START prior to initiating field sampling (Ref. 22). An amendment to the QASP was submitted prior to the August re-sampling effort (Ref. 23). The QASP describes the sampling strategy, sampling methodology, and analytical program used to investigate potential hazardous substance sources and potential receptors. With few exceptions the field activities were conducted in accordance with the approved QASP. Deviations from the QASP are described, when applicable, in this section and in the sampling location discussions in Section 7 (Source Areas) and Section 8 (Receptors).

The initial field sampling event was conducted from April 26 through May 1, 2010. A total of 107 samples, including two background samples and 13 QA (field replicates and trip blanks) samples were collected during the sampling event. Sample types and methods of collection are described below. During the period May 12 to May 20, 2010, a total of 12 samples, including one background and two QA (field replicate and trip blank) samples were collected. The final field sampling event was conducted from August 16 through 20, 2010. A total of 86 samples, including two background and 10 QA (field replicates) samples were collected during this sampling event. Three properties sampled during the April sampling event did not elect to participate in the August sampling event. Five of the soil samples were split with MEAN. A list of all samples collected for laboratory analysis during this sampling event is contained in Table 2. Photographic documentation of the field activities is included as Appendix A.

Alphanumeric identification numbers applied to each sample location (e.g., MWW01) are used in the report as the sample location identifiers. Sample locations are shown in Figure 5.

This section describes sampling methodology, analytical protocol, global positions system, and investigation-derived waste.

3.1 SAMPLING METHODOLOGY

Grass, leaves and other vegetative material, rocks, and other debris unsuitable for analysis were removed from samples before being placed into sample containers. Samples were stored on ice in coolers continuously maintained under the custody of field personnel. Sampling methods used for each sample type are described below.

3.1.1 Groundwater Sampling

Groundwater samples from the two public supply wells and from two private wells were collected at the tap nearest the well before any treatment (Figure 5, Table 2). After establishing flow from the tap, the samples were collected directly into the pre-preserved sample containers. An aliquot of sample was collected for measurement of pH, temperature, conductivity, turbidity, total dissolved solids (TDS) and oxidation reduction potential (ORP) (Table 3, Ref. 25). After collection, the sample containers were placed in a cooler with ice for transport to the field command post for processing.

3.1.2 Distribution System and Residential Water Sampling

Water samples from five distribution system monitoring locations were sampled during both the April and August sampling events. Water samples were collected from 34 residential properties in April and from eight residential properties in August (Figure 5, Table 2). Samples were collected directly from taps at the sample locations. Some taps used for residential sample collection were located inside the homes, while others were located on the exterior of the building. After establishing flow from the tap, the samples were collected directly into the pre-preserved sample containers. An aliquot of sample was collected for measurement of pH, temperature, conductivity, turbidity, TDS and ORP (Table 3, Ref. 25). After collection, the sample containers were placed in a cooler with ice for transport to the field command post for processing.

3.1.3 Soil Gas Sampling

START installed 10 passive soil gas samplers obtained from Beacon Environmental Services, Inc. (Beacon) in 4 properties within the eastern portion of the Mossville AOI on May 12, 2010 (Figure 5, Table 2). Samplers were installed at a depth of approximately two (2) feet bgs.

Samplers were retrieved on May 19, 2010. The passive soil gas samplers were installed and retrieved according to Beacon's recommended installation/retrieval instructions (Ref. 26). A list of the target analytes and reporting limits is included in the Beacon instructions. After packaging, the samples were shipped to the Beacon laboratory for VOCs chemical analyses.

3.1.4 Surface Water Sampling

Surface water samples were collected from three ponds located within the Mossville AOI (Figure 5, Table 2). During the April 2010 sampling, samples were collected using a peristaltic pump directly into the sample containers (except metals/mercury) using EPA Environmental Response Team (ERT) Standard Operation Procedure (SOP) #2013 Surface Water Sampling as guidance. Samples for metals/mercury analysis were filtered using QED Quickfilter 0.5 micron filters discharging directly into the sample container. During the August 2010 sampling, samples were collected using a beaker on an extension pole with the sample being transferred directly into the sample container. An aliquot of sample was collected for measurement of pH, temperature, conductivity, turbidity, TDS and ORP (Table 3, Ref. 25). After collection, the sample containers were placed in a cooler with ice for transport to the field command post for processing.

3.1.5 Sediment Sampling

START collected sediment/soil samples from three ponds located within the Mossville AOI (Figure 5, Table 2). Using EPA ERT SOP #2016 Sediment Sampling as guidance, samples were collected using a bottom dredge to obtain material from the bottom of the ponds. The material was placed in stainless steel bowls and homogenized using pre-cleaned stainless steel trowels and placed directly into the sample containers. Aliquots for VOC analysis were collected using Environmental Sampling Supply Core N' One samplers. After collection, the sample containers were placed in a cooler with ice for transport to the field command post for processing.

3.1.6 Fish Sampling

The fish specimen was captured utilizing a baited hook from Pond C (Figure 5, Table 2). After capture, the specimen was placed on ice in a cooler for storage. The specimen was frozen solid before packaging and shipment to the analytical laboratory.

3.1.7 Soil Sampling

START collected soil samples from 45 locations on the site during the April sampling event and from 58 locations during the August sampling event (Figure 5, Table 2). Using EPA ERT SOP #2012 Soil Sampling as guidance, soil within the 0 to 12 inch bgs horizon was homogenized in place, except the VOC fraction, using pre-cleaned stainless steel trowels and placed directly into the sample containers. Aliquots for VOC analysis were collected using Environmental Sampling Supply Core N' One samplers. After collection, the sample containers were placed in a cooler with ice for transport to the field command post for processing.

3.2 ANALYTICAL PROTOCOL

Analytical protocols applied to the SI samples included off-site fixed laboratory analysis of:

- Target Analyte List (TAL) Total Metals + Mercury: Contract Laboratory Program (CLP) ILM01.2
- TAL Dissolved Metals + Mercury: CLP ILM01.2
- Target Compound List (TCL) Semi-volatile Organic Compounds (SVOC): CLP OLM04.2- water, SOM01.2 – soil/sediment
- TCL VOCs: CLP OLM04.2- water, SOM01.2 – soil/sediment
- TCL Pesticides (PEST): CLP OLM04.2- water, SOM01.2 – soil/sediment.
- TCL PCB as Aroclors: CLP OLM04.2- water, SOM01.2 – soil/sediment.
- Dioxins and Furans: CLP DLM02.2
- Fecal and total coliforms and E. coli: SM21 9222B and 9222D
- Total Metals + Mercury, PEST, PCB, Dioxins and Furans in Tissue: SW846 methods 6010B, 7471A, 8081A, 8082 and 8290.
- VOC in Air: SW846 8260 modified.

Analyses applied to each of the samples collected during the SI are presented in Table 2.

Table 4 indicates number of samples by matrix and analyses submitted to CLP, Houston EPA and subcontract laboratories

3.3 GLOBAL POSITIONING SYSTEM

Trimble GeoExplorer ®3 Global Positioning System (GPS) units were utilized to obtain coordinates for each of the soil, sediment and surface water sample locations. Data was processed and corrected utilizing Trimble Pathfinder Office Version 4.10 software. The GPS units utilized the WGS1984 coordinate system. After correction using the Pathfinder Office software, the accuracy of the individual sample points ranged from 0.9 to 2.2 meters. Coordinates of the sampling points are included in Appendix D.

