October 9, 2009

PERFORMANCE-BASED REMEDY DECISION DOCUMENT

RCRA CORRECTIVE ACTION for the 1991 EPA ADMINISTRATIVE ORDER
FORMOSA PLASTICS CORPORATION (FPC-TEXAS)

POINT COMFORT, TEXAS

TXT490011293

THE PURPOSE OF THE REMEDY DECISION DOCUMENT IS TO:

- Identify the proposed corrective action objectives for addressing groundwater, surface water and soil contamination and explain the rationale for the objectives;
- Solicit public review and comment on the corrective action objectives and information contained in the Administrative Record;
- Provide information on how the public can be involved in the remedy decision process; and
- Provide history and background about the facility and surrounding site.

EPA ANNOUNCES CORRECTIVE ACTION REMEDY DECISION DOCUMENT

I. INTRODUCTION

This performance-based remedy decision document is issued by the Environmental Protection Agency (EPA) as part of its public participation responsibilities under the **Resource Conservation and Recovery Act (RCRA)** for the 1991 EPA Administrative Order. Addressing stakeholder concerns is critical to the success of the final remedy. Terms in **boldface** are defined in the glossary at the end of this remedy decision document. The remedy decision document summarizes information that can be found in greater detail in the **Administrative Record**. A discussion of the **conceptual site model** at FPC-Tx and the surrounding area are presented in the draft **October 2009 Final Risk Management Plan (RMP).**

Ground water and soil sampling data collected to determine the extent of contamination are included in the Administrative Record. The development and evaluation of **corrective action objectives (CAO's)** are presented in this document, and also presented in the RMP. It is EPA's expectation to base the remedy decision on the attainment of corrective action objectives (Section IV), with the assurance that the remediation goals are met through required reporting on remedy effectiveness (Section V). The performance-based approach to remedy selection will enhance long-term sustainability by supplanting the traditional approach of selecting a technology as a final remedy.

COMMUNITY PARTICIPATION

EPA encourages the public to review the Administrative Record in order to gain a more comprehensive understanding of the RCRA investigation and interim measures activities that have been conducted at the Facility. The Administrative Record is available for review at the EPA Dallas office, or at the following location:

Point Comfort Branch Library
1 Lamar Street
Point Comfort, Texas
(361) 987-2954
Tues - Thurs - 10:30 a.m. to 6:00 p.m.
Friday - 10:00 a.m. to 3:00 p.m
Saturday – 9:00 am – 12:00 noon.

EPA welcomes public comment on the corrective action objectives described in this document. Comments on the information supporting the corrective action objectives are an important contribution to the remedy implementation process. EPA may modify the proposed CAOs based on new and/or substantive information presented to EPA through public comments.

The public comment period for the remedy decision document begins *October 15, 2009, and ends on November 30, 2009*. During the public comment period, written comments must be postmarked by November 30, 2009 and submitted to:

U.S. Environmental Protection Agency
Attention: Nancy Fagan, Mail Code 6PD-O
1445 Ross Avenue
Dallas, Texas 75202-2733

EPA will also accept comments sent via email received by November 30, 2009. EPA will also hold a public meeting beginning at *7 p.m., October 15, 2009*, to inform the community about this proposed remedy approach and obtain their comments. The public meeting will be held at the following location:

Calhoun High School
201 Sandcrab Blvd.
Port Lavaca, Texas
(361) 552-3775

EPA will address all comments received during the public comment period in **the Final Decision and Response to Comments document (RTC**). The RTC will explain EPA's rationale for the remedy approach to address contamination problems at FPC-Tx. Based upon public comment, new information, or a re-evaluation of existing information, any significant differences from this remedy decision document will be explained in the RTC. The RTC will be incorporated into the Administrative Record and made available to the public in the information repositories.

The final remedy selected by EPA will be implemented through the Corrective Measure Implementation (CMI) phase in the corrective action process, as outlined in the Administrative Order (Order) [Docket No. VI-001 (h)-90-H 3008(h)] issued to FPC-Tx on February 27, 1991. Discussions are on-going with the **Texas Commission on Environmental Quality** (TCEQ) to conduct corrective measures under TCEQ jurisdiction after this decision is finalized.

