U.S. ENVIRONMENTAL PROTECTION AGENCY
SUPERFUND PROPOSED PLAN
LCP CHEMICALS GEORGIA SUPERFUND SITE
OPERABLE UNIT 3 – UPLAND SOIL

Brunswick, Glynn County, Georgia **August 2019**

INTRODUCTION

The U. S. Environmental Protection Agency (EPA) is issuing this **Proposed Plan**[1] for Operable Unit 3 (OU3) at the LCP Chemicals Georgia **Superfund** Site (Site) in Brunswick, Glynn County, Georgia. This Proposed Plan is issued by the EPA, the lead agency for the Site, and the Georgia Environmental Protection Division (GAEPD), the support agency. The Proposed Plan presents the results of the **Remedial Investigation/Feasibility Study** (RI/FS), including **Baseline Risk Assessments** for human and ecological receptors. This Proposed Plan discusses the risks associated with the surface and shallow subsurface soil in the Upland portion of the Site (OU3) and recommends no further action.

EPA, in consultation with GAEPD, will select the final remedy for OU3 after the **public comment period** has ended and the information submitted during the comment period has been reviewed and considered. The final decision will be documented in a **Record of Decision** (ROD)**.** EPA is issuing this Proposed Plan as part of its public participation responsibilities under Section 117(a) of the **Comprehensive Environmental Response, Compensation and Liability Act** (CERCLA or Superfund) and the Section 300.430(f)(2) of the **National Oil and Hazardous Substances Pollution Contingency Plan** (NCP). The Proposed Plan summarizes information that can be found in greater detail in the RI/FS reports and other documents, which present the results of sampling conducted from 1995 through 2018.

PUBLIC COMMENT PERIOD:

September 3, 2019 – October 2, 2019

The EPA will accept written comments on the Proposed Plan during the 30-day public comment period. Send written comments by mail or email to:

Pam Scully
USEPA Region 4
61 Forsyth Street SW
Atlanta, Georgia 30303
scully.pam@epa.gov

AVAILABILITY SESSION:

As a part of the public involvement process, an availability session will be held on **September 11, 2019** at the Marine Extension Building located at 715 Bay Street in Brunswick. Drop by between **2 pm to 5 pm**.

PUBLIC MEETING:

A public meeting is scheduled on **September 12, 2019**. The meeting will be held at Maranatha Baptist Church located at 3706 Norwich Street in Brunswick, GA at 5:30 pm. At this meeting, the EPA will present the information it has about the Site, describe its reasons for recommending no further action in the Proposed Plan, and answer any questions. Oral and written comments will be accepted at the meeting.

For more information, see the Administrative Record at the following locations:

Brunswick-Glynn Co. Library
208 Gloucester Street
Brunswick, GA 31520
(912) 267-1212

U.S. EPA - Region 4
61 Forsyth St., SW
Atlanta, GA 30303
Attn: Tina Terrell
(404) 562-8835

[1] Terms first appearing in bold are defined in the glossary at the end of this Proposed Plan.

These reports and documents are contained in the **administrative record,** located at the **information repository.**

1.0 SITE BACKGROUND

On June 17, 1996, the LCP Chemicals Georgia Site was added to the **National Priorities List** (NPL). The NPL listing means that the Site ranks among the nation's highest priorities among the known releases of hazardous substances, pollutants or contaminants for remedial evaluation and response under the federal Superfund law.

1.1 Site Description

The LCP Chemicals Georgia Site property occupies approximately 813 acres immediately northwest of the City of Brunswick, Glynn County, Georgia (Figure 1). Tidal marshland comprises about 670 acres of the property. Manufacturing operations at the Site occurred on approximately 134 acres of Upland area east of the marsh. The Site is bordered by a county land-disposal facility and a pistol firing range to the north, Ross Road to the east, the Turtle River and associated marshes to the west, and Brunswick Cellulose to the south.

In order to facilitate the investigation of different pathways and areas of contamination, the Site was divided into three **Operable Units** (OUs): the marshland portion of the Site is designated as OU1; Site-wide groundwater and all soil beneath the former cell building area are designated as OU2; and the Upland portion of the Site (excluding the groundwater and the cell building area) is designated as OU3.

The subject of this Proposed Plan is the Upland portion of the Site, OU3. The Upland area is east of the marsh (OU1) and is characterized by gently sloping terrain ranging from approximately 5 feet (ft) above mean sea level (amsl) along the marsh/Upland border to an elevation of approximately 15ft amsl along Ross Road. This area of the Site is roughly divided in half (north/south) by the east-west entrance road (B Street), which transitions into the causeway road where B Street ends at the marsh-Upland border and extends to Purvis Creek. The Upland portion of the Site is also roughly divided in half (east/west) by a fence line separation of the land used in former industrial operations and land primarily used for office and petroleum products storage facilities. These natural property breaks were used to form quadrants, which were used as **exposure units** in the **Human Health Risk Assessment** (HHRA). Figure 2 shows the four quadrants.

Two non-contiguous areas are considered part of the Upland area. They are the Off-Site Tank Farm (OTF), located east of the main Upland parcels, and the Salt Dock, a separate land parcel located approximately one half mile from the primary Upland parcel along the Turtle River (Figure 3). The tanks in the OTF, which no longer exists, were 2.4 million gallon tanks constructed by the Atlantic Richfield Company (ARCO) petroleum refinery. The Salt Dock, as the name implies, was the location where barges delivering brine for the **mercury cell process** were received. Brine was converted to a slurry and pumped via a pipeline to the mercury cell building area. Both the OTF and the Salt Dock property were investigated and are included in this Proposed Plan.

1.2 Site Operating History

Figure 4 shows the areas where past industrial operations occurred at the Site, leading to contamination of soil, sediment, groundwater, and surface water with a number of contaminants and hazardous