3.4 INVESTIGATION-DERIVED WASTE

Investigation-derived wastes (IDW) included solid waste consisting of personal protective equipment and empty boxes/containers. The IDW was contained in accordance with EPA ERT SOP #2049 IDW Management. Solid wastes were double bagged and returned to the START office for proper disposal.

4 QUALITY ASSURANCE/QUALITY CONTROL

QA/QC data are necessary to determine precision and accuracy and to demonstrate the absence of interferences and/or contamination of sampling equipment, glassware, and reagents. Specific QC requirements for laboratory analyses are incorporated in the *USEPA Contract Laboratory Program Statement of Work for Inorganic Analyses, Multi-Media, Multi-Concentration; USEPA Contact Laboratory Program Statement of Work for Organic Analyses, Multi-media, Multi-Concentration; and USEPA Analytical Services Branch Statement of Work for Analysis of Chlorinated Dibenzo-p-Dioxins (CDDs) and Chlorinated Dibenzofurans (CDFs), Multi-Media, Multi-Concentration.*. These QC requirements, or equivalent requirements, were followed for analytical work on the Mossville SI. This section describes the QA/QC measures taken for the SI and provides an evaluation of the usability of data presented in this report.

All samples were collected following the guidance of the QASP for Mossville, Sulphur-Westlake, Calcasieu Parish, Louisiana for the field activities. Groundwater, municipal supply system water, surface water and soil/sediment samples were analyzed for metals and mercury, VOCs, semivolatile organics, PCBs, pesticides, dioxins and furans and coliforms. The fish tissue sample was analyzed for metals and mercury, PCBs, pesticides, and dioxins and furans. Passive air samples were analyzed for VOCs. Analyses were performed by Houston EPA Laboratory located in Houston, TX; Datachem Laboratories located in Salt Lake City, UT, Accutest Laboratory located in Houston, TX; Beacon Environmental Services located Bel Air, MD; Test America West Sacramento located in West Sacramento, CA; and Cape Fear Analytical located in Wilmington, NC. Analyses were also performed by SGS North America located in Wilmington, NC. All data from analyses performed at the Houston EPA, Datachem Laboratories, SGS North America and Cape Fear Analytical were reviewed and validated by the Houston EPA Laboratory. Data from analyses performed at the Accutest, Beacon and Test America West Sacramento laboratories were reviewed and validated by START personnel. The results from SGS were rejected and deemed unacceptable during QA review due to improper laboratory documentation procedures. These samples were recollected for analysis in August 2010. Data qualifiers were applied as necessary according to the following EPA guidance:

- *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review*.
- *USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review*.
- *USEPA Analytical Services Branch National Functional Guidelines for Chlorinated Dibenzo*-p-Dioxins (CDDs) and Chlorinated Dibenzofurans (CDFs) Data Review

When necessary, laboratory- and method-specific QC criteria were applied to the data. Copies of the data QA memoranda are included in Appendix C.

4.1 SATISFACTION OF DATA QUALITY OBJECTIVES

The following EPA guidance document was used to establish data quality objectives (DQOs) for this SI:

- *Data Quality Objectives Process for Superfund, Interim Final Guidance*, EPA 540-R-93-071.

The EPA SAM determined that definitive data without error and bias determination would be used for the sampling and analyses conducted during the field activities. The data quality achieved during fieldwork produced sufficient data that meet the DQOs stated in the QASP for Mossville, Sulphur-Westlake, Calcasieu Parish, Louisiana.

A detailed discussion of the SI objectives that were accomplished are presented in the following sections.

4.2 QUALITY ASSURANCE/QUALITY CONTROL SAMPLES

QA samples (3 trip blanks) were collected for this project. Trip blanks were analyzed for VOCs. QC samples included blind field duplicate and matrix spike/matrix spike duplicate (MS/MSD) samples. Blind field duplicate samples were collected at a frequency of one in ten samples per matrix and MS/MSD samples were collected at a frequency of one in every twenty samples per matrix. These QC samples were analyzed for metals and mercury, VOCs, semivolatile organics, PCBs, PEST, and dioxins and furans. Two soil and one aqueous PE samples were collected for dioxin analysis.

4.3 PROJECT-SPECIFIC DATA QUALITY OBJECTIVES

The laboratory and field collection data were reviewed to ensure that DQOs for the project were met. Precision, accuracy, representativeness, completeness and comparability (PARCC) parameters were evaluated and are summarized in Table 5. The data quality was acceptable and 100% of the data was usable. The laboratory and the field team were able to meet DQOs for the project. Data validation reports are included in Appendix C.

4.4 LABORATORY QUALITY ASSURANCE/QUALITY CONTROL PARAMETERS

The laboratory data also were reviewed for holding times, laboratory blanks, serial dilution samples, PE samples, and rinsate and trip blanks. These laboratory QA/QC parameters are also summarized in Table 5. In general, the laboratory QA/QC parameters were considered acceptable. The laboratory validation reports are included in Appendix C. Results for the PE samples and trip blanks are in Table 6.

5 ANALYTICAL RESULTS EVALUATION

This section describes the reporting and methods applied to analytical results presented in Sections 7 (sources) and 8 (receptors) of this report. Table 2 lists all samples collected for laboratory analysis.

5.1 ANALTICAL RESULTS EVALUATION CRITERIA

Analytical results presented in the analytical summary tables show all analytes/compounds detected above laboratory quantitation limits and indicating significant/elevated concentrations of contaminants in source samples (Section 7) and receptor samples (Section 8) with respect to background concentrations are shown in bold type. For the purposes of this investigation, significant/elevated concentrations are those concentrations that are:

- Present at concentrations exceeding risk-based screening levels established by EPA (Table 7, Ref. 73).
- Concentrations of substances present in residential areas at concentrations significantly above background AND associated with nearby chemical manufacturing (minimum of 3X Bkgd).

The analytical summary tables present all analytes/compounds, but only those detected analytes/compounds at potential sources and receptors meeting the significant/elevated concentration criteria are discussed in the report text. All detected concentrations are discussed for the background samples. When samples were diluted for re-analysis at a laboratory, the dilution results were considered for evaluation and are provided in the tables and in the sample results discussion.

Dioxins and furans are typically found in complex mixtures and setting of health based risk levels for each of the individual components (congeners) is impractical. Dioxins are evaluated using a TEQ, where the relative toxicity of the individual congeners relative to the most toxic dioxin (2,3,7,8-tetrachloro-p-dibenzodioxin – 2,3,7,8-TCDD) is established using toxicity equivalency factors (TEF). The concentrations of the individual dioxins and furans are multiplied by their TEFs and the results are summed to provide the TEQ value for the sample. This TEQ is compared to the health based risk concentration. A risk based standard has not been finalized for dioxins in soil, therefore the sample TEQs are compared to Preliminary Remediation Goals (PRG) established by the EPA.

6 BACKGROUND SAMPLES

Background samples were collected for each of the naturally occurring media from which soil gas, public supply and soil samples were collected. These media are soil gas, water and soil. Results for the appropriate background samples are shown in the first column of the analytical results summary tables for comparison against source or target results.

6.1 BACKGROUND GROUNDWATER SAMPLES

6.1.1 Sample Locations

No samples were collected directly from public supply or residential wells to serve as background sample locations. Residential well samples were not included in the original sample design but were added during field operations to respond to resident concerns. The water sample collected from Parcel 38 (Figure 5), Westlake Community Center, is a sample of treated groundwater from wells outside of the area of interest and is considered as a background location for the groundwater, including the residential tap samples.