The **site constituents** originally determined from the waste stream are the following **volatile organic compounds (VOCs**):

- Ethylene dichloride or **EDC** (1,2-dichloroethane or 1,2-DCA)
- 1,1-dichloroethane (1,1-DCA)
- 1,1-dichloroethene (1,1-DCE)
- Cis-1,2 dichloroethene
- Trichloroethene (TCE)
- Tetrachloroethene (PCE)
- 1,1,2-trichloroethene
- 1,1,2,2-tetrachloroethane
- 1,2-dichloroethene
- Trans-1,2 dichloroethene
- Trans-1,4-dichloro-2-butene
- Chloroform
- Chlorobenzene
- Ethylbenzene
- Toluene
- Xylene
- Benzene; and
- Vinyl chloride.

The list of constituents has been narrowed down based on the confirmed set of VOCs found in groundwater and soils in concentrations over the **laboratory reporting limit**. The Interim Measures Implementation Report (1/29/93) indicated dioxins and furans were not detected above the laboratory limits from any of the samples collected during the RCRA Facility Investigation (RFI). Semivolatile organics (SVOCs) and metals were sampled from 1993 until 2002. After an EPA review of sampling results, SVOCs and metals were removed from the sampling program (see Section II.F).

II. FACILITY BACKGROUND

A. Site Description

Formosa Plastics Corporation, Texas (FPC-Tx) owns and operates a chemical manufacturing facility in Point Comfort, Texas. This facility is located in Calhoun County along State Highway 35 and Farm to Market Road (FM) 1593, adjacent to Lavaca Bay. FPC-Tx manufactures vinyl chloride monomer (VCM) and ethylene dichloride (EDC) at the facility, which are used to produce polyvinyl chloride (PVC) resin.

In accordance with the U.S. Environmental Protection Agency (EPA) Administrative Order on Consent (Order) dated February 27, 1991 (EPA I.D. No. TXT490011293), FPC-Tx has undertaken measures to characterize and remediate soil and groundwater affected by site constituents at the Point Comfort facility.

The EPA 1991 Order is relevant to the area of the FPC-Tx plant where historical releases occurred from the Waste Water Treatment (WWT) area that operated from 1983 to 1993 and various units located in the Vinyl Chloride Monomer (VCM) plant. The former Brookings property (now owned by FPC-Tx) south of Hwy 35 was also investigated under the EPA Order. Remediation efforts for other portions of the plant (including the expansion areas) are conducted under the jurisdiction of the TCEQ **(Figure 1)**.

B. Regulatory History

Under the terms of the Order FPC-Tx is required to complete the following actions: Task I) conduct an Accelerated RCRA Facility Investigation (ARFI) to install additional wells and conduct additional sampling for determining nature and extent of contamination; Task II) conduct interim measures (IM), as necessary to control offsite migration of contaminated groundwater; Task III) conduct an RCRA Facility Investigation (RFI) to determine the nature and extent of contamination resulting from past facility operations; Task IV) perform a Corrective Measures Study (CMS) to evaluate the various clean-up alternatives; and Task V) submit

Figure 1


Formosa Plastics
Pre-1990 Property (Red Boundary)
ALCOA
Former Brookings Property
Cox Creek
Point Comfort
35
35
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to the EPA a Corrective Measures Implementation (CMI) Program Plan concurrently with the final CMS. On April 24, 2009, EPA issued a letter to FPC-Tx requesting the submittal of a Risk Management Plan (RMP) in lieu of a final CMS. The RMP sets forth the performance-based approach of getting media-specific corrective action objectives in place that FPC-Tx must meet to be protective of human health and the environment.

C. Closure and Site Investigation History

A RCRA Facility Assessment (RFA) was conducted by an EPA contractor (PRC Environmental Management) in July 1990. In the RFA, 35 **solid waste management units (SWMUs**) were identified **(Figure 2).** In the early 1990's, the Used Oil Storage Area (SWMU #31) was taken out of service, and three EDC storage tanks VT-763A (SWMU 24), VT-763B (SWMU 25), and VT-102 (SWMU 26) were closed.

FPC-Tx has completed activities under the Interim Measures phase of Work to be Performed, as described in Section VI of the 1991 EPA Order. The Interim Measures Plan (IMP) was submitted to EPA to characterize and remediate affected soils and groundwater identified in the Order. The IMP was approved by the EPA on May 13, 1991.

