INTERIM FINAL
PRELIMINARY ASSESSMENT REPORT
For
MOSSVILLE
SULFUR, CALCASIEU PARISH, LOUISIANA

Prepared for
U.S. Environmental Protection Agency Region 6
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☐ The EPA Task Monitor provided final approval of this report

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Attachment A Copy of TDD No. TO-0009-009-05-01 and Amendments
Attachment B Properties Within Mossville Area of Interest
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LIST of ABBREVIATIONS

AOI	Area of Interest
ATSDR	Agency For Toxic Substances & Disease Registry
BLS	Below Land Surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COCs	Contaminants of Concern
EPA	Environmental Protection Agency
FEMA	Federal Emergency Management Agency
GPS	Geographical Positioning System
HRS	Hazard Ranking System
LDEQ	Louisiana Department of Environmental Quality
LDOT	Louisiana Department of Transportation
msl	Mean Sea Level
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
PA	Preliminary Assessment
PCBs	Polychlorinated Biphenyls
PPB	Parts Per Billion
PPT	Parts Per Trillion
RCRA	Resource Conservation and Recovery Act
RI/FS	Remedial Investigation/Feasibility Study
SAM	Site Assessment Manager
SARA	Superfund Amendments and Reauthorization Act
SCDM	Superfund Chemical Data Matrix
START	Superfund Technical Assistance and Response Team
SCDMs	Superfund Chemical Data Matrix
TCDD	2,3,7,8-Tetrachlorodibenzodioxin
TDD	Technical Direction Document
TDL	Target Distance Limit
TEF	Toxicity Equivalence Factor
TEQs	Toxicity Equivalent Quotients

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1 INTRODUCTION

Dynamac Corporation (Dynamac) Superfund Technical Assistance and Response Team (START-3) was tasked by the U.S. Environmental Protection Agency (EPA), Region 6, under Technical Direction Document (TDD) No. TO-0009-09-08-01 (Attachment A) to conduct a Preliminary Assessment (PA) for Mossville, located in Sulfur, Calcasieu Parish, Louisiana. See Figures 1 and 2 for the location of the area of interest in Mossville. The specific goals for the Mossville PA, as identified by the EPA, are:

- To assess the potential threat to public health and the environment posed by the site;
- To determine the potential for a release of hazardous constituents into the environment;
- To screen the site for potential placement onto the National Priorities List (NPL); and
- To provide the documentation necessary to support a decision by the EPA Region 6 Site Assessment Manager (SAM) regarding the need for further action under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)/Superfund Amendments and Reauthorization Act (SARA).

The PA was prepared according to *Guidance for Performing Preliminary Assessments Under CERCLA*, 40 CFR Part 300, Hazard Ranking System (HRS) Final Rule, the HRS Guidance Manual, and the Superfund Chemical Data Matrix (SCDM) (Ref. 1; Ref. 2; Ref. 3; and Ref. 4).

The scope of the PA, as listed in the TDD (Attachment A) and in discussions with the EPA, included:

- Prepare the PA Report according to EPA guidance for performing preliminary assessments (EPA540-G-91-013, Publication 9345.0-01A).
- Review of all available EPA and Louisiana Department of Environmental Quality (LDEQ) site files;
- Review of all available EPA and LDEQ files for facilities near the Mossville area of interest the may have contributed contamination to the Mossville area of interest;
- Conduct an on-site reconnaissance inspection; and
- Collect additional data (e.g., water well survey) to be used in assessing the site.

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2 SITE DESCRIPTION

This section provides information about the site location and description, regulatory history, and summary of previous investigations related to the site.

2.1 Site Location

The area of interest (AOI) in Mossville consists of residential communities located west and northwest of the concentration of chemical plants in Westlake and northern Lake Charles, Louisiana (Figure 2). The site is predominately residential, with areas of woodlands and a few commercial properties/businesses (Figure 2). The AOI encompasses the residential properties along Old Spanish Trail/Burton Rd., Prater Rd., Evergreen Rd., and LA 109/N. Cities Service Hwy., an area roughly bounded by the KCS Railroad tracks on the south, VCM Plant Road on the east, Junius Road on the west, and Village Orphanage on the north. Old Spanish Trail/East Bruton Road 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).