6.1.2 Sample Results

Trihalomethane compounds commonly found in treated drinking water were detected in the water sample collected from Parcel 38 (Ref. 73, p. 3) (Table 12, Table 13).

Metals (calcium, copper, magnesium and sodium) were also detected at concentrations greater than Contract Required Quantitation Limits (CRQLs) in the background water sample collected from Parcel 38 (Table 12, Table 13).

6.2. BACKGROUND SOIL GAS SAMPLES

6.2.1 Sample Locations

The soil gas sample collected from Parcel 33 (Figure 5) is up/cross gradient from the groundwater flow direction in the shallow aquifers identified at the site and is considered the background sample for this matrix. The soil gas samples are associated with the groundwater pathway.

6.2.2 Sample Results

No target analytes were detected in the background soil gas sample from Parcel 33 (Table 14, Ref. 50, p. 3).

6.3 BACKGROUND SURFACE WATER and SEDIMENT SAMPLES

No background surface water or sediment samples were collected. Health-based concentrations were used to compare receptor samples from the ponds.

6.4 BACKGROUND SOIL SAMPLE

6.4.1 Sample Location

The soil sample collected from Parcel 38 (Figure 5) is utilized as the background sample for the soil matrix.

6.4.2 Sample Results

Low concentrations (below CRQLs) of several volatile and semivolatile organics (primarily PAHs) were detected in the background sample. Several metals were detected above CRQLs in the background soil sample. OCDD and 1,2,3,4,6,7,8-HpCDD were detected above CRQLs in the sample. Table 20 contains the full analytical results of the soil background samples.

Dioxins and furans are by-products of many chemical processes. There is also a natural background for these materials in soils, as well as for PAHs, as they are also produced as by-products from the combustion of many materials, including wood. The concentrations in the above background sample reflects the natural occurance of these materials in the environment.

7 AREAS OF INVESTIGATION

This section describes Areas of Investigation (AI), sample locations, and analytical results of Mossville samples obtained from potential sources. All of the potential sources identified are also evaluated as receptors.

7.1 AREA of INVESTIGATION – Contaminated Soil

All of the soil within the AOI is an AI for the soil exposure pathway and for the surface water pathway (Figure 1).

7.1.1 Sample Locations

Samples were collected from 45 properties within the AOI (Figure 5). The samples will be discussed in detail in the Soil Exposure Pathway discussion, section 8.3.2.1.

7.1.2 Sample Results

Sample results for the soil samples are discussed in detail in the Soil Exposure Pathway, section 8.3.2.1.

7.2 AREA of INVESTIGATION – Contaminated Groundwater

Contaminated groundwater is documented in several water bearing zones (10, 20, 50, 80 and 200 foot sands) in the eastern portion of the area of interest, originating from the chemical plants to the east. The greatest extent of contamination is within the 50 foot sand (Figure 4), although the extent of contamination is similar for all of the zones. Treatment of contaminated groundwater is being conducted by SASOL and Conoco-Phillips.

7.2.1 Sample Locations

No sampling was conducted of the contaminated groundwater source since there are no public supply or residential wells drawing from within the known extent of the contamination.

7.2.2 Sample Results

No samples were collected.

7.3 AREA of INVESTIGATION – Surface Impoundments

The surface impoundments within the Mossville AOI are AIs and receptors since allegations have been made that at least one of the ponds (Pond C) has been used for disposal (Figure 1, Figure 2). Pond A is located west of Princess Street and north of Duke Street. The pond is approximately 400 feet by 550 feet, with an unknown depth. Pond B is located north of East Burton Street, east of Edna Hardy Lane and west of Benjamin Street. The irregular shaped impoundment is approximately 900 feet in length south-north, and ranges from 75 to 300 feet in width, with an unknown depth. There are actually three impoundments at Pond C, located east of Coach Williams Drive. The impoundments are approximately 600 by 470 feet, 400 by 350 feet, and 500 by 300 feet, with unknown depths.

None of the impoundments appear to be natural. The dates of construction and details about the construction of the impoundments have not been determined. Pond C is actively used as a source of soil for building in the Lake Charles area, and it is likely that all of the ponds were originally constructed for this purpose.

7.3.1 Sample Locations

Sediment and surface water samples were collected from each of the ponds (Figure 5). A fish sample was collected from Pond C. The ponds are also receptors for the surface water pathway, and samples are discussed in detain in section 8.2.

7.3.2 Sample Results

Sample results are discussed in section 8.2.

8 MIGRATION/EXPOSURE PATHWAYS AND RECEPTORS

The following subsections describe migration pathways and potential Receptors within the site's range of influence (Figures 5, 6, 7 and 8). This section discusses the groundwater migration pathway, the surface water migration pathway, the soil exposure pathway, and the air migration pathways.

8.1 GROUNDWATER MIGRATION PATHWAY

The target distance limit (TDL) for the groundwater migration pathway is a 4-mile radius that extends from the sources at the site. Figure 6 depicts the groundwater 4-mile TDL.

8.1.1 Geologic Setting

Calcasieu Parish in Louisiana is located within the Gulf Coastal Plain, which is composed of sediment deposits of Recent age laid down in the Gulf of Mexico and in the valleys of streams. The deposits generally consist of fine sand, silt, clay and a few lenses of coarse sand. Limited use aquifers are located in sand zones within these deposits. The Pleistocene deposits which underlie the recent deposits were laid down during glacial retreats. The system of aquifers formed by the Pleistocene deposits has been named the Chicot Aquifer. The aquifer consists of thick deposits of gravel, sand and clay. The material generally becomes coarser with depth. The sediments forming this plain slope gently towards the Gulf of Mexico. The principal fresh - water-bearing zones in the Chicot Aquifer are the "200, 500 and 700" foot sands, named for the depth at which they occur in the industrial area of Lake Charles, generally south and east of Mossville. These sands are separate hydrologic units at Lake Charles, but become one unit north of the parish. The base of the "700" foot sand at 900 feet below sea level in Lake Charles marks the base of the Chicot Aquifer, below which begins the Pliocene Foley Formation. The Evangeline Aquifer, consisting of a series of fine and medium sand, silt and clay is found within the Foley Formation. Pliocene deposits at Lake Charles are considered to be approximately 1,800 feet thick, and dip to the south (Ref. 51, pp. 8-11).

The average annual rainfall in Calcasieu Parish is 55.8 inches, and the net precipitation is between 15 to 30 inches per year (Ref. 52, p. 1; Ref. 2, Figure 3-2, Table 3-4).

8.1.2 Aquifer System

Sands in the Recent deposits recharge by migration of rainfall onto the surface of the water levels in these sands usually rise after rainfall events. Near streams and rivers, groundwater levels also tend to rise and fall with the rise and fall of stream levels, both from rainfall and tidal influence, indicating hydraulic connection between the aquifers and the streams (Ref. 51, p. 22). Wells in the Recent deposits are typically 50 foot or less in depth, and produce water at a rate of 2 to 3 gallons per minute (gpm) (Ref. 51, p. 26).