Figure 1 – Site Location

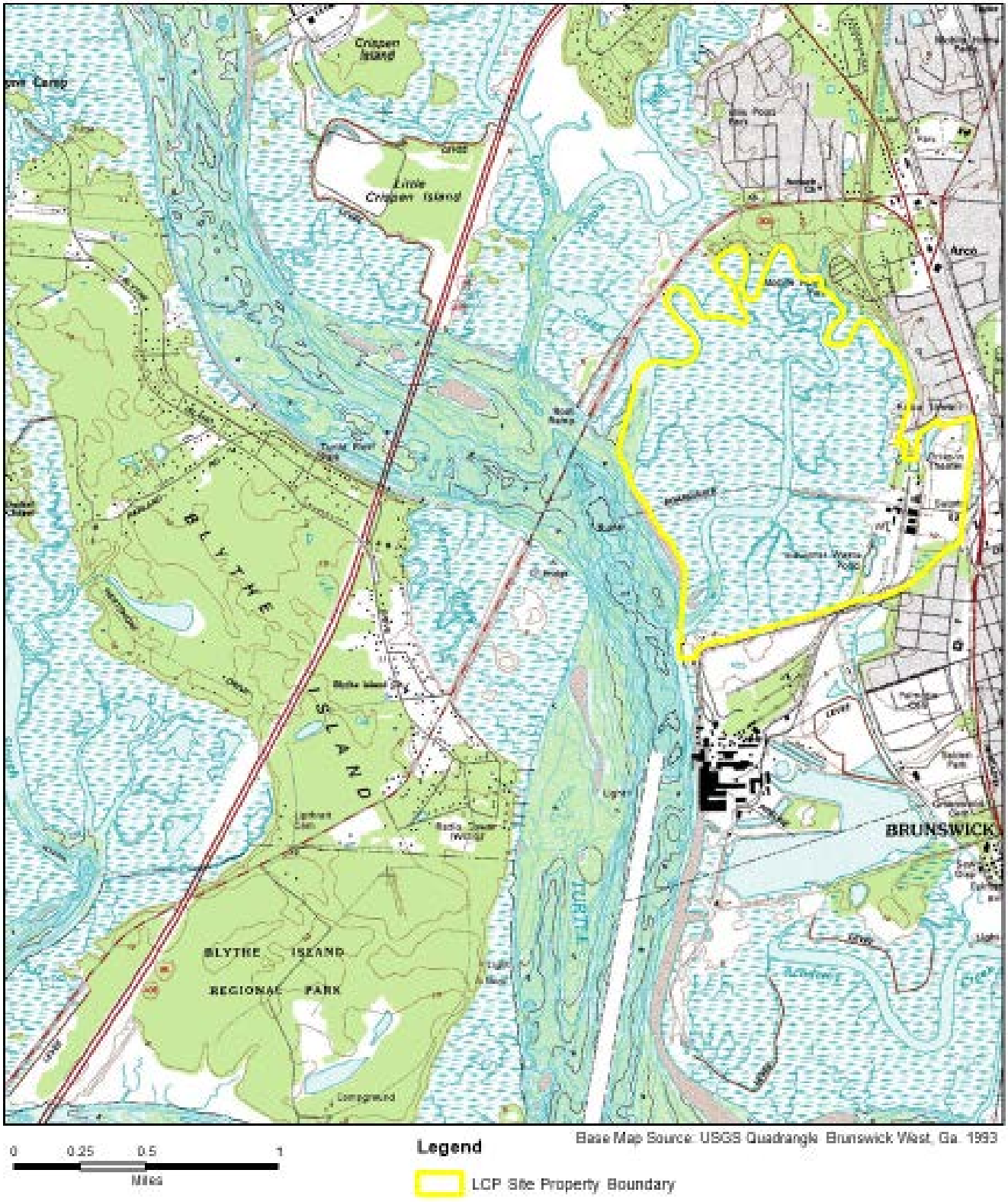


Figure 2 – Upland Exposure Units for the OU3 Human Health Risk Assessement

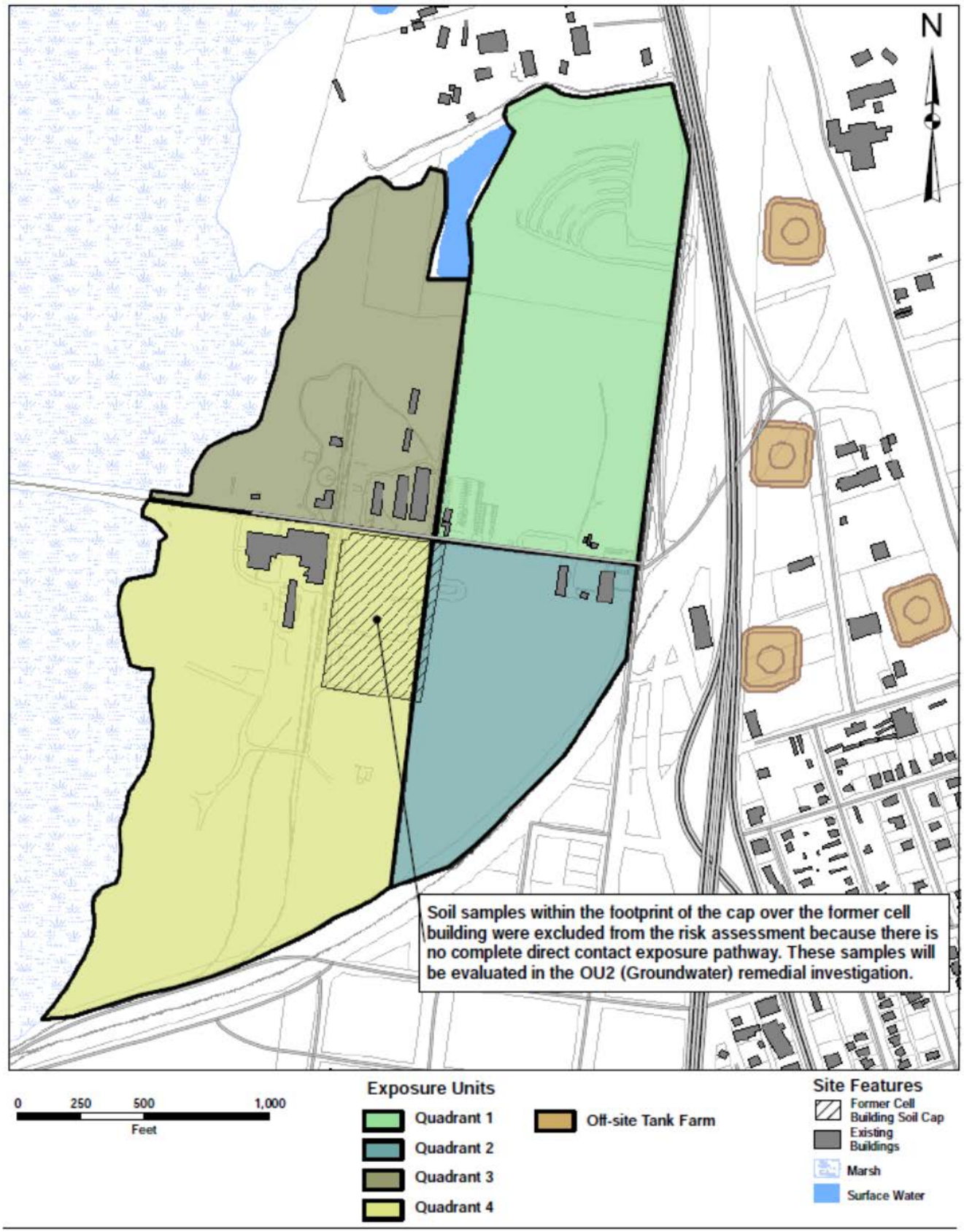


Figure 3 – Upland Removal Action Extent

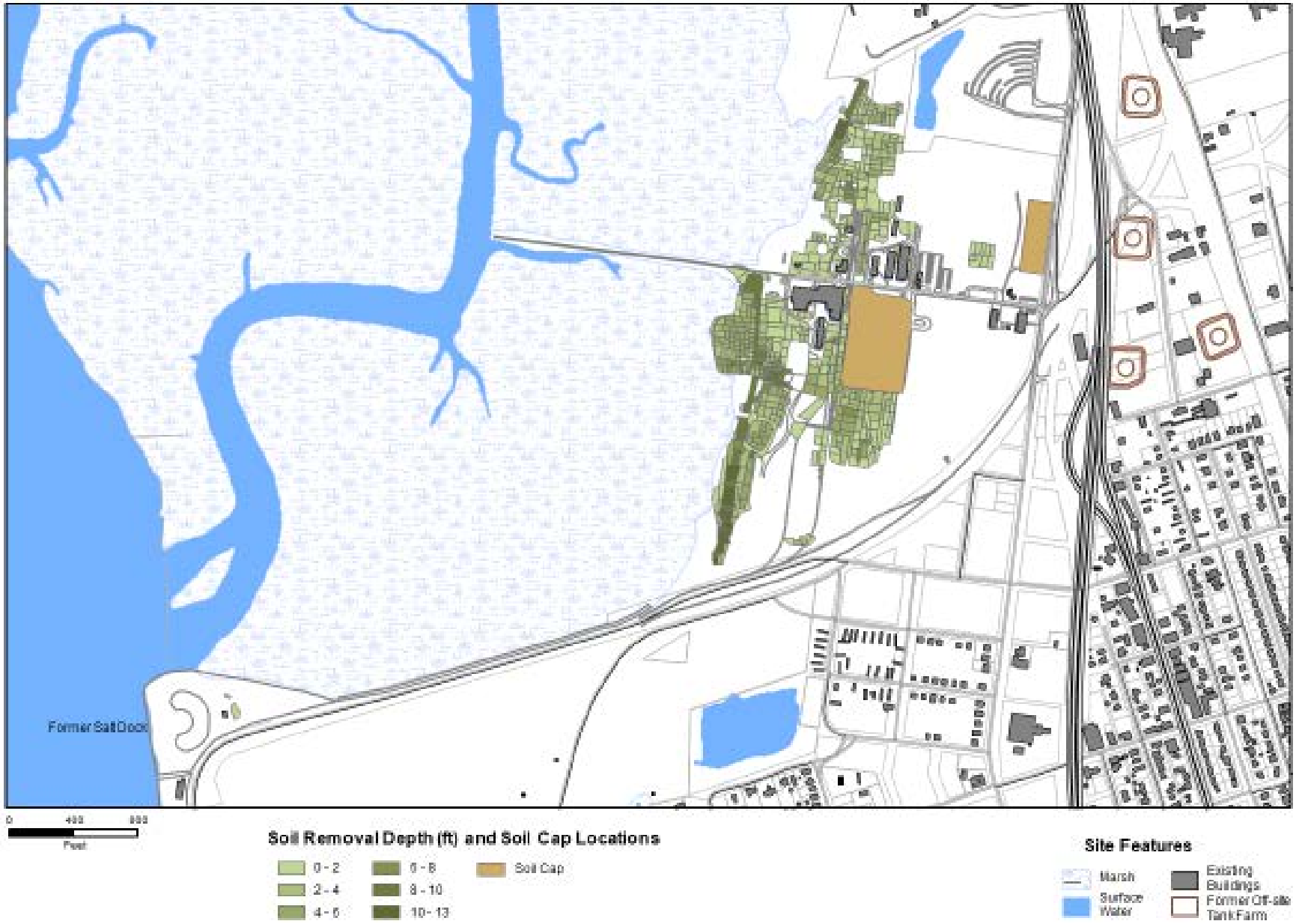


Figure 4 – Site Operational Areas

substances. ARCO operated at the Site as a petroleum refinery from 1919 until 1935. At one time, over 100 process and storage tanks were present on the Site.

After the refinery closed, Georgia Power Company (Georgia Power) purchased portions of the Site in 1937, 1942, and 1950. These purchases included two parcels of land and two 750 kilowatt electric generators. Georgia Power had increased its power generation capacity at the Site to 5500 kilowatt by 1941.

The Dixie Paint and Varnish Company, now a subsidiary of the O'Brien Corporation, operated a paint and varnish formulation facility from 1941 until 1955 on a portion of the Site property, south of the Georgia Power parcels.

In 1955, after acquiring almost all the land constituting what is now known to be the Site, Allied Chemical and Dye Corporation (Allied) established and operated a **chlor-alkali** facility on the western portion of the Upland, principally for the production of chlorine gas, hydrogen gas, and caustic solution. The plant operated using the mercury cell process, which involves passing a concentrated brine solution between a stationary graphite or metal anode and a flowing mercury cathode to produce chlorine gas, sodium hydroxide (caustic) solution, and hydrogen gas, as a by-product. Sodium hypochlorite (bleach) was also produced in a secondary reaction. For a time, the graphite anodes were impregnated with the **Polychlorinated Biphenyl** (PCB) **Aroclor** 1268 to extend their use.

Allied operated the facility until 1979, when Linden Chemicals and Plastics, Inc. (LCP, owned by the Hanlin Group) purchased the property and the chlor-alkali plant. The chlor-alkali process continued with modification following the purchase. Part of the modification included the production of hydrochloric acid by reacting chlorine and hydrogen. Manufacturing operations continued until February 1994, when LCP implemented an orderly shutdown of the plant and filed for backruptcy.

Honeywell International, Inc. (Honeywell), the company formed when Allied merged with Honeywell, Inc., repurchased most of the Site property in 1998. The northeast portion shown as Quadrant 1 in Figure 3 was sold to Glynn County in 2012 for redevelopment. The Salt Dock parcel shown on Figure 4 was sold to Koch Cellulose. Honeywell also purchased the Georgia Power operational areas shown on Figure 4 in 2016.

1.3 Enforcement Activities

In February 1994, after numerous investigations by the GAEPD and the EPA, GAEPD requested that the EPA initiate removal enforcement actions at the Site. The EPA Action Memorandum signed in May 1994 identified the Site as a high priority for a removal action.

A Unilateral Administrative Order for removal action was issued to the Hanlin Group (LCP) and Allied in 1994 and then amended in 1995 to include ARCO, Georgia Power, and the O'Brien Corporation as additional respondents. Three **Potentially Responsible Parties** (PRPs), Allied, Georgia Power, and ARCO, subsequently entered into a mixed funding Administrative Order on Consent (AOC) to conduct additional removal activities in August 1997. The removal activities were completed in July 1999.

The RI/FS has been performed pursuant to a separate 1995 AOC, between ARCO, Allied, Georgia Power and the EPA. The PRPs agreed to perform the RI/FS concurrently with the removal work.

In May 2007, Honeywell, identified earlier as the successor to Allied, signed an AOC agreeing to perform a time-critical removal of a caustic brine pool located in the vicinity of the former mercury cell buildings, which are part of OU2. The caustic brine pool beneath the Site is still undergoing treatment in order to neutralize the pH of groundwater.

On September 22, 2015, the EPA signed a ROD for OU1. Honeywell and Georgia Power agreed to perform the work required in the OU1 ROD in a **Consent Decree** (CD) for **Remedial Design and Remedial Action** (RD/RA) at OU1, which was approved by the U.S. District Court, Southern District of Georgia, Brunswick Division on July 27, 2017. The OU1 RD is underway and scheduled for completion in November 2020. The RD includes a two-year pilot study of the thin layer cap portion of the remedy.