2.2 Site Description

START-3 conducted a drive-by reconnaissance inspection at the Mossville AOI on October 27, 2009. Mr. Keith Horn of the LDEQ, Brenda Cook, EPA SAM, and John Meyer, EPA, accompanied START-3 on the inspection. START-3 personnel, David Anderson, visually observed the property features and current conditions within the Mossville AOI.

In the Bel Air Subdivision, the easternmost portion of the Mossville AOI, bounded by Rigmaiden, Old Spanish Trail, VCM Plant Road, and 7th/8th Street, the majority of the lots (295 of 329) are currently owned by Sasol North America (Ref. 35). 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 further west are in use as private residences.

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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. 11). Chemical plants/refineries operated by Georgia Gulf, Sasol North America, and ConocoPhillips are located adjacent to the eastern boundary of the Mossville AOI (Ref. 34). Other industrial facilities southeast of Mossville (Figure 3) 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 (Ref. 34). The Entergy Roy S. Nelson power plant is located north-northeast of Mossville (Ref 10, p. 5).

2.3 Summary of Regulatory History and Previous Investigations

Regulatory History

As Mossville is a residential community, there is no direct regulatory involvement by either the EPA or 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).

Previous Investigations

For purposes of this discussion, dioxin and dioxin like compounds will refer to all of the 200 PCD and PCF congeners and the PCB congeners. The most toxic congener, 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD), is the only specific dioxin being discussed. Other congeners exhibiting TCDD-like toxicity are assessed using Toxicity Equivalence Factors (TEF) to calculate TCDD toxicity equivalent quotients (TEQ).

In 1997, EPA requested that ATSDR conduct a health consultation on samples provided by a resident of Calcasieu Parish (Ref. 11, 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. 11, p.2). Samples were analyzed for poly chlorinated dioxins and furans (PCD and PCF) and for nine polychlorinated biphenyl (PCB) congeners (Ref. 11, p. 2). Three of the

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eleven individual blood samples had TCDD, TEQs, or TEQs+PCBs greater than the reference ranges utilized in the study (Ref. 11, p. 6). The pooled composite blood sample also had TCDD and TEQ concentrations greater than the reference values (Ref. 11, 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. 11, 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 elsewhere (Ref. 11, p. 5). 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 recommend additional investigation to determine the source (Ref. 11, p. 10).

As a result of the 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) 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 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 95th percentile of a comparison population (Ref. 7, pp. 6). Soil sample concentration 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 that 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. 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 know clinical health effects (chloracne or elevated liver enzyme levels). Dioxin TEQ levels

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in the breast milk sample were not considered to be elevated, and the soil and egg concentrations were not at levels of health concern.

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. 12, 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. 12, 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, collection of biota samples to characterize potential impacts of selected fauna, and to assess the risk to human health and ecological receptors (Ref. 12, 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. 12, p. 24). Contaminants detected in samples from Bayou Verdine included polynuclear aromatic hydrocarbons, volatile organics, dioxins and metals. Maple Fork originates in the western portion of the AOI and flows south to its confluence with Bayou d' Inde (Ref. 12, p. 60). Sampling during the RI/FS did not extend into the AOI, although elevated levels of contaminants (dioxins, polynuclear aromatic hydrocarbons, PCBs and metal) were detected downstream (Ref. 12, pp. 19-20). There are no major contaminant sources in Maple Fork Bayou (Figure. 4).

ATSDR conducted Health Consultations based on the surface water and sediment samples collected during the RI/FS, using the contaminants of concern determined during the RI/FS (Ref. 13; Ref. 14). 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. 13, 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. 13, 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. 14, p. 11).