Recharge of the Chicot Aquifer occurs at its outcrops in Beauregard, Allen, Rapides and Evangeline Parishes, north of Calcasieu Parish (Ref. 51, p. 22). Wells in the Chicot Aquifer are typically under an artesian head, and interconnection between the different sands is present, dependent on the quality of the clay separating the sand at specific locations (Ref. 51, pp. 22, 58). The principal water producing zones in the Chicot Aquifer are the “200, 500 and 700” foot sands, although there are some shallower zones of production (Ref. 51, p. 26). These shallow wells typically have yields of less than 100 gpm (Ref. 16, pp. 26-27). The top of the “200 foot” sand varies considerably in depth (85 – 175 feet) below the surface and thickness (20 – 200 feet), and dips southward at 4-10 feet per mile. In the vicinity of the Mossville AOI, the sand is reportedly 70 feet thick at a depth of 175 feet. Recharge in the “200 foot” sand occurs in northern Calcasieu and southern Beauregard Parishes. The sands grade from fine to medium at the top to coarse sand to gravel at the base. Water from the “200 foot” sand is used for domestic and irrigation purposes, although there is also industrial use. Yields vary depending on location, but range from 1,800 to 4,500 gpm (Ref. 51, pp. 27-30).

The Evangeline Aquifer nears the surface in northern Beauregard, Allen and Evangeline Parishes, where the aquifer is recharged. Few wells in Calcasieu Parish are completed in the Evangeline Aquifer. The Evangeline is more commonly utilized to the north where it is shallower (Ref. 51, pp. 37-40).

Both the Chicot and Evangeline aquifers are under artesian heads, although neither aquifer has artesian flow at the surface. Water levels in the Chicot Aquifer have declined due to pumping (Ref. 51, pp. 44-55).

Due to groundwater contamination at the chemical plants within the Calcasieu Estuary, there are numerous ongoing groundwater monitoring and remediation actions being conducted (Ref. 15; Ref. 16; Ref. 53). Plants operated by Georgia Gulf and Sasol North American are located adjacent to the east side of the Mossville AOI, and are the most likely to impact groundwater within the AOI. Four water bearing zones within the Recent deposits have been identified on the Sasol facility (Ref. 53), the “10 foot,” “25 foot,” “50 foot” and “80 foot” sands. These four zones, along with the “200 foot” zone in the Chicot Aquifer are all monitored as part of the 1986 Consent Agreement between Vista (the predecessor of Sasol) and LDEQ (Ref. 14). Monitoring under the 1986 Consent Agreement Plume in the “25 foot”, “50 foot” and “200 foot” zones is also conducted on Conoco’s facility (Ref. 16).

<u>10 Foot Sand</u>

Monitoring and recovery wells are located within the “10 foot” sand on the Sasol facility. The 3rd quarter 2009 monitoring results indicate that the flow in this zone is generally to the south. The historic potentiometric surface has been between 5 and 14 feet above mean sea level (msl); however, pumping from the recovery wells has resulted in a lower potentiometric surface in the recent past. The extent of the zone appears to be limited to the northwest portion of the Sasol facility. The westward extent of the zone is not known, and stratigraphic studies indicated that the sands are not laterally continuous (Ref. 53, p. 3). This zone has not been described on the Conoco facility (Ref. 15).

<u>25 Foot Sand</u>

Groundwater flow in the “25 foot” sand is dominated by the pumping of the recovery wells on the Sasol facility. The natural southern gradient has been reversed to the north on the southern portion of the Sasol facility and on the Conoco facility. Potentiometric surfaces in this zone have historically ranged from +13 to -1 foot above msl. The “25 foot” sand is believed to be in hydraulic connection with Bayou Verdine which passes through the Conoco facility south of Old Spanish Trail (Ref. 53, pp. 3-4). As with the “10 foot” sand, the westward extent of the zone has not been determined. On the Conoco facility south of the bayou, flow is north and east toward to bayou (Ref. 15, p. 23).

50 Foot Sand

In the “50 foot” sand, historical groundwater flow has been toward the west-southwest, but pumping at recovery wells has altered the flow on the Sasol facility toward the recovery wells (Ref. 53, pp. 4-5). The westward extent of the “50 foot” sand has not been determined. Flow to the southwest occurs on the Conoco facility, where the potentiometric surface is -2 to -4 feet below msl (Ref. 15, p. 23). This zone was originally described as the “lower 50-foot” sand as there are discontinuous sand/silt layers in what was described as the “upper 50-foot” sand.

80 Foot Sand

The “80 foot” sand layer consists of discontinuous sandy lenses and stringers with a limited areal extent. Flow is to the southwest with a historic potentiometric surface of 2.6 to -10.3 feet msl. The layer is continuous in the western portion of the Sasol plant and within the eastern portion of the AOI, and was not identified on the Conoco facility (Ref. 53, p. 5; Ref. 15, p. 23). This layer has shown the greatest extent of groundwater contamination (Figure 4).

200 Foot Sand

The “200 foot” sand layer flows to the south-southwest with a potentiometric surface of -30.71 to -33.79 foot below MSL (Ref. 53, p. 5). Reported flow direction on the ConocoPhillips facility is also to the southwest (Ref. 15, p. 23).

500 Foot Sand

The “500 foot” sand is the principal aquifer in the parish. The aquifer ranges in thickness from 25 to 310 feet, at depths of 165 to 590 feet bgs. In the vicinity of Mossville, this sand is reported to be encountered at a depth of 390 feet bgs, and is 170 feet thick. The recharge area outcrops in central Beauregard and Allen Parishes, and the sand dips southward at about 18 feet per mile. The “500 foot” sand is tapped for public supply, irrigation and industrial use, yielding 600 to 3,800 gpm. The City of Sulfur reportedly obtains its public supply from this sand. The public water supply in Mossville is obtained from the “500 foot” sand. The “500 foot” sand ranges from fine sand at the top to coarse sand and gravel at the base (Ref. 51, pp. 30-34).

700 Foot Sand

The “700 foot” sand is used by industries and irrigators, and is the primary drinking water source for the City of Lake Charles. The “700 foot” sand ranges in thickness from 60 to 220 feet within the parish. In the vicinity of Mossville, the sand is found at a depth of 700 feet bgs and is 220 feet thick. The sand dips southward at 10 feet per mile, but varies depending on location. The material consists of fine to coarse sands (top to bottom) (Ref. 51, pp. 34-37).

8.1.3 Drinking Water Receptors

START conducted a water well survey utilizing the Louisiana Department of Transportation (LDOT) website to determine the number of registered water wells located within the 4-mile radius of the Mossville AOI. The LDOT registered water well database contains information pertaining to public supply, domestic, irrigation, industrial, rig supply, and monitoring wells (Ref. 21). Review of the database indicates an active total of six public supply wells, two private domestic wells, one irrigation well, and 25 monitoring/recovery/piezometer wells registered within the AOI, and several wells that have been plugged and abandoned (Table 8). Two of the public supply wells are utilized by the Mossville Water Works District 2 to provide water within the Mossville AOI (Ref. 56). Within a 4-mile radius of the AOI, 100 public supply wells, 467 private domestic wells, 17 irrigation wells, 126 industrial supply wells, and 1,032 monitoring/recovery/observation/piezometer wells have been registered (Ref. 56). The public supply wells and their distances to the Mossville AOI are shown in Table 9 Public wells within the 4-mile radius are utilized by parish water districts and the cities of Sulphur, Lake Charles and Westlake.

All but three of the identified municipal water wells within the Mossville AOI and within 4 miles of the Mossville AOI are drawing water from the “500 foot” sand of the Chicot aquifer (Ref. 56). One well owned by the City of Westlake and two wells utilized by the Louisiana (LA) State Park system draw water from the “200 foot” sand of the Chicot aquifer (Ref 56).