1.4 Past Removal Response Actions

Between 1994 and 1997, removal response actions were performed by the PRPs, with EPA oversight, in the marsh, around the mercury cell buildings, and on the Upland portion of the Site. The removal actions included the excavation of contaminated soil and industrial process waste from 26 areas of the Site (Figure 3). A total of approximately 130,000 cubic yards (CY) of soil and waste were removed during these actions. The removal areas contained material contaminated with constituents including petroleum hydrocarbons (volatile and **semi-volatile organic compounds**), mercury, alkaline sludges, PCBs, and lead. After excavation, the areas were backfilled as needed to restore to the original grade.

Areas formerly containing petroleum hydrocarbon source materials included the North and South Removal Areas, North and South Separators, and Bunker "C" Tank Area (Figure 5). Both the North and the South Removal Areas contained petroleum hydrocarbon-saturated soil and petroleum tar/sludge waste. The removal activities at these two areas included excavation and off-site disposal of approximately 30,500 CY of waste. The North and South Separators contained petroleum hydrocarbon bottom sludge. Approximately 1,240 and 1,325 CY of sludge were removed from the North and South Separators, respectively. The Bunker "C" Tank Area included petroleum hydrocarbon-saturated soil and above-ground tanks containing fuel oil, wastewater and bottom sludge. The contents of the tanks were removed, the tanks were demolished, and approximately 2,900 CY of Bunker "C" Tank Area soil were excavated and disposed off-site.

Areas formerly containing mercury and mercury-contaminated alkaline sludges included the cell building area (OU2), mercury retort area, caustic tanks area, bleach mud at the north removal area, lime softening mud at the waste disposal impoundment, the brine mud impoundments, former facility disposal area, and adjacent portions of the marsh (OU1), including tidal channels (Figure 5). Removal activities at the cell building area resulted in the elimination of above-grade sources. This included the removal (off-site recycling) of elemental mercury from the process equipment, decommissioning and demolition of the mercury cell buildings, and placement of a soil cover over the entire cell building area. At the mercury retort area, the above-ground concrete structures as well as the soil and retort waste that were contaminated with mercury were excavated and disposed of off-site. Above ground tanks and approximately 2,500 CY of soil that were contaminated with mercury and caustic were removed from the caustic area. The alkaline sludges that were contaminated with mercury included the bleach mud, lime softening mud, and brine mud. Removal of these contamination sources was accomplished by excavating and disposing a total of approximately 37,000 CY of the process wastes from the north disposal area, waste disposal impoundment, and brine mud impoundments.

Table 1 presents the approximate hazardous and non-hazardous waste totals removed and properly disposed of from each of the areas shown on Figures 3 and 5.

Figure 5 – Upland Geographic (Source) Areas

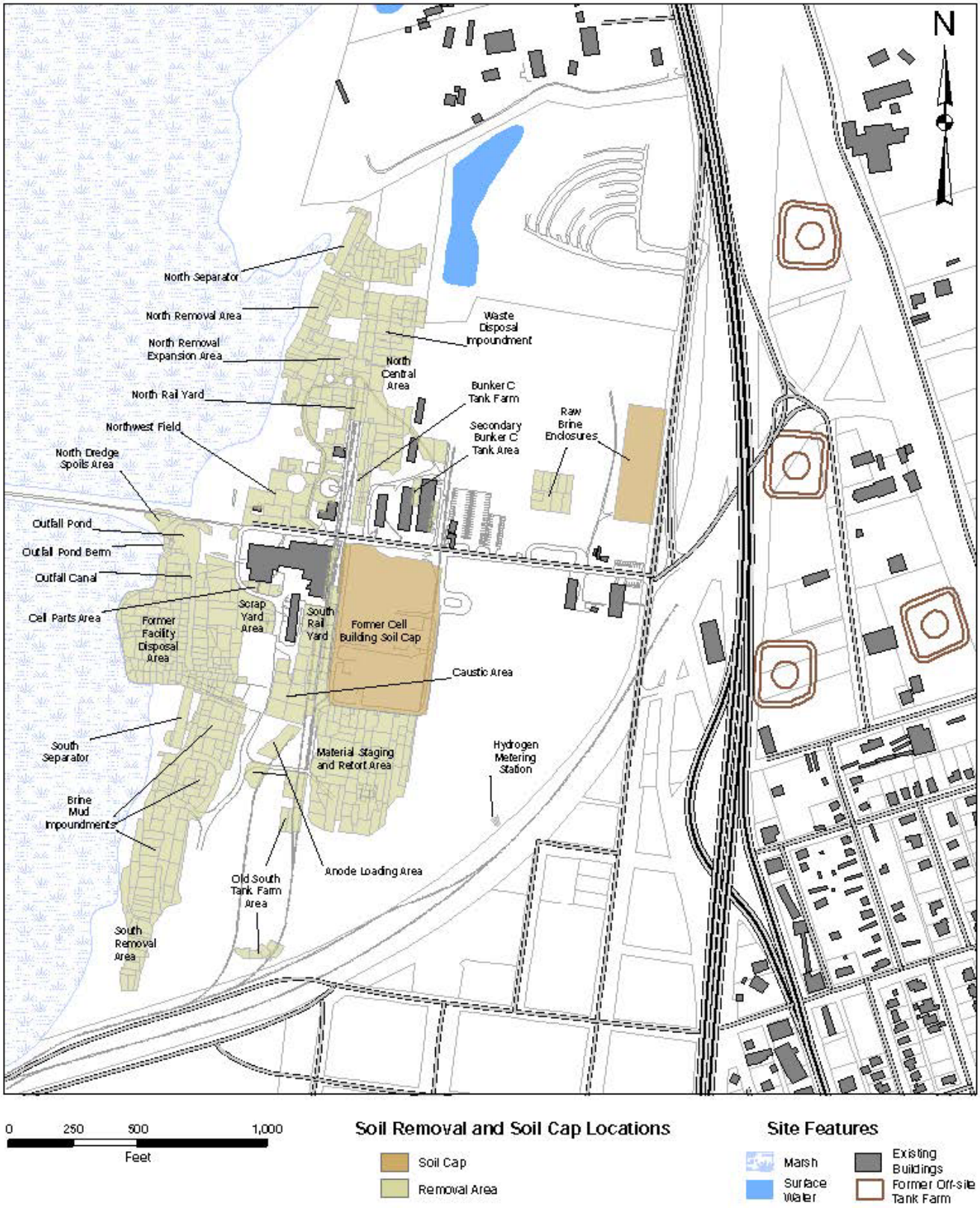


Table 1: Approximate Removal Quantities			
Removal Area	**Subtitle D Waste[2] (CY)**	**Subtitle C TSCA Waste[3] (CY)**	**Total (CY)**
Anode Loading Area	0	900	900
Bunker “C” Tank Farm	2,510	350	2,860
Brine Mud Impoundment	16,397	10,393	26,790
Caustic Area	1,735	785	2,520
Former Facility Disposal Area	0	18,915	18,915
Hydrogen Metering Station	0	61	61
Material Staging and Retort Area	0	7,145	7,145
North Central Area	1,780	300	2,080
North Dredge Spoils and Outfall Pond Berm	455	710	1,165
North Rail Yard	1,140	0	1,140
North Removal Area	9,345	0	9,345
North Removal Expansion Area	9,075	0	9,075
North Separator	1,240	0	1,240
Northwest Field	320	1,750	2,070
Old South Tank Farm	770	0	770
Outfall Pond and Canal	0	1,880	1,880
Salt Dock Area	0	135	135
Scrap Yard and Cell Parts Area	80	10,165	10,245
Secondary Bunker “C” Tank Area	325	15	340
South Rail Yard	1,665	1,200	2,865
South Removal Area	18,735	2,440	21,175
South Separator	0	1,325	1,325
Waste Disposal Impoundment	5,590	491	6,081
Site Total	**71,162**	**58,960**	**130,122**

[2] Non-hazardous soil and waste
[3] Hazardous soil and waste

1.5 Past Public Participation

The EPA has engaged the public during the implementation of the past removal actions and the investigation of the marsh. The EPA maintains a website for the Site that contains many of the documents that support the OU3 proposed remedy and information related to OU1 and OU2: https://www.epa.gov/superfund/lcp-chemicals-georgia. The Site's remedial project managers have met with and made multiple presentations before the members of the Glynn Environmental Coalition and have participated in radio interviews about the Site. The Region has published the *Brunswick Environmental Cleanup Newsletter* to update the public on the cleanup progress at the LCP Chemicals Georgia Site and the three other Superfund sites in the Brunswick area.

In December 2014, the EPA hosted a Proposed Plan meeting during which the EPA presented a description of the proposed remedy for the **estuarine** portions of the Site (the marsh or OU1). Additionally, in February 2015, EPA, in collaboration with GAEPD, the Agency for Toxic Substance and Disease Registry (ATSDR) and the Georgia Department of Health, hosted an Availability Session to answer questions regarding the marsh remedy and questions regarding the health effects of PCBs. In May 2018, a full-day Availability Session was held where the public was invited to be updated on the entire LCP Chemicals Site, along with the three other Superfund sites located in Brunswick, Georgia.

2.0 SITE CHARACTERISTICS

Investigations were conducted between 1994 and 2011 in Upland areas to determine: where time critical removals should be conducted; the nature and extent of remaining soil contamination; and the risks to human health and the environment posed by the remaining soil contamination. By June 1996, approximately 592 surface and subsurface soil samples had been collected and analyzed for contaminants, including **volatile organic compounds (VOCs)** and semi-volatile organic compounds (SVOCs). Similarly, approximately 920 soil samples were analyzed for PCBs and **heavy metals,** including lead. In 2011, Upland soil were sampled for **polychlorinated dibenzo-*p*-dioxin and polychlorinated dibenzo-*p*-furan congeners (dioxins/furans)**. Surface soil is considered to extend from the ground surface (0 feet) to two (2) feet below ground surface (bgs). For purposes of evaluating exposure to an excavation worker, concentrations of contaminants in surface and subsurface soil are considered from the ground surface (0 feet) to five (5) feet bgs.

Brunswick Cellulose collected additional data at the Salt Dock when clearing structures for future use of the property. Based on previous sampling results, the sample analyses were limited to PCBs, mercury, and metals.