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In 2001, ATSDR conducted a Follow-Up Exposure Investigation in the Mossville area (Ref. 15). 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. 15, pp. 11). Only two of the soil, indoor dust and attic dust sample locations were within the Mossville AOI, the remaining locations were located through-out the general Lake Charles area (Ref. 38). Three of the soil sample locations were located in communities outside of the Lake Charles area, and serve as background locations (Ref. 38). There were no water well samples collected as part of this study within the Mossville AOI (Ref. 38). Samples were analyzed for dioxins and PCBs (Ref. 15, p. 11). Lipid-adjusted serum total dioxin TEQs for the blood samples ranged from 4.1 to 245.2 ppt (Ref. 15, p. 19). Total dioxin TEQs for the soil samples ranged in concentration from 0.09 to 19.26 ppt (Ref. 15, p. 21). Concentrations in the two samples collected within the AOI were 1.22 and 6.47 ppt (Ref. 38). Total dioxin TEQs for the indoor dust samples ranged from 0.24 to 83.13 ppt (Ref. 15, p. 21), with concentrations in the two samples collected within the AOI at 8.44 and 8.85 ppt (Ref. 15, p. 21). Total dioxin TEQs for the attic dust samples ranged from 0.32 to 922.77 ppt (Ref. 15, p. 21), with concentrations in the two sample collected within the AOI at 16.63 and 143.35 ppt (Ref. 38). Dioxins were not detected in the well water samples (Ref. 15, p. 21). 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. 15, p. 46). Dioxin concentration in surface soil, indoor dust, well water and the homegrown produce were not at levels of concern (Ref. 15, p. 46).

In 2001/2002, 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

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miles from the corridor, (Ref. 9, p. 15). Results were compared to the results from Lafayette Parish, located east of Calcasieu Parish (Ref. 9, p. 15). 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 15-29 – 8.4 ppt, age 30-44 – 14.3 ppt, age 45-59 – 18.7 ppt, age >60 36.9 ppt) (Ref. 9, p. 23, 31). 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 male, 19.3 female; industrial buffer – 15.7 male, 25.8 female; outer ring – 19.1 male, 15.1 female) (Ref. 9, p. 31). 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. 24).

3 SOURCE EVALUATION

There are no indications or records indicating that wastes from the chemical plants have been disposed of within the AOI, therefore the primary potential source of contamination within the Mossville AOI is soil contaminated by deposition from air emissions from the chemical plants. A limited number of soil samples have been collected during ASTDR Exposure Investigations; however, chemical analysis of collected samples has been 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. 38).

A second potential source within the Mossville AOI is contaminated groundwater originating from the chemical plants in the area. 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. 18; Ref. 19; Ref. 20; Ref. 38; Ref. 39) (Figure 4). Natural groundwater flow is typically to the south or southwest, however regional flow is often impacted by the proximity of

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the bayous and rivers, as well as by tidal actions, especially within the shallowest zones (Ref. 18, pp. 3-5). Based on the typical flow, the Sasol and Georgia Gulf facilities would be 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. Active groundwater contamination remediation programs are currently in operation at both the Sasol and ConocoPhillips facilities. Pumping for these remediation programs has also impacted ground water flow directions, in some cases reversing the natural flow from to the south to the north.

4 PATHWAY ASSESSMENTS

4.1 Groundwater Migration Pathway

The Groundwater Migration Pathway assesses the potential for suspected contamination in the underlying aquifers. The primary emphasis of the groundwater migration pathway is the identification of drinking water wells and the aquifers from which they draw water.

4.1.1 Groundwater Characteristics

Regional Geology

Calcasieu Parish in Louisiana is located within the Gulf Coastal Plain, which is composed of sediments 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 age deposits which underlie the recent deposits were laid down during glacial retreats during the Pleistocene age. The system of aquifers formed by the Pleistocene deposits have 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”

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foot sand at 900 feet below sea level in Lake Charles marks the base of the Chicot Aquifer, below which begins the Pliocene age 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 thick, and dip to the south (Ref. 16, p.14-17).