The service area of the Mossville Waterworks District 2 includes the majority of the Mossville AOI, excluding only the area south of the Union Pacific railroad tracks and north of US Hwy 90. The number of connections to the Mossville Waterworks District 2 is 371 (337 residential) (Ref.

70) and the system serves 879 (Ref. 23, Ref. 25) persons. Water District 2 utilizes two (2) drinking water wells, depths ranging from 425 feet bls to 458 feet bls (Table 8, Ref. 70). The municipal wells are located at the waterworks situated north of the Jacob Rigmaiden Center, near the center of the Mossville AOI (Figure 5).

The City of Sulphur water system, utilizing six wells, provides potable water to the residents of Sulphur. The number of connections to the Sulphur water system is 7,896, providing water to approximately 21,000 persons (Ref. 71). One well at a depth of 580 feet bls is located between ¼ and ½ mile of the Mossville AOI. One well at a depth of 580 feet bls is located between ½ and 1 mile of the AOI. Two wells at depths of 533 and 540 feet bls are located between 2 and 3 miles of the Mossville AOI. The remaining two wells at depths of 578 and 544 feet bls are located between 3 and 4 miles of the AOI.

The City of Westlake water system, utilizing five wells, supplies potable water to the residents of Westlake. The number of connections to the Westlake water system is 1,750, serving a population of approximately 7,000 (Ref. 71). Two of the wells used by Westlake are located between 1 and 2 miles of the Mossville AOI, at depths of 527 and 537 feet bls. LDOT registration also lists an additional well with a depth of 240 feet bls, which may not be in use. The three remaining Westlake wells, with depths of 511, 552, and 558 feet bls, are located between 2 and 3 miles of the AOI.

The Calcasieu Parish Waterworks District 4, utilizing two wells, supplies potable water to the residents of north Westlake. The number of connections to the water system is 1700, serving a population of approximately 1600 (Ref. 70). Both of the wells used by District 4 are located between 2 and 3 miles of the Mossville AOI, at depths of 492 and 480 feet bls.

Two wells owned by the LA State Park system are located between 3 to 4 miles of the Mossville AOI. Lake Charles HA owns one well located between 2 and 3 miles of the AOI and one well between 3 and 4 miles of the AOI (Ref. 56). Usage of these wells has not been determined. Numerous other public supply wells, designated for commercial use, are located within the 4 mile target distance radius (Ref. 56). Estimated number of population served by municipal wells by distance ring (see Appendix F for calculations) is 879 (0 to 0.25 miles), 3,500 (>0.25 to 0.5 miles), 3,500 (>0.5 to 1 mile), 2,800 (>1 to 2 miles), 12,800 (>2 to 3 miles) and 7,000 (>3 to 4 miles). It should be noted that municipal drinking water users may be overestimated due to the fact that the number of connections could include businesses.

According to the LDOT water well database, a total of 443 active private drinking water wells are located within the 4-mile radius (Table 10; Ref. 56). Domestic or private water wells within the 4-mile radius include 3 wells drawing from alluvial aquifers, 45 wells drawing from the recent age deposits, 257 wells drawing from the "200 foot" sand of the Chicot aquifer, 104 wells drawing from the "500 foot" sand of the Chicot aquifer, one well drawing from the "700 sand" of the Chicot aquifer, and 33 wells of unknown depth (Ref. 56). Two of the wells are located within the Mossville AOI. Estimated population served by private wells by distance ring (see Appendix F for calculations) in the recent deposits is 13 (>1 to 2 miles), 33 (>2 to 3 miles) and 69 (>3 to 4 miles). Usage in the alluvial aquifers is 8 (>3 to 4 miles). In the "200" foot sand, usage is 23 (0 to 0.25 miles), 10 (>0.25 to 0.5 miles), 8 (>0.5 to 1 mile), 99 (>1 to 2 miles), 148 (>2 to 3 miles), and 359 (>3 to 4 miles). In the "500" foot sand, usage is 3 (0 to 0.25 miles), 3 (>0.25 to 0.5 miles), 3 (>0.5 to 1 mile), 25 (>1 to 2 miles), 53 (>2 to 3 miles), and 176 (>3 to 4 miles). An estimated 3 persons use water from the "700" foot sand from between 0 to 0.25 miles from the AOI.

The identified target water wells within the 4-mile radius ranged in depth from 13 feet bgs to 698 feet bgs. The target wells were screened in the Recent deposits, and the "200 and 500 foot" sands of the Chicot Aquifer (Ref. 56). Totals by distance for groundwater usage, both municipal and residential, are included in Table 11.

The LDOT water well survey indicates the presence of seventeen (17) registered irrigation wells screened in the Chicot aquifer within a 4 mile radius of the Mossville AOI (Ref. 56, pp. 21-22 and 30-31).

The Mossville Waterworks District 2, Calcasieu Parish Waterworks District 4, City of Sulphur and City of Westlake water systems are all located within a State approved wellhead protection area (Ref. 69).

8.1.4 Sample Locations and Results

Groundwater samples were collected from Mossville Water System Well 1, Mossville Water System Well 2 (with a duplicate), from a residential well located on Parcel 36 (with a duplicate) and a residential well located on Parcel 40 (Figure 5, Table 2). All sample locations are within the AOI. Samples from the two water system wells were analyzed for all parameters. Samples from the two residential wells were analyzed for all parameters except dioxins.

In addition to the groundwater samples collected directly from the wells, samples were also collected from residential taps and from monitoring taps within the Mossville distribution system to address the concerns of the residents raised during public meetings (Figure 5, Table 2). Samples collected from Parcel 01, Parcel 06, Parcel 09, Parcel 15, Parcel 18, Parcel 25, Parcel 30, Mossville Distribution Tap 1, Mossville Distribution Tap 2 (dioxin duplicate), Mossville Distribution Tap 3, Mossville Distribution Tap 4 and Mossville Distribution Tap 5 were analyzed for all parameters.

Samples collected from Parcel 02 (duplicate), Parcel 03, Parcel 04, Parcel 05, Parcel 07, Parcel 08, Parcel 10, Parcel 11, Parcel 12 (duplicate), Parcel 13, Parcel 14, Parcel 16, Parcel 17, Parcel 21, Parcel 22 (duplicate), Parcel 23, Parcel 24, Parcel 26, Parcel 27, Parcel 28, Parcel 29, Parcel 31, Parcel 34, Parcel 39 and Parcel 49 were analyzed for all parameters except dioxin.

Samples from Parcel 16A (and its duplicate) were analyzed for coliforms only.

Soil gas samples were collected at Parcel 30 (4 samples), Parcel 31 (3 samples) and Parcel 32 (2 samples). Samples were analyzed for VOCs.

For the well samples, in comparison to the water sample collected at Parcel 38 and MCLs, no analytes were detected at significant/elevated concentrations in any of the groundwater samples. Complete sample results are included in Table 12.

For the distribution system samples, in comparison to the water sample collected at Parcel 38 and MCLs, no analytes were detected at significant/elevated concentrations. Coliforms (8 cfu/100 ml) were detected in the sample from Parcel 16 but were not detected when the location was re-sampled. Complete sample results are included in Table 13.