Sediment and surface water data were collected from the freshwater pond in Quadrant 1 for use in the Baseline Risk Assessments. Biota, including grass, berries, insects, spiders, earthworms, fiddler crabs, and small fish, were collected, in addition to co-located surface soil and surface sediment for food chain modelling.

2.1 Contaminants in Soil

Surface Soil (Excluding the Salt Dock)

The compilation of pre- and post-removal action sampling events provides a comprehensive data set of chemicals/contaminants detected in surface soil. The list was reduced or retained for use in the Human

Health Risk Assessment based on the following: whether the maximum detected concentration exceeds the applicable **Regional Screening Level** (RSL**)** for residential soil; whether the constituents are considered essential human nutrients; and whether the frequency of detections is low and the detection limit is below the screening level. Additionally, the mobility, persistence, and **bioaccumulation** properties of each contaminant, as well as historical evidence of use at the Site, were used to retain or drop contaminants. The Contaminants of Potential Concern (COPCs) for surface soil in the OTF and each of the exposure units shown in Figures 2 are provided in Table 2.

The Upland **Baseline Ecological Risk Assessment** (BERA) evaluated four primary COPCs because they were the COPCs identified in the more extensive BERA for the **estuary** at the Site. The primary COPCs were mercury (including inorganic mercury and methylmercury (**MeHg**)), Aroclor 1268, lead, and **polycyclic aromatic hydrocarbons** (PAHs). Five additional COPCs (secondary COPCs) were also evaluated – antimony, copper, nickel, vanadium, and zinc.

Subsurface Soil (Excluding the Salt Dock)

In addition to surface soil analytical data, subsurface soil data (defined as the upper five feet of soil) was included for OU3 for the purpose of evaluating the excavation worker scenario. COPCs evaluated in subsurface soil were the same as evaluated in surface soil (Table 2).

Salt Dock Soil

Characterization sampling of the Salt Dock was conducted in October 1994 and August 1996. The lateral and vertical extent of impacted soil was delineated in April and May 1996. A total of 17 soil and sediment samples were collected for chemical analysis to characterize the salt debris, tank sediment, and graphite anode disposal area. Fifteen additional soil samples were collected for chemical analysis to delineate the Anode Area.

As part of the removal actions conducted at the Site, a total of 135 CY of waste were excavated from the Salt Dock anode disposal area. Additionally, three steel tanks containing water and sediment were removed. A total of nine confirmational samples were collected from the Anode Area. One sidewall sample (96137-SD-02) had an analytical result above removal clean up goals, and the corresponding sidewall was further excavated and resampled. A total of eight confirmational samples represent the existing subgrade and perimeter sidewalls of the Anode Area. From these eight samples, the results for the three main contminants are as follows: the mercury concentrations range from 1.13 to 17.2 ppm; lead concentrations range from 9.18 to 50.4 ppm; and PCB concentrations range from 0 to 12.1 ppm. Clean soil was used to backfill the excavation area (shown on lower left corner of Figure 3).

After demolition of the three steel tanks was complete, four five-point composite confirmational soil samples were collected from the footprint and perimeter of the tank locations. Analytical results for the four samples show that constituent concentrations are essentially non-detect.

In 2014, Brunswick Cellulose conducted demolition and removal of the three buildings on the property. The buildings were removed without removing the concrete foundations. In addition, the remnants of the metal conveyor system located on the dock and on the Upland area around the salt impoundment were removed, as well as the impoundment and the contents within the impoundment (between 5200 and 7200 CYs). The material was transferred to a Resource Conservation and Recovery Act (RCRA) Subtitle D landfill. The **residual** concentrations of COPCs were determined to be below screening levels, and the Salt Dock was not evaluated further for human health or ecological receptors.

Table 2. Contaminants of Potential Concern - Upland Soil				
Offsite Tank Farm	Quadrant 1	Quadrent 2	Quadrant 3	Quadrant 4
Arsenic Benzo(a)anthracene Benzo(a)pyrene Benzo(b)fluoranthene Chromium Dibenzo(a,h)anthracene Lead Mercury	Aroclor-1260 Aroclor-1268 Arsenic Benzo(a)anthracene Benzo(a)pyrene Benzo(b)fluoranthene Benzo(b/k)fluoranthene(1) bis(2-Ethylhexyl) phthalate Chromium Dibenzo(a ,h)anthracene Indeno(1,2,3-cd)pyrene Iron Lead Mercury Vanadium	Aroclor-1221 Aroclor-1254 Aroclor-1260 Aroclor-1268 Arsenic Benzo(a)anthracene Benzo(a)pyrene Benzo(b)fluoranthene Benzo(b/k;)fluoranthene(1) Carbazole Chromium Dibenzo(a,h)anthracene Indeno(1,2,3-cd)pyrene lron Mercury	1,1,2,2-Tetrachloroethane 1,2,4-Trimethylbenzene 1,4-Dichlorobenzene 1-Methyl Naphthalene 2-Methylnaphthalene 4,6-Dinitro-2-methylphenol Aluminum Antimony Aroclor-1016 Aroclor-1254 Aroclor-1260 Aroclor-1268 Arsenic Benzene Benzo(a)anthracene Benzo(a)pyrene Benzo(b)fluoranthene Benzo(k)fluoranthene Bis(2-chloroethyl)ether Carbazole Chromium Dibenzo(a ,h)anthracene Dibromochloromethane Dichloromethane(2) Ethylbenzene Indeno(1,2,3-cd)pyrene lron Lead Mercury Naphthalene n-Butylbenzene n-Propylbenzene Vanadium	1,2,4-Trimethylbenzene 1-Methyl Naphthalene Aluminum Antimony Aroclor-1254 Aroclor-1260 Aroclor-1268 Arsenic Benzo(a)anthracene Benzo(a)pyrene Benzo(b)fluoranthene Benzo(k)fluoranthene Chloroform Chromium Chrysene Cobalt Dibenzo(a,h)anthracene Indeno(l,2,3-cd)pyrene Iron Lead Manganese Mercury Naphthalene n-Butylbenzene Tetrachloroethene Vanadium Zinc
(1) Although benzo(b)fluoranthene and benzo(k)fluoranthene are distinct chemical constituents, historical samples in Quadrants 1 and 2 included analyses in which these two analytes were reported together (i.e., as benzo(b/kfluoranthene). This constituent was included as a COPC in these two quadrants based on a comparison to the more conservative RSL value for benzo(b)fluoranthene. In these two quadrants, both benzo(b)fluoranthene and benzo(k)fluoranthene (as individual analytes) were eliminated as COPCs based on comparisons with their respective RSL values. (2) Methylene chloride				

Leachablity of COPCs in Surface Soil

Extensive evaluations were performed to determine the potential for chemicals in the Upland soil to cause unacceptable risk by means of **leaching** via rainfall infiltration through vadose zone soil to the underlying groundwater. The four COPCs that generated the most concern were naphthalene, arsenic, lead and mercury. The evaluations led to a determination that surface soil concentrations and conditions are not likely to be the principal factor in the underlying COPC groundwater concentrations.

2.2 Contaminants in Surface Water

Surface water from the freshwater pond located in Quadrant 1 was evaluated. There were no PAHs detected in the surface water samples. Mercury, lead, other metals were detected, however, below the **Ambient Water Quality Criteria** (AWQC). A criterion has not been developed for vanadium and a

specific criterion is not available for Aroclor 1268, though the average concentrations exceeds the AWQC based on more toxic congener mixes.

2.3 Contaminants in Sediment

Surface sediment of the freshwater pond (located in Quadrant 1) was characterized by a texture that was predominantly sand. Mean concentrations of COPCs in surface sediment of the pond never exceeded the National Oceanic and Atmospheric Administration's (NOAA's) threshold effects levels (TELs) for all the chemicals except antimony, vanadium, or total PAHs. An upper effects threshold (UET) of 12 mg/kg has been established for total PAHs, which is three orders-of-magnitude higher than total PAH levels observed in sediment of the pond. Although PCBs, mercury, PAHs and lead were detected in the pond sediment, the concentrations were also below the EPA's regional screening levels for industrial and residential soil.

2.4 Contaminants in Biota

Terrestrial food items for Upland wildlife evaluated in food-web exposure models included: grass (both shoots and roots) in the family Poaceae; berries from plants; insects (containing some aquatic species); and spiders (obtained from the shore of the freshwater pond). Earthworms and small mammals, also considered to be food of modeled wildlife, could not be collected at the LCP Site because they were not present, either due to sandy soil conditions or activity at the site.

Grass obtained from potentially impacted sampling stations was characterized by a few higher mean concentrations of primary COPCs than grass from reference stations. There were few substantial differences in concentrations of secondary COPCs at potentially impacted versus reference stations.

Berries from the southern bayberry obtained from potentially impacted stations and reference stations exhibited no substantial or meaningful differences in concentrations of primary or secondary COPCs. In particular, methylmercury and vanadium were never detected in berries; and Aroclor 1268 and antimony were infrequently detected in berries.

Insects from potentially impacted stations were characterized by higher body burdens of Aroclor 1268 and, to a lesser extent, mercury and lead than insects from the center of the reference area. Otherwise, meaningful differences in body burdens of primary or secondary COPCs between the two areas were not apparent.

Spiders, because of limited body mass, were analyzed for COPCs in only one composite sample (from the shoreline of the freshwater pond). The composite sample from spiders contained substantial body burdens of methylmercury, Aroclor 1268, lead, copper and zinc.

3.0 SCOPE AND ROLE OF RESPONSE ACTION

In order to facilitate the investigation of different pathways and areas of contamination, the Site was divided into three OUs: the marsh portion of the Site is designated as OU1; Site-wide groundwater and all soil beneath the former cell building are are designated as OU2; and the Upland portion of the Site (excluding the groundwater and the cell building area) is designated as OU3.

The subject of this Proposed Plan is the Upland portion of the Site OU3. In the 1990s, removal response actions were performed on the Upland portion of the Site resulting in the excavation of contaminated soil and industrial process waste from 26 areas of the Site (Figure 3). A total of approximately 130,000 cubic yards (CY) of soil and waste were removed during these actions. The purpose of this Proposed Plan is to discuss the residual contamination in OU3 and any response actions needed to ensure the area is protective of human health and the environment in the future. This is the second remedy proposed at this Site; on September 22, 2015, the EPA signed a ROD for OU1, the marsh located west of OU3. The remedial design for the work required in the OU1 ROD is underway.