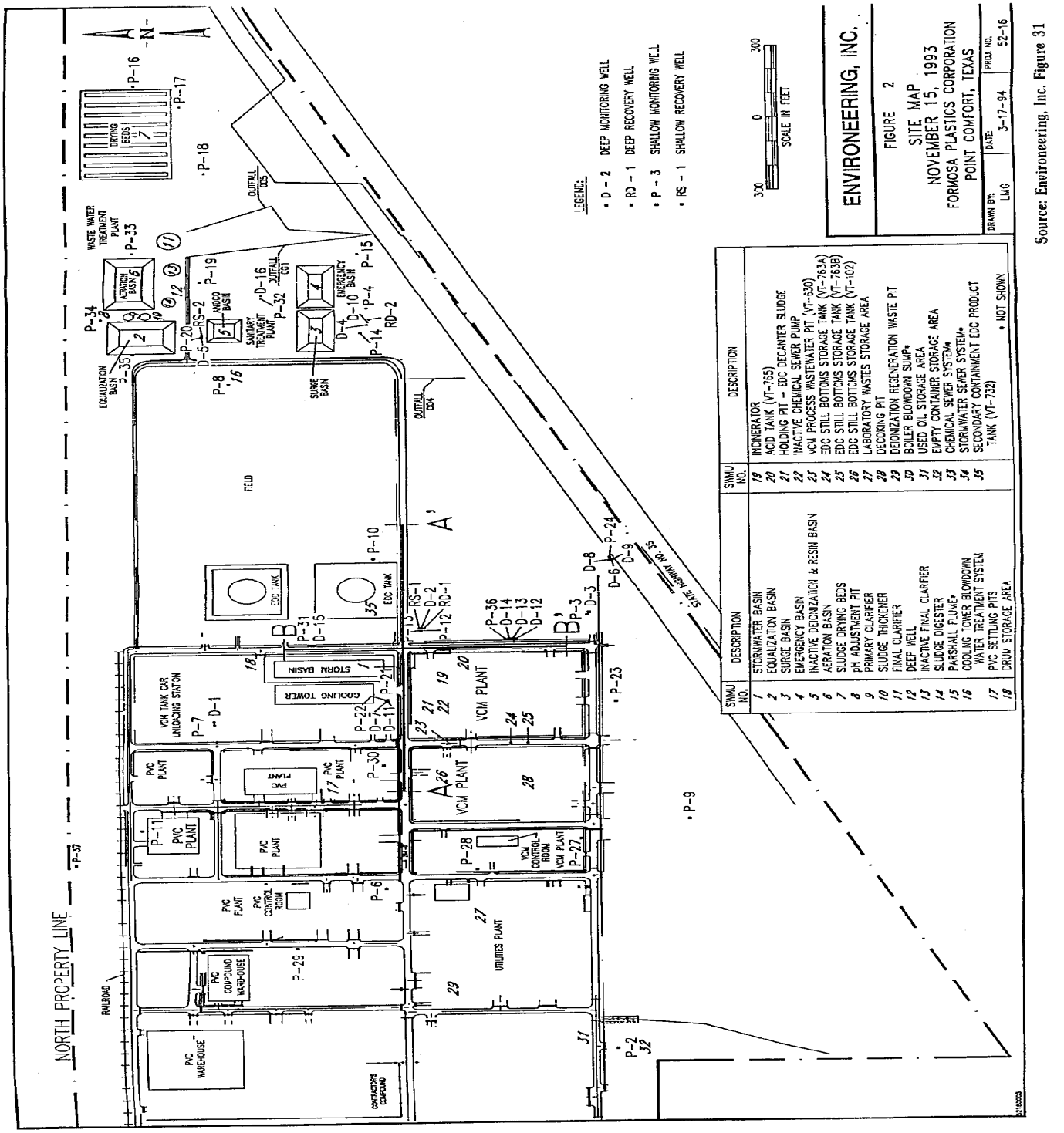
The interim measure for remediation of groundwater was a system which recovered and treated groundwater contaminated with volatile organics. The recovery of groundwater by pumping creates a cone of depression in the water bearing zone which can result in the hydraulic containment of dissolved contaminants. The IM system of using recovery wells to pump affected groundwater from two areas in the facility commenced operations on May 13, 1993. Groundwater data from the Supplemental RFI report confirms the presence of two groundwater plumes associated with the former wastewater treatment plant and the current VCM plant.
The work performed as part of the RFI phase has been conducted from 1991 until the present. On January 8, 2007 EPA approved the RFI. Groundwater sampling activities are documented in quarterly groundwater reports. Development of the conceptual site model began after the RFI approval and is presented in the final RMP. Work completed at FPC-Tx according to the Order is documented in the following reports:

- Description of Current Conditions Report (Mar 1991)
- RFI Workplan (October 1991)
- Accelerated RCRA Facility Investigation Assessment, (Geraghty & Miller, Inc. Dec.1991)
- Interim RCRA Facility Investigation Assessment, (Engineering Science, 1992)
- Closure/Corrective Measures Report for Tank VT-763A&B (Sept. 1992)
- WWT System Surface Impoundments Closure Plan (Mar 1994)
- Supplemental RCRA Facility Investigation Workplan (Environeering, 1994)
- Interim Measures (IM) Workplan (Environeering 1994)
- Construction Quality Assurance (CQA) Plan Interim Measures (Environeering 1994)
- Interim Measure Implementation Report (Environeering 1994)
- Groundwater Quality Assessment Plan (Environeering 1994)
- Cone Penetrometer Testing (CPT) Fenceline Sampling Event (C-K Associates 1995)
- Aquifer Tests Report (C-K Associates, 1995)
- Supplemental RCRA Facility Investigation (C-K Associates June 1995, revised May 1998)
- VCM Fenceline Investigation (Radian International 1999)
- Proposed Modification, IM Groundwater Monitoring (MFG 2001)
- Summary of Metals Analyses 2002 Groundwater well sampling recommendation (MFG 2002)
- Stage 1 Groundwater Investigation Report, Former Brookings Property (PBW 2007)
- Current Conditions Technical Memorandum (TetraTech 2008)
- Final Risk Management Plan (October 2009)

Former Waste Water Treatment (WWT) SWMUs – Current Status

The former WWT area operated from 1983 to 1993. SWMUs that are located in the WWT area include: SWMU #2 Equalization Basin,

Figure 2



Source: Environeering, Inc. Figure 31

SWMU #3 Surge Basin, SWMU #4 Emergency Basin, SWMU #5 Andco Basin, SWMU #6 Aeration Basin, and SWMU #7 the Sludge Drying Beds. All ancillary equipment for SWMUs in this area have been isolated and all solids have been removed for recycling or disposal. When SWMU #4 was operational, it received some EDC and VCM-contaminated wastewater from the VCM process upsets. The Surge Basin and Emergency Basin are considered **source areas** for groundwater contamination at the WWT area.

VCM Area SWMUs – Current Status

The VCM area is an operational area of the facility located west of the former WWT area. The Storm Water Basin (SWMU #1) was in continuous operation from 1983 to 1993. All ancillary equipment has been isolated and all solids have been removed for recycling or disposal. The basin was constructed of four-inch-thick concrete underlain by a 6-mil polyethylene liner and compacted backfill. This basin received contaminated run-off from all plant process areas, washdown water, blast cleaning water, column steam bumping water and water from cleaning chemical spills in the process area. The primary constituent present was EDC. This SWMU is considered a potential source for the contaminated groundwater in the VCM plant. As reported in the 1998 RFI, FPC-Tx made changes to reduce the amount of contaminated water entering the basin when signs of the structural integrity were in question. Some changes included the construction of the PVC settling pits (SWMU #17) at the PVC processing area to remove PVC from the stormwater sewer system, and installing a second EDC stripping column to treat process and storm water runoff in the VCM processing area. In addition, FPC-Tx removed an underground storm water pipeline connected to the Storm Water basin and disposed of contaminated soils off-site.