EPA conducted an evaluation of the Mossville Water System with the objective of documenting the current compliance status with the requirements of the Safe Drinking Water Act and the ability of the water system to achieve future compliance (Ref. 76). The evaluation investigated the operations, management and infrastructure of the system. Concentrations of iron and manganese in samples collected from the two system wells exceeded secondary MCLs, however concentrations in samples of treated water were below MCLs. Low levels of disinfection byproducts, below EPA limits, were detected in treated water samples. The evaluation noted deficiencies with the location of a septic system in relation to one of the wells, the capacity of the filtration system, and a lack of flush valves on the dead-end lines in the system.

The evaluation concluded that the water system is in compliance with all drinking water requirements of the National Primary Drinking Water Regulations. Potential problems identified include the financial issues (insufficient operating ration, debt coverage ratio and financial resources), excessive unaccounted for water, insufficient operational resources, undersized storage tank, potential contamination of the east well by a septic system and lack of sealing, lack of flush valves on dead-end lines, old greensand filters not operating properly, and problems with access in the buy-out area making operations difficult.

For the soil gas samples, significant/elevated concentrations of toluene (40.99 ng) and total petroleum hydrocarbons (TPH) in the C5-9 gasoline range, 2949 ng) were detected in one of the samples from Parcel 30 and toluene (31.42 ng) was detected in a second sample from Parcel 30. Screening levels are 25 ng for toluene and 2,500 ng for TPH C5-C9. The C5-C9 range of TPH and toluene are typically associated with gasoline and are not in the plume of contaminated groundwater that originates from the SASOL facility. No target analytes were detected in the remaining two samples for Parcel 30 or in the samples from Parcel 31 or from Parcel 32. Complete sample results are included in Table 14.

8.2 SURFACE WATER MIGRATION PATHWAY

The surface water migration pathway TDL begins at the probable point to entry (PPE) of surface water runoff from the site to a surface water body and extends downstream for 15 miles. Figure 7 depicts the surface water 15-mile TDL.

8.2.1 Overland Route

Surface runoff from the eastern portion of the AOI flows into Bayou Verdine, a perennial surface water body, both directly and from drainage ditches (Figure 7; Ref. 5). The PPE (PPE 1) for Bayou Verdine is defined as the location where Bayou Verdine enters the AOI. Bayou Verdine flows southeast for approximately 3.25 miles, passing through the ConocoPhillips and Lyondell Chemical Facilities, until discharging into the Calcasieu River north of Coon Island (Figure 7, Ref. 5). The remaining 11.75 miles of the flow is within the Calcasieu River and the Calcasieu Ship Channel. The western portion of the AOI flows directly and from drainage ditches into Maple Fork, a perennial surface water body originating just north of the AOI, which flows for approximately 3 miles to the southeast into Bayou D'Inde (Figure 7; Ref. 5). The PPE for Maple Fork (PPE 2) is defined as the locations where Maple Fork enters the AOI. Bayou D'Inde flows approximately 2.5 miles southeast into the Calcasieu Ship Channel/Calcasieu River southwest of Coon Island, where the flow converges with the flow from Bayou Verdine. As the overland flow segments pass through the Mossville AOI and the source is contaminated soil, the overland flow distance is 0 feet (Figure 7). There are numerous active NPDES discharges to Bayou Verdine, Maple Fork/Bayou D'Inde and the Calcasieu River/Calcasieu Ship Channel.

The Calcasieu River is under tidal influence (Ref. 18, p. 5; Ref. 58, p. 5), the in-water segment also extends northeast within the river for 11.75 miles (Ref. 2; Ref. 3; Ref. 58, p. 5). Flow rates are not measured. Due to the flat topography of the area, it is likely that Bayou Verdine, Bayou d'Inde and Maple Fork are also under tidal influence.

The two-year, 24-hour rainfall for the area of the site is approximately 5.0 to 5.5 inches (Ref. 57, p. 1).

Mossville is situated within the Gulf Coast Prairies of Calcasieu Parish (Ref. 58, p. 1). The soils within the AOI are generally silt loams comprising 9 soil groups (Ref. 59, p. 10). The Guyton-Messer silt loams, Kinder-Messer silt loams and Mowata-Vedrine silt loams are the most common soils in the AOI (Ref. 58, pp. 13-40; Ref. 59, pp. 12-21). The soils range from moderately-well drained to frequently flooded with slopes of 1 to 3 percent and generally have high water capacities. Soils range from 60 to 80 inches in thickness. Water transmissivity ranges from low to high (Ref. 59, pp. 12-29).

Portions of the Mossville AOI along Bayou Verdine and Maple Fork are within the Federal Emergency Management Agency (FEMA) 100-year floodplain (Ref. 60). Based on observations during the site reconnaissance, there are no containment features that would prevent or contain a release in the event that the Mossville AOI becomes flooded.

In addition to Maple Fork and Bayou Verdine, three surface impoundments are located within the area of interest. Pond A is located west of King Street, Pond B is located north of E. Burton Street, and Pond C is located east of Coach William Drive (Ref. 5, Figure 1, Figure 2). The three impoundments appear to be man-made, resulting from the excavation of sand/soil for use. There are no defined inflows into the impoundments. Due to the shallow depth to groundwater in the area, water levels in the impoundments are likely to be closely associated to the shallow groundwater.

8.2.1.1 Sample Locations and Results

Surface water and sediment samples were collected from Pond A. Surface water and sediment were collected from Pond B. Surface water (duplicate) and sediment (duplicate) were collected from Pond C (Figure 5, Table 15 and Table 17). Surface water and sediment samples were analyzed for all parameters (Table 2).

No background sample was collected for the surface water, sediment or fish matrices. The sediment samples were compared to the results from the health-based benchmark.

No analytes were detected at concentrations above MCL in the surface water samples. Complete surface water sample results are included in Table 15.

Concentrations of arsenic in the sediment samples from all three ponds exceeded its EPA soil screening level (SSL) of 0.39 parts per million (ppm - milligram per kilogram – [mg/kg]), however arsenic is a naturally occurring element and the sample concentrations were all less than the LDEQ background level of 12 ppm. Arsenic has not been identified in the releases from the plants. Benzo(a)pyrene was detected in Pond A at a concentration above its SSL of 15 micrograms per kilogram (ug/kg). The benzo(a)pyrene concentration was consistent with the local background. Complete sediment sample results are included in Table 17.

Table 16
Pond Sediment Results Above SSLs

Analyte	SSL	Local BKG	Pond A	Pond B	Pond C	Pond C/DUP
Arsenic	0.39 mg/kg	1.1 mg/kg	3.3 mg/kg	9.9 mg/kg	1.1 mg/kg	2.0 mg/kg
Benzo(a)pyrene	15 ug/kg	21 ug/kg	21 ug/kg			

8.2.2 Drinking Water Receptors

Surface water is not utilized for public supply in Calcasieu Parish (Ref. 58, p. 3), therefore this pathway was not evaluated. Drinking water is obtained from either municipal or domestic water wells screened in the Recent Deposits or Chicot Aquifers (Ref. 58, p. 3).

8.2.3 Human Food Chain Receptors

Contamination within the Calcasieu River and Estuary, has prompted health advisories relating to the consumption of fish and shellfish from the estuary by LDEQ in 1992 and Louisiana Department of Health and Hospitals in 2000 (Ref. 61). Guidance used to issue the health advisories is included in Reference 62. Area residents and property owners indicate that fishing for consumption of bass, gar and catfish occurs in the three surface impoundments within the AOI (Ref. 63). Surface water resource usage occurs within Calcasieu Parish, primarily for rice farming (Ref. 58, p. 2). It has not been determined if water from the 15-mile TDL of the Calcasieu River is being used as a resource.