4.0 SUMMARY OF SITE RISK

As part of the RI, EPA conducted baseline risk assessments to determine the current and future effects of contaminants on human health and the environment (see the text box on page 16 "What is Risk and How is it Calculated?"). The HHRA and the BERA analyzed the potential for adverse effects under current and/or future conditions if no further actions are taken to control or reduce exposures to hazardous substances present in the LCP Chemicals Upland.

4.1 Human Health Risks

A site-specific HHRA was performed to quantitatively evaluate both cancer risks and non-cancer health hazards associated with potential current and/or future exposures to COPCs present in soil from the Upland of OU3 in the absence of any further action to control or mitigate the contaminants. Human exposure to the surface water and sediment in the freshwater pond in Quadrant 1 was eliminated from consideration before the HHRA was performed because it is has been completely covered with algae and duckweed, so it is not an attractive water body for human exposure. Additionally, there are no edible wildlife in the pond because of the low dissolved oxygen levels.

Hazard Identification

During the hazard identification step for the HHRA, a screening-level process was used to compare measured site concentrations to risk-based concentrations. As a result, several chemicals were identified as requiring quantitative assessment of risks, including mercury and PCBs in surface soil.

Exposure Assessment

Because risk assessments are designed to be conservative to ensure that risk management strategies will be protective of human health, as well as consistent with EPA requirements, two types of exposure scenarios were analyzed in the HHRA to assess the range of potential risk: the reasonable maximum exposure (RME), which estimates the highest level of human exposure that could be reasonably expected to occur, and the central tendency exposure (CTE or "typical") scenario. Cancer and non-cancer health hazards were assessed under both these scenarios.

The receptors evaluated in the OU3 HHRA, assuming the anticipated future use is unknown, include:

- current/future industrial worker;
- future excavation worker;
- current trespasser;
- future trespasser; and
- future hypothetical adult and child resident.

What Is Risk and How Is It Calculated?

A Superfund baseline risk assessment is an analysis of the potential adverse effects caused by hazardous substances at a site under current and future conditions in the absence of any actions to control or mitigate these effects. Both the human health risk assessment (HHRA) and baseline ecological risk assessment (BERA) have four main components used for assessing site-related human health or environmental risks:

Hazard Identification (used in an HHRA) or Problem Formulation (used in a BERA): In the *Hazard Identification* step of the LCP Chemicals Upland HHRA, the potential COCs in soil (both surface and subsurface) are identified based on such factors as toxicity, frequency of occurrence, fate and transport of the contaminants in the environment, concentrations of the contaminants in soil and mobility, **persistence**, and bioaccumulation. In the *Problem Formulation* component of the BERA, potential COCs are identified, ecological effects and exposure pathways are reviewed, assessment endpoints are selected, and a conceptual model is developed.

Exposure Assessment: In this component, the different exposure pathways through which receptors (people and animals) might be exposed to the contaminants identified in the previous step are evaluated. Examples of exposure pathways include incidental ingestion of and dermal contact with contaminated sediment. Factors relating to the exposure assessment include, but are not limited to, the concentrations that people or wildlife might be exposed to and the potential frequency and duration of exposure.

Toxicity or Effects Assessment: In this component, the types of adverse health effects associated with chemical exposures and the relationship between the magnitude of exposure and severity of adverse effects are determined. Potential health effects are chemical-specific and may include the risk of developing cancer over a lifetime or other non-cancer health effects, such as changes in the normal functions of organs within the body (e.g., changes in the effectiveness of the immune system) or reproductive effects. Some chemicals are capable of causing both cancer and non-cancer health effects.

Risk Characterization: This step summarizes and combines outputs of the exposure and toxicity assessments to provide a quantitative assessment of site risks. In an HHRA, exposures are evaluated based on the potential risk of developing cancer and the potential for non-cancer health hazards. The likelihood of an individual developing cancer is expressed as a probability. For example, a 1E-04 cancer risk would mean a one-in-ten-thousand excess cancer risk to an exposed individual, or that one additional cancer may be seen in a population of 10,000 people as a result of exposure to site contaminants under the conditions explained in the Exposure Assessment. Current federal Superfund guidelines for acceptable exposures are "generally concentration levels that represent an excess upper bound cancer to an individual of between 1E-04 to 1E-06" (40 Code of Federal Regulations [CFR] § 300.430[e][2](i)[A][2]; corresponding to a one-in-ten-thousand to a one-in-a-million excess cancer risk). The 1E-06 risk is used as the point of departure for determining remediation goals. For non-cancer health effects, a "**hazard quotient**" (HQ) is calculated for each contaminant. An HQ represents the ratio of the estimated exposure to the corresponding **reference doses** (RfDs). The sum of the HQs is termed the "**hazard index**" (HI). The key concept for a non-cancer HI is that a "threshold level" (measured as an HQ or HI of 1) exists, below which non-cancer health effects are not expected to occur. In a BERA, risks to the environment are evaluated using individual contaminant HIs calculated for representative species.

Current/future industrial workers presently perform operations and maintenance (O&M) activities,comprised of mowing access roads and operating a groundwater treatment system at the Site. Industrial workers are assumed to be exposed to surficial soil (0-to-2 ft bgs) without protective equipment or clothing other than work clothes. The industrial worker scenario includes potential exposure to constituents via ingestion, dermal contact, and inhalation of particulates and vapors.

In the event that any subsurface excavations were to occur at the Site, excavation workers could come in contact with constituents in a soil interval consisting of both surficial and shallow subsurface soil (0-to-5 ft bgs). Excavation workers were assumed to be exposed to soil without protective equipment or clothing other than common work clothes. The excavation worker scenario includes potential exposure to constituents via the same routes of exposure as the industrial worker.

The current trespasser scenario is based on an adolescent who might visit the property on an intermittent basis. This scenario includes potential exposure to COPCs in surface soil (0-to-2 ft bgs) via ingestion, dermal contact, and inhalation of particulates and vapors. Because access to the Site is currently

controlled, the current trespasser scenario assumes exposure frequencies of 24 days/year and six days/year for the RME and CTE scenarios, respectively. A separate future trespasser scenario was included in the HHRA to reflect the possibility that Site access might not be controlled as tightly in the future. An exposure frequency of 52 days/year is assumed for the RME future scenario.

The future hypothetical resident scenario evaluates potential exposure to COPCs via ingestion of and dermal contact with surficial soil and inhalation of particulates and vapors in air.

Toxicity Assessment

The HHRA provided detailed discussions on the toxicity of contaminants including mercury, PCBs, lead and PAHs and their associated uncertainties. Some of the major toxic effects are presented in the text box entitled "What is Mercury?" below and in the text box "What are Contaminants of Potential Concern?" on page 20.

Risk Characterization

The baseline HHRA describes the cancer risks and non-cancer health hazards associated with contaminants in soil from the LCP Chemicals Upland. Risk decisions are based on the RME, consistent with the NCP. Ingestion and dermal contact with soil, as well as inhalation of particulates and vapors from soil, are the primary pathways for exposure to COPCs in OU3 and for potential adverse health effects.

What is Mercury?

One of the main contaminants in the LCP Chemicals Georgia Site is mercury. Allied Chemical and LCP Chemicals used mercury in the production of chlorine and caustic soda at the mercury-cell chlor-alkali plants.

Most of the mercury in surface water, sediment, and soil is in the form of inorganic mercury salts; whereas organic forms of mercury (e.g., methylmercury) are dominant in shellfish, fish and wildlife. **Methylation** of mercury is a key step in the entrance of mercury into food chains. The biotransformation of inorganic mercury to methylated organic forms can occur under low oxygen conditions in sediment and moist soil. Mercury is known to adversely affect organisms through inhibition of reproduction, reduction in growth rate, increased frequency of tissue histopathology, impairment in ability to capture prey and olfactory receptor function, alterations in blood chemistry and enzyme activities, disruption of thyroid function, and other metabolic and biochemical functions. It is emphasized that methylmercury is significantly more toxic and bioaccumulative than inorganic mercury.

Mercury biomagnifies up the food chain. The accumulation of methylmercury by biota is rapid and depuration is slow relative to inorganic mercury, which is less efficiently adsorbed and more readily eliminated from the body. Hence, methylmercury is significantly more toxic and bioaccumulative than inorganic mercury. Half or more of the mercury that accumulates in birds and mammals is methylmercury. Accordingly, mercury exposure and accumulation is of particular concern for animals at the highest trophic levels in the terrestrial food webs and for animals and humans that feed on these organisms.

Mercury is a known human and ecological toxicant. Methylmercury-induced neurotoxicity is the effect of greatest concern when exposure occurs to the developing fetus. Dietary methylmercury is almost completely absorbed into the blood and distributed to all tissues including the brain; it also readily passes through the placenta to the fetus and fetal brain. Neurotoxic effects include subtle decrements in motor skills and sensory ability at comparatively low doses. Other adverse effects of mercury include reduced reproductive success, impaired growth and development, and behavioral abnormalities.

Cancer risks and hazard quotients (HQs) are used to identify risk to human health. They are determined by the estimated concentration of the contaminants, standard exposure parameters, and chemical-specific toxicity values.

For cancer, the EPA has defined the acceptable risk within a range from 1 additional cancer in 1,000,000 exposed individuals ($1x10^{-6}$) to 1 additional cancer in in 10,000 exposed individuals ($1x10^{-4}$). Calculated risks that are greater than the upper limit of this cancer risk range ($1x10^{-4}$) are evaluated further to determine the need for **remediation**.

For non-cancer effects, the EPA calculates a value known as a hazard quotient (HQ). The sum of the quotients from multiple pathways is known as the **hazard index** (HI). If the cumulative HI is less than or equal to 1, remedial action is generally not needed to protect human health and the environment.

Table 3 summarizes cancer risks and non-cancer health hazards calculated for each exposure scenario in the HHRA.[4] The table presents the cumulative HI estimates, assuming worst-case, i.e. the non-cancer hazard for Aroclor-1268 is calculated using the RfD for Aroclor-1254, as opposed to Aroclor 1016. Risks and hazards that exceeded EPA's acceptable risk range are described as follows:

- *Cancer risks:* With respect to potential carcinogenic effects, only the RME future hypothetical resident in Quadrant 4 had an excess lifetime cancer risk that was equal to the upper-end of the target risk range ($1x10^{-4}$). There were no unacceptable cancer risks associated with any of the other exposure scenarios evaluated.
- *Non-cancer health hazards:* As to potential non-carcinogenic effects, the RME excavation worker scenario in Quadrant 4; the RME future hypothetical resident scenario in Quadrants 2, 3, and 4; and the CTE hypothetical resident scenario in Quadrants 2, 3 and 4 had cumulative HI estimates that exceeded the threshold value of 1. The HI estimates for all other receptors and exposure units were below 1.