EPA conducted a meeting at the FPC-Tx site June 10 – 12, 2008 to review current status of SWMUs and all surface soil and groundwater data associated with each SWMU. It was determined that 20 of the 35 SWMUs could be closed with no further corrective actions (NFA) based on data comparisons to the TCEQ Texas Risk Reduction Program (TRRP) screening levels for an industrial scenario. The WWT SWMUs retained for corrective measures are:

#2 Equalization Basin

#3 Surge Basin

#4 Emergency Basin

#5 Andco Basin

#6 Aeration Basin

#7 Sludge Drying Beds

The VCM area SWMUs retained for corrective measures are:

#1 Storm Water Basin

#17 PVC Settling Pits

#19 Incinerator area

#21/22/23 Holding Pit, Inactive Sewer Pump and VCM Waste Pit

#24/#25 closed EDC storage tank area

#35 Secondary containment tank area

Of the SWMUs retained for corrective measures, some SWMUs were grouped according to the need for further action to address groundwater issues only. The results of the review are summarized in Appendix A of this document.

D. Site Geology and Hydrogeology

FPC-Tx is underlain by the Beaumont Formation, which is made up of several hundred feet of dominantly fine-grained silt and clay, with sequences of interbedded fine sand and silt units. The upper **groundwater saturated units** have been designated as Zones P, A, B, and C in descending order. Zone P represents the uppermost saturated discontinuous silty sand that forms a perched water table that is laterally discontinuous. It is important to note that the site geology and hydrogeology conditions vary from the VCM area to the WWT area (which is characteristic of **fluvial depositional environments**).

VCM Plant Area – At ground surface in the VCM plant area, a stiff to very stiff, brown silty clay and hard reddish brown clay with iron staining and

ferrous nodules is encountered to a depth of about 18 feet below ground surface (bgs), interbedded with a seam of silty sand about one foot thick. Well P-13 is constructed with a screen at this thin sand seam which represents the uppermost water-bearing unit. Silty clay underlies this sand seam to a depth of about 25 to 27 feet bgs where a silty sand unit about 20 feet thick is encountered. This unit is underlain by a hard gray clay to a depth of about 70 feet bgs and is about 23 feet thick. A firm brown fine-grained sand that ranges in thickness from about 14 feet to 30 feet thick is encountered below the clay.

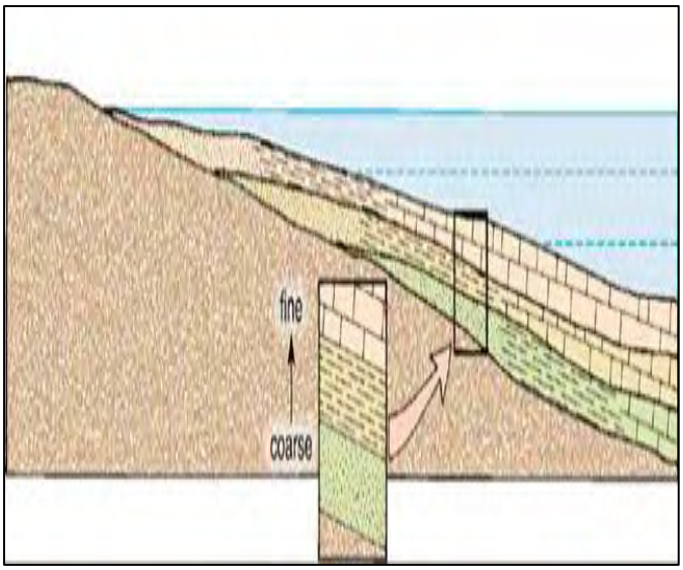
WWT Area - At ground surface in the WWT area, a dark gray to olive gray and red-brown, silty clay is encountered to a depth of about 16 feet bgs, interbedded with a one-to two -foot seam of red-brown silty sand. Wells P-20 and P-47 are screened across this thin sand seam. This sand seam is underlain by a very hard olive-gray to red-brown mottled clay to a depth of 63 feet bgs. A brown, very fine-grained silty sand about 14 feet in thickness is encountered at this depth.

As noted at the ALCOA site adjacent to the south, there are shallow sand lenses in the Beaumont Clay hydraulically connected to shallow silty clays. It is expected that the shallow saturated zones transcend the various **facies changes** from silty sands to silty clays; hence the need to describe the saturated zones as Zones A, B, and C. Figure 3 depicts a representation of facies changes typical of the depositional environment near the FPC-Tx site.

It is not known if the Zones described at the ALCOA site are the same hydrogeologic units at the FPC-Tx site. Another characteristic worthy of noting is that the shallow silty clays in some areas have very low hydraulic conductivity (8.0×10^{-8} cm/sec in sample P-38 at 18-20 feet bgs) and high porosity (50%). Since the presence of product or "free phase" has not been detected in the monitoring wells, it can be assumed that contaminants are adsorbed in the shallow silty clays (mudstones).