8.2.3.1 Sample Locations and Results

A fish sample was collected from Pond C (Figure 5). The fish sample was analyzed for metals, PEST, PCB and dioxins.

In the fish sample from Pond C, concentrations of 1,2,3,4,7,8-HxCDF (6.5 nanograms per kilogram - ng/kg), 1,2,3,7,8-PeCDF (0.27 ng/kg) and WHO-2005 TEQ (2.2903 ng/kg) exceed EPA screening levels (1,2,3,4,7,8-HxCDF (2.4 ng/kg), 1,2,3,7,8-PeCDF (0.24 ng/kg), WHO-2005 TEQ (0.24 ng/kg)). Other dioxins and furans were detected in the sample, generally at concentrations below screening levels and below quantitation limits. Complete sample results are in Table 18.

8.2.4 Environmental Receptors

According to the Louisiana Department of Wildlife and Fisheries, there are two (2) species of birds (red-cockaded woodpecker – *Picoides boreakus* and bald eagle –*Haliaeetus leucocephalus*) and one (1) species of mammal (red wolf – *Canis rufus*) that are either federally or state-designated endangered or threatened species in Calcasieu Parish (Ref. 64, pp. 1-3). The location of the critical habitats for these designated endangered or threatened species has not been obtained.

Wetlands are present along Bayou Verdine, Maple Fork and the Calcasieu River within the TDL, with an estimated 257,161 feet or 48.7 miles of wetlands frontage, calculated using ESRI ArcMap, Version 9.3, 2008 (Ref. 5; Figure 7).

8.2.4.1 Sample Locations and Results

No samples were collected.

8.3 SOIL EXPOSURE PATHWAY

The soil exposure pathway is evaluated based on the threat to resident and nearby populations from soil contamination within the first two feet of the surface.

8.3.1 Site Setting and Exposed Sources

Mossville consists of residential and agricultural land, and small businesses located in an unincorporated area of Calcasieu Parish, north of US Highway 90, and north of Lake Charles, Louisiana. The AOI encompasses approximately 1.5 square miles. The area is north and west of a series of refineries and chemical plants (Figure 3, Ref. 65). No records of disposal of any chemicals within the AOI have been located; however, deposition of chemicals from air emissions from the refineries and chemical plants is likely to have occurred. Limited soil sampling has been conducted in the area; however, the analyses have been limited to dioxins and dioxin-like materials, with dioxin-like materials being detected. ATSDR concluded that dioxin concentrations in surface soils were not at levels of concern (Ref. 21, p. 46).

The Calcasieu Parish School system has a facility within the AOI, and the Rigmaiden Recreation Center is located within the AOI (Figure 1).

8.3.2 Receptors

There are over 1,600 parcels located within the AOI, and over 900 of these properties are residential or commercial (Ref. 66). One school administration building and one recreation center are also located within the AOI (Figure 1).

Calcasieu Parish contains two (2) species of birds and one (1) species of mammal that have been designated as either federally- and/or state-endangered or threatened; however, the exact locations for critical habitats for these species have not been documented (Ref. 64, pp. 1 - 3).

No terrestrial resource usage (commercial agriculture, commercial silviculture, or commercial livestock grazing/production) has been documented within the Mossville AOI or within 200 feet of the AOI (Ref. 2, Sec. 5.1.3.4).

As previously stated, the AOI is located in an unincorporated area of Calcasieu Parish (Figures 1 and 2). According to U.S. Census tract data, the population within the Mossville AOI is 665, and the population within a 1-mile radius of the AOI is 6,287 (Ref. 67, Ref. 68). The AOI is accessible, and there is recreational use at the Rigmaiden Recreation Center on the AOI (Figure 1, Figure 6).

8.3.2.1 Sample Locations and Results

Samples were collected from 51 parcels within the AOI. Samples collected from Parcel 01, Parcel 02 (duplicate), Parcel 03 Parcel 04, Parcel 05, Parcel 06, Parcel 07, Parcel 08, Parcel 09, Parcel 11, Parcel 12, Parcel 13, Parcel 14, Parcel 15, Parcel 16, Parcel 17, Parcel 18, Parcel 21, Parcel 22 (duplicate), Parcel 23, Parcel 24, Parcel 25, Parcel 26, Parcel 28, Parcel 29, Parcel 30, Parcel 31, Parcel 32 (duplicate), Parcel 33, Parcel 34, Parcel 39, Parcel 41, Parcel 42 (duplicate), Parcel 43, Parcel 44, Parcel 45, Parcel 46, Parcel 47, Parcel 48 and Parcel 49 were analyzed for all parameters. Samples collected for Parcel 27 and Parcel 36 were analyzed for all parameters except dioxins. Four samples were collected from Parcel 10 with one sample analyzed for all parameters and the remaining three analyzed for dioxins only. Five samples were collected from Parcel 50 with one sample analyzed for all parameters and the remaining four samples analyzed for dioxins only. Samples collected from Parcels 51, 52, 54, 55, 56 and 57 were analyzed for dioxins only (Table 2).

Two metals (arsenic and lead), 5 SVOA PAHs (benzo(a)pyrene, benzo(b)fluoranthene, benzo(a)anthracene, dibenzo(a,h)anthracene and indeno(1,2,3-cd)pyrene) and Aroclor 1254 were detected in soil samples at concentrations greater than their SSLs (Table 19). Dioxins and furans were detected in all of the soil samples; however the TEQs for the samples did not exceed the residential soil PRG of 72 ppt TEQ that was proposed during the Dioxin Reassessment process and is still under review. This value is a non-cancer risk-based value that, in this case, would be roughly equivalent to an ELCR of 10-5.

Arsenic concentrations were generally less than three times the local background from Parcel 38, and except at Parcel 4 (16.7 mg/kg), were less than LDEQ background of 12 ppm (mg/kg). The concentrations of benzo(a)pyrene were also generally less than CRQLs and within three times the local background, indicating that its presence is consistent with the local background. Parcel 10 is the only sample where all eight of the analytes were detected at concentrations exceeding SSLs. Evidence of a recent structure fire was noted at Parcel 10 which probably accounts for the high levels of the PAHs. Parcels 4, 5, 7, 13, 32 and 48 had multiple detects of PAHs greater than SSLs, and Parcel 46 had an Aroclor 1254 detect. The organics that are released from the plants (Section 2.4.1) were not detected, or were detected at very low concentrations, in the samples.

Complete analytical results for the soil samples are included in Table 20.

8.4 AIR MIGRATION PATHWAY

The air migration pathway TDL is a 4-mile radius that extends from sources at the site (Figure 6).

8.4.1 Human Receptors

The Mossville AOI consists of residential and commercial lots within a one and a half square mile area of Calcasieu Parish (Ref. 66). The site is located in the vicinity of numerous chemical plants and refineries (Ref. 65). The chemical plants and refineries are active facilities with ongoing permitted releases under the Clean Air Act (CAA). Air sampling was not conducted during the Site Inspection. An evaluation of unpermitted air releases may result in an observed release to the air migration pathway. The sampling design for the SI focused on the collection and analysis of soil samples that may have been impacted from past activities. Potential contaminants of concern include the contaminants from the chemical plants which may accumulate in the soil within the Mossville AOI. A review of the 2009 Toxic Release Inventory (TRI) indicated that thirty-three industries located in Westlake, Sulphur, Lake Charles, and Carlyss, Louisiana, reported releases.