Revised Risk Characterization Quadrant 4

The non-carcinogenic hazard to excavation workers in quadrant 4 is driven by concentrations of Aroclor 1254 and Aroclor 1260 in two samples locations (LC-204 and LC-639). Because these samples were collected during the removal activities in the late 1990s, and they were vastly different than nearby samples, there was substantial uncertainty associated with the results. Therefore, the locations were resampled in August 2018 (see results below), and it was found that Aroclor results were much lower than previous results. The new results are consistent with other sample locations in the vicinity.

	Aroclor 1254		Aroclor 1260		Aroclor 1262		Aroclor 1268		Total PCB	
	Prior	New	Prior	New	Prior	New	Prior	New	Prior	New
LC-204 (0-1ft)	ND	ND	110	ND	NA	0.094	NA	0.083	110	0.177
LC-639 (0-1ft)	6.9	ND	160	ND	NA	1.25	NA	1.54	166.9	2.79
LC-639 (1-2ft)	9.2	ND	120	ND	NA	0.112	NA	0.111	129.2	0.223

ND not detected all units in mg/kg

NA not analyzed

[4] Note that Table 3 summarizes the risk/hazard estimates using the data sets, excluding those from the initial on-site laboratory which operated early during the late 1990s removal. The initial mobile laboratory was, after a time, recognized to have unacceptable quality control and was replaced by another mobile laboratory.

Table 3. Summary of HHRA Risks and Hazards

Exposure Scenario	Exposure Unit	Cancer Risk		Non-Cancer HI	
		RME	CTE	RME	CTE
Industrial Worker	OTF	6E-06	4E-07	0.01	0.002
	Quad 1	3E-06	2E-07	0.1	0.02
	Quad 2	1E-05	9E-07	0.7	0.07
	Quad 3	1E-05	8E-07	1	0.2
	Quad 4	3E-05	2E-06	1	0.2
Future Excavation Worker	OTF	3E-07	4E-08	0.03	0.009
	Quad 1	2E-07	2E-08	0.2	0.1
	Quad 2	6E-07	7E-08	1	0.4
	Quad 3	4E-07	6E-08	1	0.4
	Quad 4	1E-06(9E-07)[5]	2E-07	**3** (0.9)[5]	0.9
Current Trespasser	OTF	3E-07	3E-08	0.001	0.0001
	Quad 1	1E-07	2E-08	0.02	0.002
	Quad 2	7E-07	9E-08	0.2	0.03
	Quad 3	5E-07	6E-08	0.2	0.02
	Quad 4	2E-06	2E-07	0.2	0.03
Future Trespasser	OTF	6E-07	3E-08	0.002	0.0001
	Quad 1	3E-07	2E-08	0.02	0.001
	Quad 2	2E-06	9E-08	0.11	0.006
	Quad 3	1E-06	6E-08	0.2	0.01
	Quad 3	3E-06	2E-07	0.3	0.02
Future Hypothetical Resident	OTF	2E-05	4E-06	0.1	0.06
	Quad 1	1E-05	3E-06	1	0.7
	Quad 2	5E-05	9E-06	**7**	**4**
	Quad 3	5E-05	8E-06	**10**	**6**
	Quad 4	1E-04	2E-05	**15**	**8**

Exposure Point Concentrations (EPCs) were re-calculated employing the new sample results to examine the effect of the updated EPCs on the Quadrant 4 HI for the Excavation Worker scenario, utilizing the same exposure factors from the HHBRA. The resultant calculation returns an HI slightly less than 1 (rounds "up" to unity or 1).

Additionally, the Agency for Toxic Substances and Disease Registry (ATSDR) recently has recommended Minimal Risk Levels (MRLs) for multiple or continuous shorter duration oral exposures to PCBs (lasting for no more than 1 year) of 0.00003 mg/kg-day.[6] Given that risk to an excavation worker is evaluated over a 6-month exposure period, estimates of the HI for the construction worker in Quadrant 4 were reevaluated applying the intermediate exposure MRL for PCBs and the EPCs re-calculated employing the new results for LC- 204 and LC-639. The resultant calculation returns estimates of HI of 0.9, below the threshold level of 1.

[5] Resampling of PCBs and use of Aroclor 1016 toxicity for Aroclor 1268 results in reduced HI for Quadrant 4 future excavation worker.

[6] ATSDR, 2018. Minimal Risk Levels (MRLs), Agency for Toxic Substances and Disease Registry (ATSDR), August 2018. [https://www.atsdr.cdc.gov/mrls/mrllist.asp]. Intermediate and Chronic Oral MRLs for Polychlorinated Biphenyl (PCBs) (Aroclor 1254), final November 2000.

What Are the Contaminants of Potential Concern (COPCs) in the LCP Chemicals Upland?

The term "COPC" is used in human health and ecological risk assessments to identify those chemicals that may be harmful to human health and the environment. The COPCs in the LCP Chemicals Upland include mercury (addressed above) and PCBs. Lead and polycyclic aromatic hydrocarbons (PAHs) are also frequently detected COPCs.

Polychlorinated Biphenyls. PCBs are mixtures of up to 209 different compounds (referred to as "congeners") that include a biphenyl and from one to ten chlorine atoms. They have been used commercially since 1930 as dielectric and heatexchange fluids and in a variety of other applications. While PCBs were manufactured and sold under many names, the most common were the Aroclor series. The most commonly detected Aroclor mixture at the LCP Chemicals Site is Aroclor 1268. This mixture contains approximately 68% chlorine by mass. PCBs (largely Aroclor 1268) were used at and released to the environment from the LCP Chemicals facility. They are persistent and accumulate in food webs. PCBs bioaccumulate in the fatty tissues of humans and other animals. PCBs are considered probable human carcinogens and are linked to other adverse health effects, such as developmental effects, reduced birth weights, and reduced ability to fight infection. Limited toxilogical information specific to Aroclor 1268 indicates that the mixture may be less toxic than other less-chlorinated Aroclor mixtures. Aroclor 1268 is also persistent and does not readily degrade in the environment.

Lead. Lead is not a human health concern at the LCP Chemicals Site; however, it is a COPC that can affect organisms. This heavy metal was released from the LCP Chemicals facility. Lead is generally toxic to aquatic organisms, especially in ionic form. Long-term exposure to lead may result in a host of adverse effects to fish and wildlife, such as damage to the blood, liver, kidney and skeletal systems.

Polycyclic Aromatic Hydrocarbons. Concentrations of PAHs at the LCP Chemicals Sitealso are not of concern to human health but may pose risks to the benthic community. PAHs are a group of compounds comprised of several hundred organic substances with two or more benzene rings. They are released to the environment mainly as a result of incomplete combustion of organic matter and are major constituents of petroleum and its derivatives. PAHs are hazardous substances. Exposure to PAHs may result in a wide range of effects on biological organisms. While some PAHs are known to be carcinogenic, others display little or no carcinogenic, mutagenic, or teratogenic activity. Several PAHs exhibit low levels of toxicity to terrestrial life forms, yet are highly toxic to aquatic organisms. PAHs were used at the LCP Chemicals facility and were also part of the waste stream.

Risk Characterization for Dioxins/Furans

A separate assessment was conducted to provide risk assessment for polychlorinated dibenzo-p-dioxin and polychlorinated dibenzo-p-furan congeners (dioxins/furans) in Upland soil. The samples were collected using an Incremental Sampling Method (ISM) that is designed to reduce data variability and provides a robust estimate of the mean concentration of an analyte in the area/volume of soil being sampled, which is commonly called a Sampling Unit ("SU"). The concentrations of dioxins/furans in all samples collected throughout the Site were converted to 2,3,7,8-tetrachloro dibenzo-p-dioxin (2,3,7,8-TCDD) Equivalents (TEQ) and compared with the EPA recommended (at that time) preliminary remediation goal (PRG) value for dioxins/furans in residential soil (72 ng/kg or 72 parts per trillion (ppt)). Only two samples from Quadrant 2, with values of 81.2 ppt and 117.1 ppt, exceeded the residential PRG. However, The average for the Quadrant 2 SU was only 47.7 ppt, and the 95% upper confidence limit (UCL) was 124 ppt. The other quadrants had lower measured levels of TCDD-TEQ. The overall conclusion of the dioxin/furan characterization was that that these constituents do not represent a health concern for future commercial/industrial use of OU3, regardless of which statistical value is used (mean or UCL), but may be of concern for residential use if the quadrant is subdivided into residential exposure units. The same conclusion is reached based on the dioxin **reference dose** (added to IRIS since this site assessment was finalized).

Uncertainties Related to the Baseline HHRA

Uncertainties are inherent in the quantitative risk assessment process due to environmental sampling design, assumptions regarding exposure, and the quantitative representation of chemical toxicity. To satisfy the EPA goal of ensuring that health risks are not underestimated, conservative assumptions were built into the HHBRA so that resultant risk estimates are more likely to overestimate risks than to underestimate them. Examples of uncertainty in the baseline HHBRA where conservative assumptions were made are as follows:

- Uncertainties in toxicity data - The most significant source uncertainty in this category relates to the characterization of risk associated with Aroclor-1268 exposures using surrogate toxicity values for Aroclor-1254. The consensus of the toxicological studies conducted with Aroclor-1268 suggests that it poses relatively low risk compared to other Aroclor mixtures evaluated.
- Uncertainties in environmental sampling and analysis - The data sets used to evaluate potential risks largely come from samples collected during the removal response action conducted between 1994 and 1998. A substantial number of these samples were analyzed by on-site laboratories that typically did not have detection limit sensitivity available through fixed-base commercial laboratories. Nevertheless, a substantial amount of more recent, higher quality data have been collected throughout the Site sufficient to support decision making at the Site.
- Uncertainties in the COPC screening process - The HHBRA included a COPC screening process that compared maximum detected levels and maximum detection limits of constituents to conservative risk-based screening levels for residential receptors. As a result, there were several constituents that were never detected (or detected very infrequently), but were retained as "Qualitative COPCs" because their presence could not be definitively ruled out. The use of this conservative screening process in the HHBRA provides a high degree of certainty that the quantitative risk assessment focused on COPCs that had the highest contribution to potential risks.
- Uncertainties related to the exclusion of initial mobile laboratory data records - The data sets used to evaluate potential risks are a combination of results from on-site/mobile laboratory testing and off-site/commercial laboratory testing. The HHBRA includes separate risk calculations for the datasets with and without data from the initial on-site laboratory. This exercise demonstrates that the exclusion of the initital on-site laboratory data has only a minor impact on the conclusions drawn from the risk characterization.