Recharge of the shallow sands occurs by migration of rainfall onto the surface of the sands in the Recent deposits, and 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. 16, p. 28). Wells in the Recent deposits are typically 50 foot or less in depth, and produce 2-3 gallons per minute (gpm) (Ref. 16, p. 32).

Recharge of the Chicot Aquifer occurs at its outcrops in Beauregard, Allen, Rapides and Evangeline Parishes, north of Calcasieu Parish (Ref. 16, p. 28). 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. 16, pp. 28, 64). 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. 16, p. 32). These shallow wells typically have yields of less than 100 gpm (Ref. 16, pp. 32-33). 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 industrial use. Yields vary depending on location, but range from 1,800 to 4,500 gpm (Ref. 16, pp. 33-36). 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 below land surface. In the vicinity of Mossville, this sand is reported to be encountered at a depth of 390 feet and

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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 town of Sulfur reportedly obtains its public supply from this sand. The "500 foot" sand ranges from fine sand at the top to coarse sand and gravel at the base (Ref. 16, pp. 36-40).

The "700 foot" sand is used by industries, 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 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. 16, pp. 40-43).

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. 16, pp. 43-45).

Both the Chicot and Evangeline aquifers are under artesian heads, although neither aquifer has artesian flow at the surface. Water levels in the Chicot have declined due to pumping (Ref. 16, pp. 49-51).

The average annual rainfall in Calcasieu Parish is 55.8 inches and the net precipitation is between 15 to 30 inches per year (Ref. 17, p. 6; Ref. 2, Figure 3-2, Table 3-4).

Site-Specific Geology

Due to groundwater contamination at the chemical plants within the Calcasieu Estuary, there are numerous ongoing groundwater monitoring and remediation actions being conducted (Ref. 18; Ref. 19; Ref. 20). 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 area of concern. Four water bearing zones within the recent age deposits have been identified on the Sasol facility (Ref. 18), 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

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Agreement between Vista (the predecessor of Sasol) and LDEQ (Ref. 19). Monitoring of the 1986 Consent Agreement Plume in the "25 foot", "50 foot" and "200 foot" zones is also conducted on Conoco's facility (Ref. 19).

10 Foot Sand

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 above feet 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 continuous laterally (Ref. 18, pp. 3). This zone has not been described on the Conoco facility (Ref. 20).

25 Foot Sand

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. 18, 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. 20, 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. 18, 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 msl (Ref. 20, p. 23). This zone was originally

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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. 18, p 5: Ref. 20, 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 above MSL (Ref. 18, p. 5). Reported flow direction on the ConocoPhillips facility is also to the southwest (Ref. 20, p. 23).

START-3 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 a total of six public supply wells, two private, domestic wells, one irrigation well, and twenty five monitor/recovery/piezometer wells registered within the AOI, although many of the wells have been plugged and abandoned (Table 1). Three of the public supply wells are utilized by the Mossville Water Works District 2 to provide water within the Mossville AOI (Ref. 21). 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 wells used as monitor/recovery/observation/piezometer have been registered (Ref. 21). The public supply wells and their distances to the Mossville AOI are shown in Table 2. Public wells within the 4-mile radius are utilized by Parish water districts and the towns of Sulphur, Lake Charles and Westlake.

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The identified target water wells within the 4-mile radius ranged in depth from 13 feet bls to 698 feet bls. The target wells were screened in the Recent Deposits, and the "200 and 500 foot" sands of the Chicot aquifer (Ref. 21).

4.1.2 Likelihood of Release

Samples were collected from five locations in the Mossville water system on August 21, 2009 and analyzed for volatile and semi-volatile organics and total metals (Ref. 22). Metals were detected in the water samples; however, concentrations did not exceed the National Primary Drinking Water Maximum Contaminant Levels (Ref. 37). Low concentrations of trihalomethanes were detected in the samples (Ref. 22). Trihalomethanes are found in treated water supplies (Ref. 37).