Top Five Industries with Releases(pounds of total chemicals)	
Chemical Waste Management, Sulphur, LA	4,141,920 lbs
Louisiana Pigment, Westlake	3,071,993 lbs
Firestone Polymers	1,281,600 lbs
Conoco Philips, Lake Charles Refinery, Westlake	1,222,121 lbs
Citgo Petroleum Corp, Westlake	1,076,336 lbs

Nineteen facilities operate in the Mossville area. Six of the facilities have high priority air violations: Louisiana Pigment, Firestone Synthetic Rubber and Latex/Polymers Lake Charles, Conoco Phillips Lake Charles Refinery, Citgo Petroleum Corp, PPG Industries, and Sasol (Condea Vista). Four of the five top emitters are also high priority violators.

According to U.S. Census tract data, the population within the Mossville AOI is 665, and within a 1-mile radius of the AOI is 6,287 (Ref. 67, Ref. 68).

8.4.2 Environmental Receptors

No terrestrial resource usage (commercial agriculture, commercial silviculture, or commercial livestock grazing/production) has been documented within the Mossville AOI or within ½ mile of the AOI (Ref. 2, Sec. 5.1.3.4). Wetland acreage on and within ¼ mile of the site, is 92.93 acres, within ¼ to ½ mile is 74.31 acres, ½ to 1 mile is 120.02 acres, 1 to 2 miles is 232.54 acres, 2 to 3 miles is 1964.59 acres, and 3 to 4 miles is 2470.44 acres, calculated using ESRI ArcMap, Version 9.3, 2008 (Figure 8).

8.4.2.1 Sample Locations and Results

No air samples were collected.

9 SUMMARY AND CONCLUSIONS

Mossville AOI is a residential community located west and northwest of a concentration of chemical plants in Westlake and northern Lake Charles, Louisiana. The AOI encompasses approximately 1.5 square miles. The majority of the land use is residential, with a few commercial entities, churches, a recreation center and a school.

Sampling was conducted on multiple occasions. From April 26 to May 1, 2010, groundwater samples were collected from two public supply wells and from two residential wells and water samples were collected from five system monitoring taps and from 34 residences. Surface water and sediment samples were collected from three pond and soil samples were collected from 45 properties. Three water samples were collected from residential properties on May 12 and 13, 2010, to confirm coliform results from the initial samples. Ten soil gas samples were collected from five properties from May 12 to May 19, 2010. A single fish sample was collected on May 20, 2010.

After the original dioxin analysis was rejected for QA issues, re-sampling was conducted from August 16 to 20, 2010 for dioxin analysis only. Groundwater samples were collected from the two public supply wells, and water samples were collected from the five system taps and from eight residences. Surface water and sediment samples were collected from the three ponds and soil samples were collected from 49 properties, including 6 properties not previously sampled.

9.1 SOURCES

The primary source of contamination within the AOI is soil which may have been contaminated by deposition from air emissions from the chemical plants. Ponds which may have been used for disposal of materials from the chemical plants are the second potential source which was evaluated.

9.2 RECEPTORS

Ground Water

Receptors for the groundwater pathway include all of the residents who obtain their drinking water from the Mossville Public Supply system. No significant/elevated concentrations of any analytes were detected in the groundwater samples collected from either the public supply or private wells, or in any of the samples collected from residences or taps within the distribution system. Low concentrations of trihalomethanes (treatment byproducts) were detected in the distribution system samples. Soil gas samples did not contain contaminants associated with the plume of contaminated groundwater from the SASOL facility underlying the AOI.

Surface Water

In the surface water pathway, concentrations of 1,2,3,4,7,8-HxCDD, 1,2,3,7,8-PeCDF and the WHO-2005 TEQ exceed the lifetime excess cancer risk range specified by the Superfund program in the fish sample collected for analysis. No analytes were detected in the water samples at concentrations exceeding MCLs. Arsenic was detected at concentrations above its SSL in the sediment samples from all three ponds; however the concentrations reflect the local and LDEQ backgrounds for arsenic. Benzo(a)pyrene was detected at a concentration greater than its SSL in the sediment sample from Pond A, but the concentration was reflective of the local soil background concentration. Dioxins and furans were detected in the sediment samples, but the TEQ concentration did not exceed the residential soil PRG of 72 ppt TEQ that was proposed during the Dioxin Reassessment process and is still under review. This value is a non-cancer risk-based value that, in this case, would be roughly equivalent to an ELCR of 10-5.

Soil Exposure

For the soil exposure pathway, numerous dioxins and furans were detected in samples that were collected, however the TEQ concentration calculated for the samples did not exceed the residential soil PRG of 72 ppt TEQ that was proposed during the Dioxin Reassessment process and is still under review. This value is a non-cancer risk-based value that, in this case, would be roughly equivalent to an ELCR of 10-5. Arsenic concentrations exceed SSLs in all of the samples; however the concentrations are consistent in all of the samples and probably are representative of the local background. Multiple PAHs with concentrations exceeding their SSLs were detected in Parcels 4, 5, 7, 10, 13, 32 and 48, and benzo(a)pyrene was detected at concentrations above its SSL in the results for 18 additional parcels. Most results are consistent with the local background collected from Parcel 38, however concentrations of lead detected at Parcel 10 and the aroclors 1254 detected at Parcels 10 and 46 are unique. Higher concentrations of PAHs were detected in the samples from Parcels 4, 10, 32 and 48.

Air Pathway

Air sampling was not conducted during the Site Inspection. An evaluation of unpermitted air releases may result in an observed release to the air migration pathway.

9.3 CONCLUSIONS

Groundwater used for public and residential use within the Mossville AOI has not been impacted by chemical contamination, based on the results of samples collected from the wells and the distribution system. Soil gas sampling indicates that the plumes of contaminated groundwater on the eastern portion of the AOI are not impacting the remaining residents within the Bel Air Subdivision.

Surface water within the AOI (ponds) contains contaminants at concentrations above health based limits; however the concentrations are within the range of the native background for the area. Fish in the ponds are likely to exceed health based limits for dioxins. It does not appear that the ponds have been used for disposal of hazardous materials.

While the presence of dioxins and furans is widespread in the soils within the AOI, TEQs calculated based on these concentrations are all below the residential soil PRG of 72 ppt TEQ that was proposed during the Dioxin Reassessment process and is still under review. This value is a non-cancer risk-based value that, in this case, would be roughly equivalent to an ELCR of 10-5. Dioxins and furans are all naturally occurring, the natural background resulting from the incomplete combustion of various materials, including wood. The mean TEQ for all samples is 6.70 ppt, and only three sample concentrations exceed three standard deviations of the mean, two samples from Parcel 10 and the sample from Parcel 46. The highest concentrations of PAHs were also detected in the sample from Parcel 10, as were lead and aroclors 1254. It was noted that a structure fire had occurred on this parcel, which is likely to account for the high concentrations present. Arsenic was detected at low concentrations, exceeding its EPA SSL, in almost all of the samples, however concentrations are likely to reflect the local background as most sample concentrations were within three times the concentration detected in the background sample, and were less than the LDEQ background for the area. Low concentrations of PAHs were detected in the majority of the samples, with benzo(a)pyrene concentrations exceeding its EPA SSL. As with dioxins, there is a natural background of PAHs due to incomplete combustion. As with arsenic, concentrations reflect the local background concentration. Chlorinated and aromatic compounds that are emitted in the permitted releases from the surrounding facilities were not detected in the soil samples.

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FIGURES

TABLES

APPENDICES