4.2 Ecological Risks

The BERA evaluated the likelihood that adverse ecological effects are occurring or may occur as a result of exposure to the contaminants associated with the LCP Chemicals Upland. The framework used for assessing site-related ecological risks is similar to that used for the baseline HHRA.

Problem Formulation

Problem formulation is a planning step that identifies the major concerns and issues to be considered in an ecological risk assessment, along with a description of the basic approaches that will be used to characterize the potential ecological risks. The COPCs quantitatively evaluated in the BERA included four primary COPCs (inorganic mercury, methyl mercury, PCBs and lead) and five Secondary COPCs (antimony, copper, nickel, vanadium, and zinc). Receptors exposed to these COPCs included soil **invertebrates; terrestrial**-feeding **granivorous, insectivorous** and **carnivorous** birds (represented by the mourning dove, Carolina wren and broad-winged hawk, respectively)**;**

terrestrial-feeding granivorous, insectivorous and carnivorous mammals (represented by the meadow vole, short-tailed shrew and long-tailed weasel, respectively); estuarine-feeding insectivorous birds (represented by the common yellowthroat); estuarine-feeding insectivorous-**crustaceovorous** birds (represented by the willet); estuarine-feeding insectivorous-**piscivorous** birds (represented by the pied-billed grebe), estuarine-feeding crustaceovorous birds (represented by the **clapper rail**); estuarine-feeding piscivorous birds (represented by the belted kingfisher); and estuarine-feeding insectivorous, **omnivorous** and carnivorous mammals (represented by the little brown bat, raccoon and mink, respectively).

Exposure Assessment

To assess exposure to various wildlife receptors, food-web models were used. These models included conservative assumptions and input values to ensure protectiveness, such as assuming that each receptor spends its entire life in the LCP Chemicals Upland and that the COPCs are 100 percent bioavailable.

Effects Evaluation

No ecological risks were identified for soil invertebrates based on absence of toxilogical responses in laboratory tests on earthworms exposed to OU3 soil. Calculated intake doses to wildlife were compared to toxicity reference values based on the **lowest observed adverse effect level** (LOAEL). Table 4 summarizes the modeled results and lists the COPCs generating the potential risks, using the LOAEL. Note that Table 4 shows in parentheses the mean estimated environmental exposure, as well as the hazard quotient using the mean.

Risk Characterization

The results indicate that PAHs do not present unacceptable risk to the wildlife receptors. Using the maximum estimated exposure, methylmercury is marginally of concern to the broad-winged hawk, while mercury and Aroclor 1268 are of potential concern to the meadow vole and short-tailed shrew. The maximum concentration LOAEL HQs exceed 1 for the meadow vole and short-tailed shrew, which indicated moderate risk. The potential for the average concentration in OU3 soil to exceed a LOAEL HQ of one in localized areas was evaluated in the FS. The concentration in soil equivalent to a LOAEL HQ of 1 for the most sensitive receptor (short-tailed shrew) was 3 mg/kg for mercury and 2 mg/kg for Aroclor 1268. These concentrations were identified as preliminary remedial goals in the BERA and FS. The OU3 FS further evaluated the average concentrations of mercury and Aroclor 1268 in soil within 4-acre grids, representing potential local population areas for the short-tailed shrew. The evaluation of the local average concentrations revealed a low probability of local average concentrations exceeding the preliminary remedial goals for mercury and Aroclor 1268 in OU3 soil. The absence of local average concentrations in soil exceeding the preliminary remedial goals meant that the potential for moderate risk to local populations was not realized when the full data set used in the RI and risk assessments was evaluated. None of the LOAEL HQs for the site mean soil concentrations for meadow vole or short-tailed shrew exceeded 1, indicating minimal risk. None of the LOAEL HQs were exceeded for the Carolina wren, common yellowthroat, willet or little brown bat, indicating minimal risks.

Table 4 also shows that, using the average estimated exposure, none of HQs are above 1, with the exception of the methylmercury exposure to the pied-billed grebe, which is marginally above 1. Bracketing the potential risks to wildlife receptors through the use of the maximum and average estimated exposures permits evaluation of realistic risk posed by current conditions at the Site, which is currently zoned by Glynn County as Basic Industrial.

Uncertainties Related to the BERA

The OU3 BERA examined a variety of uncertainties associated with the components of the BERA process and considered whether these uncertainties tend to over- or underestimate risks. It also presents

findings from several independent studies conducted at the Site and evaluates whether those studies lend additional support to, or conflict with, the conclusions of the BERA. The most significant sources of uncertainty in the OU3 BERA are briefly described below.

Table 4. Summary of Risks to Wildlife Receptors

Receptor	COCs	Maximum and (Average) estimated environmental exposure (mg/kgBW/day)	LOAEL toxicity reference value (TRV) (mg/kgBW/day)	Maximum and Average Hazard Quotient (EEE/TRV)
Mourning dove	Total mercury	0.96 (0.11)[a]	0.90	1.1 (0.1)[b]
	Lead	22 (3.1)	11.3	2.0 (0.3)
Broad-winged hawk	50% MeHg	0.072 (0.23)	0.06	1.2 (0.2)
	100% MeHg	0.14 (0.027)	0.06	2.3 (0.5)
Meadow vole	Total mercury	1.5 (0.18)	0.37	4.1 (0.5)
	Aroclor 1268	0.87 (0.11)	0.3	2.9 (0.4)
Short-tailed shrew	Total mercury	1.9 (0.24)	0.37	5.1 (0.7)
	Aroclor 1268	0.86 (0.18)	0.3	2.9 (0.6)
Long-tailed weasel	100% MeHg	0.17 (0.032)	0.15	1.1 (0.2)
	Aroclor 1268	0.56 (0.07)	0.3	1.9 (0.2)
Pied-billed grebe	MeHg	0.085 (0.08)	0.06	1.4 (1.3)
	Lead	14 (2.5)	11.3	1.2 (0.2)
Clapper rail	MeHg	0.070 (0.033)	0.06	1.2 (0.6)
	Lead	14 (1.7)	11.3	1.2 (0.2)
Belted kingfisher	MeHg	0.076 (0.045)	0.06	1.3 (0.8)
Raccoon	Aroclor 1268	0.35 (0.17)	0.3	1.2 (0.6)
Mink	Aroclor 1268	0.47 (0.19)	0.3	1.6 (0.6)

a: The average estimated environmental exposure is shown in parentheses.

b: The hazard quotient calculated using the average estimated environmental exposure is shown in parentheses.

- The evaluation of potential adverse effects to bird and mammal receptors representing 14 of the 15 assessment endpoints is based on the calculation of food-web HQs. The food-web models required collection of site-specific data on the concentrations of COPCs in wildlife dietary items, such as berries, soil invertebrates, and small mammals. Although some insects were obtained from OU3 for analysis, there were limited replicates for insect samples; and no earthworms or small mammals could be obtained from the Site. The concentrations of mercury and Aroclor 1268 in the tissues of small mammals was estimated using models. Laboratory tests on the earthworm exposed to site soil were used to assess bioaccumulation instead of earthworms collected from the Site. Limited site-specific tissue data and reliance on models could have over estimated or under estimated the Site risk.

- A major source of uncertainty in the OU3 BERA was the use of TRVs for Aroclor-1254 in food-web exposure models for mammals potentially exposed to Aroclor-1268. Appendix A of the OU3 BERA Report contains a detailed discussion of the relative toxicities of these two PCB mixtures and concludes that the use of the Aroclor-1254 TRV to represent the toxicity of Aroclor-1268 overestimates the potential for adverse effects to the mammalian assessment endpoints considered in the OU3 BERA.

5.0 BASIS FOR NO FURTHER ACTION

It is the EPA's current judgment that no further action is necessary to protect public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment from OU3 at the Site. This decision is based on the reasonable anticipated future land use, which is industrial. The property is currently zoned Basic Industrial, and the past removal actions in OU3 have eliminated the need to conduct further remedial action to address industrial exposure or exposure for other environmental receptors.

The BERA did identify unacceptable risk for a future resident, but the EPA does not reasonably anticipate future residential use of the Upland. For that reason, the EPA is not recommending remedial action either to clean the Site to levels that would support residential use or to restrict residential use.

However, the EPA does plan to establish institutional controls in the form of Post-Removal Site Controls under its removal authority in accordance with the 1995 Action Memorandum authorizing that removal action. Institutional controls are non-engineered instruments that help minimize the potential for human exposure to contamination and/or protect the integrity of the remedy. For the LCP Site, institutional controls will set activity and use limitations preventing residential development of areas cleaned up to levels protective of industrial exposure, including parts of OU3, unless additional sampling is conducted and any necessary actions are taken to protect residents. Consideration will be given to potential vapor intrusion risks prior to construction and/or the use of building controls (e.g., sub-slab depressurization system) to address potential vapor intrusion risks where volatile chemicals are present in underlying soil. The activity and use limitations would be recorded in a uniform environmental covenant (UEC) with the State of Georgia.

Because OU3 will not be remediated to levels that would support unlimited use/unlimited exposure, the EPA will conduct statutory Five-Year Reviews to ensure that the remedy selected remains protective of human health and the environment.

6.0 COMMUNITY PARTICIPATION

EPA and the GAEPD will provide information regarding the LCP Chemicals Upands to the public through public meetings, the administrative record, and announcements published in the Brunswick News. EPA and GAEPD encourage the public to review the documents available for a comprehensive understanding of this OU and the entire Site, as well as the Superfund activities that have been conducted to date at the Site.

Public Comment Period

This proposed plan is available for public comment from September 3, 2019 through October 2, 2019. Written comments can be mailed or emailed to:

Pam Scully
USEPA Region 4
61 Forsyth Street SW
Atlanta, Georgia 30303
scully.pam@epa.gov

Availability Session

As a part of the public involvement process, an availability session will be held on September 11, 2019 at the Marine Extension Building located at 715 Bay Street in Brunswick. Please drop by between 2 pm to 5 pm.

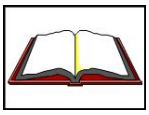
Public Meeting

As a part of the public involvement process, a public meeting is scheduled on September 12, 2019. The meeting will be held at Maranatha Baptist Church located at 3706 Norwich Street in Brunswick, GA at 5:30 pm. At this meeting, the EPA will present the information it has about the Site, describe its reasons for recommending no further action in the Proposed Plan, and answer any questions. Oral and written comments will be accepted at the meeting.