4.1.3 Groundwater Receptors

A water well survey, within a 4-mile radius of the Mossville AOI was conducted by START-3 utilizing the LDOT website (Ref. 21). The 4-mile water radius was constructed using the borders of the AOI (Figure 5). START-3 has identified that groundwater within the 4-mile radius of the site is used for the following purposes: as a municipal water supply; as a private drinking water source, for irrigation, and industrial supply (Ref. 21). It is suspected that additional private drinking water wells may be located within the 4-mile radius; however, due to the timeframe in which the water wells were drilled/installed, they may not be registered with the LDOT.

4.1.3.1 Drinking Water Receptors

Municipal Drinking Water Receptors

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. 21). 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 21).

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

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tracks and north of US Hwy 90. The number of connections to the Mossville Waterworks District 2 is 371 (337 residential) (Ref. 23) and the system serves 879 (Ref. 23, Ref. 25) persons. Water District 2 utilizes three (3) drinking water wells, depths ranging from 425 feet bls to 458 feet bls (Table 1) (Ref. 21). The municipal wells are located at the waterworks situated north of the Jacob Rigmaiden Center, near the center of the Mossville AOI (Figure 5; Ref. 21).

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. 24). 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. 24). 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. 23). 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

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miles of the AOI and one well between 3 and 4 miles of the AOI (Ref. 21). 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, but are not included in the usage calculations (Ref. 21). The estimated municipal usage by distance ring is included in Table 4 (Attachment C). It should be noted that municipal drinking water users may be overestimated due to the fact that the number of connections could include businesses.

Domestic Drinking Water Receptors

According to the LDOT water well database, a total of 443 active private drinking water wells are located within the 4-mile radius (Table 3; Ref. 21). 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. 21). Two of the wells are located within the Mossville AOI. The estimated domestic usage by distance ring is included in Table 5 (Attachment C).

Total estimated domestic and municipal groundwater usage by aquifer and distance is listed in Table 6.

4.1.3.2 Resource Usage

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. 21, pp. 21-22 and 30-31).

4.1.3.3 Wellhead Protection Areas

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. 26).

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4.2 Surface Water Migration Pathway

The Surface Water Migration Pathway, overland/flood migration component assesses the potential for suspected contamination in perennial surface water bodies identified as part of the 15-mile downstream target distance limit (TDL). Identified perennial surface water bodies include streams, rivers, lakes, coastal tidal waters and oceans. The pathway takes into account such factors as distance to the overland flow segment, the nearest surface water body, flood frequencies, drainage area, surface soil type(s), and the 2-year, 24-hour rainfall figure, the size of the source(s) being evaluated and the chemical constituents associated with the sources, and the associated surface water receptors identified within the 15-mile downstream TDL. SWMP receptors include the location of the nearest drinking water intakes and associated populations (Drinking Water Threat), fisheries and the consumption of aquatic human food chain organisms (Human Food Chain Threat), and sensitive environments (Environmental Threat) (Ref. 1; Ref. 2; and Ref. 3).

4.2.1 Surface Water Characteristics

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 1; Ref. 5). Bayou Verdine flows southeast, passing through the ConocoPhillips and Lyondell Chemical Facilities, until discharging into the Calcasieu River north of Coon Island (Figure 3, Ref. 5). Discharge from the western portion of the AOI flows into Maple Fork both from drainage ditches and from direct surface flow. Maple Fork is a perennial surface water body originating within the AOI, which flows to the southeast into Bayou D'Inde (Figure 1; Figure 3; Ref. 5). Bayou D'Inde flows southeast into the Calcasieu River one mile southwest of Coon Island. As the overland flow segments pass through the Mossville AOI and the source is contaminated soil, the overland flow distance is 0 feet (Figure 2). There are numerous active NPDES discharges to Bayou Verdine and Maple Fork/Bayou D'Inde. A remedial investigation has been conducted to assess the impact of the chemical plants around the AOI on the Calcasieu Estuary and remedial activities are ongoing (Ref. 12).