For more information, see the Administrative Record at the following locations:

Brunswick-Glynn Co. Library
208 Gloucester Street Center
Brunswick, GA 31520
(912) 267-1212

U.S. EPA - Region 4
Contact Record Manager – Tina Terrell
61 Forsyth St., SW
Atlanta, GA 30303
(404) 562-8835



GLOSSARY

Administrative Record: Documents, including correspondence, public comments, Records of Decision and other decision documents, and technical reports upon which the agencies base their remedial action selection.

Applicable or Relevant and Appropriate Requirements (ARARs): Any state or federal statute or regulation that pertains to protection of human health and the environment in addressing specific conditions or use of a particular cleanup technology at a Superfund site.

Ambient Water Quality Criteria: Numeric values limiting the amount of chemicals present in U.S. waters.

Aroclor: A discontinued registered trademark for a series of polychlorinated biphenyl (PCB) compounds. Aroclor was first sold in 1930. It was available as viscous oils and thermoplastic solids with high refractive indices. Aroclor is no longer used because of its high toxicity. Aroclor production was discontinued in the United States in 1977.

Baseline Ecological Risk Assessment: The application of a formal framework, analytical process, or model to estimate the effects of human actions on a natural resource and to interpret the significance of those effects in light of the uncertainties identified in each component of the assessment process. Such analysis includes initial hazard identification, exposure and dose/response assessments, and risk characterization.

Baseline Risk Assessment: A qualitative and quantitative evaluation performed in an effort to define the risk posed to human health and the environment by the presence or potential presence of specific contaminants.

Bioaccumulation: The uptake and storage of chemicals by living animals and plants. This can occur through direct contact with contaminated water or sediment or through the ingestion of another organism that is contaminated. For example, a small fish might eat contaminated algae, a bigger fish might eat several contaminated fish and a human might eat a bigger, now-contaminated fish. Contaminants typically increase in concentration as they move up the food chain.

Carnivorous: Feeding on other animals.

Chlor-alkali: There are three production methods for producing chlorine and sodium hydroxide in use. The mercury cell method produces chlorine-free sodium hydroxide. In a normal production cycle a few hundred pounds of mercury per year are emitted, which accumulate in the environment. Additionally, the chlorine and sodium hydroxide produced via the mercury-cell chlor-alkali process are themselves contaminated with trace amounts of mercury. The membrane and diaphragm method use no mercury, but the sodium hydroxide contains chlorine, which must be removed.

Clapper Rail: The Clapper Rail is a chicken-sized game bird that rarely flies. It is grayish brown with a pale chestnut breast and a noticeable white patch under the tail.

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA): A federal law (also known as **Superfund**) passed in 1980 and modified in 1986 by the Superfund Amendment and Reauthorization Act (SARA); the act authorizes EPA to investigate and cleanup abandoned or uncontrolled hazardous waste sites. The law authorizes the federal government to respond directly to releases of hazardous substances that may endanger public health or the environment. EPA is responsible for managing the Superfund.

Contaminant of Potential Concern: A hazardous substance or group of substances that may pose unacceptable risk to human health or the environment at a site.

Crustaceovorous: Feeding on crustaceans.

Dioxins/furans: Dioxins and furans are the abbreviated or short names for a family of toxic substances that all share a similar chemical structure. Dioxins, in their purest form, look like crystals or a colorless solid. Most dioxins and furans are not man-made or produced intentionally, but are created when other chemicals or products are made. Of all of the dioxins and furans, one, 2,3,7,8-tetrachloro-p dibenzo-dioxin (2,3,7,8 TCDD,) is considered the most toxic.

Estuarine: Formed in an estuary.

Estuary: A partially enclosed coastal body of brackish water with one or more rivers or streams flowing into it, and with a free connection to the open sea.

Exposure Point Concentration: a conservative estimate of the average chemical concentration in an environmental medium, typically the 95% upper confident limit concentrations.

Exposure Unit: A geographic area where exposures occur to the receptor of concern during the time of interest. Receptors may be human or ecological (e.g., plants, birds, fish,mammals).

Feasibility Study: A study of the applicability or practicability of a proposed action or plan conducted after the Remedial Investigation to determine what alternatives or technologies could be applicable to clean up the site-specific COCs.

Granivorous: An animal feeding on grain.

Hazard Index: The sum of more than one hazard quotient for multiple substances and/or multiple exposure pathways**.**

Hazard Quotient: The ratio of an exposure level to a substance to a toxicity value selected for the risk assessment for that substance.

Heavy metals: Metallic elements with high atomic weight, e.g., mercury, chromium, cadmium, arsenic, and lead. They can damage living things at low concentrations and tend to accumulate in the food chain.

Herbivorous: Feeds on plants.

Human Health Risk Assessment: A qualitative and quantitative evaluation performed in an effort to define the risk posed to human health by the presence or potential presence of specific contaminants.

Information Repository: A library or other location where documents and data related to a Superfund project are placed to allow public access to the material.

Insectivorous: Feed on insects.

Institutional Controls: administrative restriction that prevents an owner from inappropriately using a property. The restriction is designed to reduce exposure to hazardous substances for workers or the general public and maintain the integrity of the remedy.

Invertebrate: An animal lacking a backbone. arthropod, mollusk, annelid, coelenterate, etc.

Leaching: As water moves through soil or waste, chemicals in the soil may dissolve in the water thereby contaminating the groundwater. This is called leaching.

Lowest Observed Adverse Effects Level: The lowest level of a chemical stressor evaluated in a toxicity test that shows harmful effects on a plant or animal.

Mercury Cell Process: In the mercury cell process, sodium forms an amalgam (a “mixture” of two metals) with the mercury at the cathode. The amalgam reacts with the water in a separate reactor called a decomposer where hydrogen gas and caustic soda solution at 50% are produced. The products are extremely pure. The chlorine, along with a little oxygen, can generally be used without further purification.

MeHg: Methyl mercury. The organic form of mercury.

Methylation: The addition of a methyl group, CH3, to a molecule.

National Oil and Hazardous Substances Pollution Contingency Plan: The federal regulations governing CERCLA cleanups and the determination of the sites to be addressed under both the Superfund program and Oil Pollution Act to prevent or control spills into waters of the U.S. and elsewhere. 40 CFR Part 300 et seq.

National Priorities List: List of high priority sites with hazardous waste releases which may be addressed by EPA's Superfund program.

No Observed Adverse Effect Level: The highest level of a chemical stressor in a toxicity test that did not cause harmful effect in a plant or animal.

Omnivorous: An animal that eats food from both plants and animals, which may include eggs, insects,

fungi and algae. Many rely on both vegetation and animal protein to remain healthy.

Operable Units: Separate activities undertaken as part of a Superfund site cleanup. Often a Superfund Site is divided in phases to better address different pathways and areas of contamination.

Piscivorous: Describes a carnivorous diet that consists largely of fish, though a piscivorous diet may also include similar aquatic foods such as aquatic insects, mollusks and crustaceans.

Polycyclic Aromatic Hydrocarbons (PAHs)**:** Also known as polynuclear aromatic hydrocarbons, they are fused aromatic rings and do not contain heteroatoms or carry substituents. Naphthalene is the simplest example of a PAH. PAHs occur in oil, coal, and tar deposits and are produced as byproducts of fuel burning (whether fossil fuel or biomass).

Polychlorinated Biphenyl: A high molecular-weight halogenated organic compound formerly used in dielectric fluids in transformers and other electrical equipment.

Proposed Plan: A Superfund public participation fact sheet that summarizes the preferred cleanup strategy for a Superfund Site.

Record of Decision: A legal, technical, and public document that identifies the selected remedy at a site, outlines the process used to reach a decision on the remedy, and confirms that the decision complies with CERCLA.

Reference Dose: An estimate (with uncertainty spanning perhaps an order of magnitude) of a daily oral exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime. It can be derived from a NOAEL, LOAEL, or benchmark dose, with uncertainty factors generally applied to reflect limitations of the data used. Generally used in EPA's noncancer health assessments.

Remedial Action: A phase of remedial work that follows the remedial design in which construction and monitoring are performed to meet objectives.

Remedial Action Objectives: They provide overall cleanup goals which guide the comparison and selection of remedial options.

Remedial Design: A phase of remedial work that follows the remedial investigation / feasibility study and Record of Decision and includes development of engineering drawings and specifications for a site cleanup.

Remedial Investigation / Feasibility Study (RI/FS): A two-part investigation conducted to fully assess the nature and extent of a release, or threat of release, of hazardous substances, pollutants, or contaminants, and to identify alternatives for cleanup. The Remedial Investigation gathers the necessary data to support the corresponding Feasibility Study.

Remediation: Cleanup or other methods used to remove or contain a toxic spill or hazardous substances from a Superfund site.

Residual: Contaminants that are left in place following remediation.

Semi-volatile Organic Compounds: Organic chemicals that evaporate slowly at standard temperature (70 degrees Fahrenheit).

Superfund: The common name for the program operated under the legislative authority of the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), the federal law that governs cleanup of abandoned hazardous waste sites. The Superfund Amendments and Reauthorization Act (SARA) amended CERCLA on October 17, 1986.

Terrestrial: An animal that lives on land opposed to living in water.

Toxicity reference factor: Represents a daily dose associated with an effect level or threshold and is expressed in units of milligrams of chemical per kilogram of body weight of the wildlife receptor per day. TRVs are developed in the effects assessment and used in the risk characterization phases of a BERA.

Volatile Organic Compound: Chemicals that, as liquids, evaporate into the air.

MAILING LIST ADDITIONS/CORRECTIONS

LCP CHEMICALS SITE MAILING LIST

If you would like to be added to the mailing list for the LCP Chemicals Site, please complete this pre-addressed form. If you have any questions regarding this mailing list, please call Angela Miller, EPA Community Relations Coordinator, at 1-877-718-3752 (toll free).

NAME: _____

ADDRESS: _____

CITY, STATE, ZIP: _____

TELEPHONE: (_____)_____ AFFILIATION: _____

USE THIS SPACE TO WRITE YOUR COMMENTS

Your input on the Proposed Plan for the LCP Chemicals Superfund Site is important in helping EPA select a remedy for the site. Please use the space below to write your comments.Then fold and mail. A response to your comments will be included in the Responsiveness Summary, an Appendix to the Record of Decision.

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U.S. Environmental Protection Agency
Superfund and Emergency Management Division
Restoration and Sustainability Branch – Attention Pam Scully
61 Forsyth St., SW
Atlanta, Georgia 3030