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Using Maple Fork north of US Highway 90 as the probable point of entry (PPE) into surface waters, the in-water segment extends for approximately 2 mile to the confluence of Maple Fork with Bayou D'Inde, 2.5 miles to the confluence of Bayou D'Inde and the Calcasieu River, and then southwest and south in the Calcasieu River for the remaining 10.5 miles to the TDL. Since the Calcasieu River is under tidal influence (Ref. 12, p. 5; Ref. 28, p. 3), the in-water segment also extends northeast within the river for 10.5 miles (Ref. 2; Ref. 3; Ref. 5, p. 5).

4.2.2 Likelihood of Release

As stated in Section 4.2.1, Bayou Verdine and Maple Fork pass thru or originate within the Mossville AOI. The distance to a perennial surface water body is 0 feet (Figure 2). The two-year, 24-hour rainfall for the area of the site is approximately 5.0 to 5.5 inches (Ref. 27, p. 1).

Mossville is situated within the Gulf Coast Prairies of Calcasieu Parish (Ref. 28, p. 1). The soils within the area of concern are generally silt loams comprising 9 soil groups (Ref. 29, 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 . 28, pp. 13-40; Ref. 29, pp. 12-21). The soils range from moderately well drained to frequently flooded soils, 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. 29, pp. 12-29).

Portions of the Mossville AOI along Bayou Verdine and Maple Fork are within the Federal Emergency Management Agency (FEMA) 100 year floodplains (Ref. 30). 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.

4.2.3 Surface Water Receptors

Surface water is not utilized for public supply in Calcasieu Parish (Ref. 28, p. 3). Drinking water is obtained from either municipal or domestic water wells screened in

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the Recent Deposits or Chicot aquifers (Ref. 28, p. 3). Surface water resource usage occurs within Calcasieu parish, primarily for rice farming (Ref. 28, p. 2). It has not been determined if water from the 15 mile TDL of the Calcasieu River is being used as a resource.

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. 31). Guidance used to issue the health advisories is included in Reference 32. 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 considered as federally or state designated endangered or threatened species in Calcasieu Parish (Ref. 33, pp. 1-3). The location of the critical habitats for these designated endangered or threatened species has not been obtained.

Wetlands are present along the Calcasieu River within the TDL. An estimate of the wetland frontage has not been determined (Figure 1).

4.3 Soil Exposure Pathway

The Soil Exposure Pathway assesses the threat to human health and the environment by direct exposure to hazardous substances and areas of suspected contamination. This pathway takes into account potential contact with in-place hazardous substances at a site, rather than the migration of substances from the site (Ref. 1). The following subsections will describe the various details associated with this pathway.

4.3.1 Likelihood of Exposure

Likelihood of Exposure is concerned with areas of suspected contamination and is not limited to soil, but any sources, areas of contamination or other material on the surface that can be considered as areas of suspected contamination.

Mossville consists of residential, agricultural, and small businesses located in an unincorporated area of Calcasieu Parish, north of US Highway 90, and north of Lake

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Charles, Louisiana. The AOI encompasses approximately 1.5 square miles. The area is north and west of a series of a large number of refineries and chemical plants (Figure 3, Ref. 34). 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 analysis has been limited to dioxins and dioxin like materials, with dioxin-like materials being detected. ATSDR concluded that dioxin concentration in surface soil were not at levels of concern (Ref. 15, p. 46).

4.3.2 Soil Exposure Receptors

There are over 1,600 parcels located within the AOI, with over 900 of these properties being residential or commercial in nature (Ref. 35, Figures 6, 6-Ahru 6-P, Attachment B). One school and one recreation center are also located within the AOI (Figure 1).

Calcasieu Parish does contain two (2) species of birds and one (1) species of mammal that have been designated as either federally and/or state endangered and threatened species; however, the exact locations for these critical habitats have not been documented (Ref. 33, 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 within a 1-mile radius of the AOI is 6,287 (Ref. 36). The AOI is accessible, and there is recreational use occurring at the Rigmaiden Recreation Center on the AOI (Figure 1).

4.4 Air Migration Pathway

The Air Migration Pathway assesses the threat to human health and the environment through the threat of airborne releases of hazardous substances.

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4.4.1 Air Pathway Characteristics

The Mossville AOI consists of residential and commercial lots within a one and a half square mile area of Calcasieu Parish (Ref. 35). The site is located in the vicinity of numerous chemical plants and refineries (Ref. 34). Potential contaminants of concern include the contaminants from the chemical plants which have accumulated in the soil within the Mossville AOI.

Likelihood of Release

Since the chemical plants and refineries are active facilities with ongoing permitted releases, attribution of any release from the potentially contaminated soil within the Mossville AOI cannot be conducted. For this reason, the air pathway will not be evaluated at this time.

4.4.2 Air Pathway Receptors

Pathway is not evaluated.

5 SUMMARY

Mossville consists of residential, commercial and woodland properties in an incorporated area of Calcasieu Parish, Louisiana. The Mossville AOI encompasses the residential properties along Old Spanish Trail/Burton Rd., Prater Rd., Evergreen Rd., and LA 109/N. Cities Service Hwy. an area roughly bounded by the KCS Railroad tracks on the south, VCM Plant Road on the east, Junius Road on the west, and Village Orphanage on the north. Old Spanish Trail/East Bruton Road passes thru the AOI, providing the primary access to the area (Figures 1 and 2). Mossville is located west and northwest of the concentration of chemical plants in Westlake and northern Lake Charles, Louisiana.

To apply the collected data to the HRS model to determine if the site was eligible for the NPL, the groundwater and surface soil were evaluated as sources of potential contamination. The contaminants of concern (COCs) include dioxin and dioxin like compounds, chlorinated materials such as vinyl chloride and ethylene dichloride, as well as benzene, polynuclear aromatic hydrocarbons and metals.

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The pathways of concern are the Soil Exposure Pathway based on residents living on potentially contaminated soil and the Groundwater Migration Pathway, based on potential groundwater receptors. Sampling has been of limited extent and analysis of samples has been limited to primarily dioxin and dioxin like compounds. Although dioxin has been detected in the surface soils in the limited number of samples collected within the AOI, the concentrations detected are not significantly greater than in samples collected outside of the AOI. Groundwater wells are used to obtain the drinking water supply within the AOI and within a 4-mile radius of the site. Four water supply systems have wells that serve approximately 11,717 connections serving approximately 30,479 persons. The public supply wells are screened in various sands of the Chicot aquifer and range in depth from 240 feet bls to 580 feet bls. Wells for the Mossville Waterworks District 2 are located within the AOI. According to the LDOT, 443 registered, domestic water wells have been identified within the 4-mile radius, with the closest private drinking water well located within the AOI. It should be noted that additional private drinking water wells may be located within the 4-mile radius; however, they may not have been registered with LDOT. Seventeen (17) irrigation wells have been identified within four miles of the AOI however, it is not known if these wells are currently used for the growing of commercial food or forage crops or used to water commercial livestock. All municipal water wells are located within a Wellhead Protection Area.

Contaminated soil may exist throughout the Mossville AOI, which contains over 800 residential, commercial and wooded properties. Based on 2004 census estimates, 665 persons live within the AOI and 6,287 persons live within one mile of the AOI. The Rigmaiden Recreation Center is located within the AOI.

The Surface Water and Air Migration Pathways are not HRS pathways of concern because there are past or current regulated releases from nearby industries. Several federal or state designated endangered, rare, or threatened terrestrial species exist within Calcasieu Parish; however, the critical habitats associated with these terrestrial species have not been documented on-site or within 200 feet of the site.

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