Figure 3

Typical Coastal Fluvial Depositional Sequence



Fine grained = mudstone facies
Medium grained = siltstone facies
Coarse grained = sandstone facies

The following description of the local hydrogeology is taken from the 1999 Remedial Investigation (RI) report for the neighboring ALCOA Superfund site:

Zone A consists mostly of interbedded sand, silt, and clay sediments characteristic of overbank flood basin depositional environments. Sand/silt strata also occur in Zone A as sublinear, branching sand-rich bodies, which are representative of fluvial-deltaic and channel deposits. Zone A typically occurs at an elevation of approximately 5 to 0 ft mean sea level (msl). Zone A is overlain and underlain by the Beaumont Clay. Zone B is separated from Zone A by the Beaumont Clay and includes strata consisting of fining-upward or massive sequences of silty sand to well-graded sand, as well as some finer grained sediments. Zone B sand strata are characteristic of dominantly fluvial depositional environments, with adjacent floodbasin and **interdistributary deposits**. Zone B is typically encountered at elevations of -20 to -30 ft msl. The thickness of Zone B sand and silt sequences ranges from less than 1 foot to greater than 20 feet. Zone B occurs below sea level and groundwater occurs under confined conditions. Zone C is separated from Zone B by the Beaumont Clay and is the deepest transmissive zone defined at the Plant. A groundwater "mounding effect" exists beneath the ALCOA Process Lakes and Bauxite Residue Lakes, with the potentiometric surface

elevation decreasing radially away from the Lake Complex. Groundwater discharges to Lavaca Bay and the upper reach of Cox Lake under natural conditions. Generally, the vertical gradients between Zones A and B are downward. Upward hydraulic gradients from Zone B to Zone A were observed near shoreline areas away from the ALCOA process lakes. Vertical hydraulic gradients between Zone B and Zone C tended to follow the same pattern (i.e., downward in the interior and new process lake areas and upward near the shoreline.) Zone A groundwater at the Northern Perimeter (of ALCOA) moves to the north toward the city of Point Comfort (and subsequently to Lavaca Bay) and the Formosa Plastics facility (and subsequently to Cox Creek/Lake). Groundwater in Zone A flows offsite toward Cox Lake and Cox Creek. Groundwater flowing horizontally in Zone B also discharges into the Bay System. In the ALCOA ship/barge channel and turning basin, direct discharge occurs where the deep channel cut (bottom elevation of approximately -40 ft msl) intercepts Zone B. Elsewhere, potentiometric data confirm that groundwater from Zone B discharges offshore upward into shallower strata and, thus, to the Bay System. Zone B groundwater at the Northern Perimeter (of ALCOA) similar to Zone A flow moves to the north toward the city of Point Comfort and the Formosa Plastics facility. Near the northeastern perimeter, groundwater in Zone B flows offsite toward Cox Lake and Cox Creek. Near the southeastern perimeter of ALCOA, Zone B groundwater may discharge into Cox Marsh and/or the original channel of Cox Creek.

The description above is pertinent to the understanding of groundwater flow in the general area and the effects on groundwater flow beneath the FPC-Tx facility. The Process and Bauxite Residue Lakes have a large volume of wetted clay that create the “mounding effect” on Zone A and Zone B, affecting the hydraulic gradients as described.

F. Interim Measures (IM) Groundwater Recovery System

FPC-Tx initiated an expedited interim groundwater recovery and remediation program at the Point Comfort facility while awaiting completion and approval of the RCRA Facility Investigation (RFI) and final corrective action plan. This interim groundwater recovery and remediation program was implemented in accordance with the approved Expedited Interim Measures Groundwater Remediation Plan (IMP) dated January 23, 1992. The IMP required quarterly sampling and reporting on the progress and effectiveness of the interim measures. Quarterly monitoring has been conducted and reports have been submitted to the EPA with groundwater data from 1993 until the present. EPA conducted **split sampling** of groundwater as part of the EPA oversight of the Order from 1993 until 1998.

In October 2001, FPC-Tx proposed modifications to the groundwater-monitoring program. EPA reviewed the proposed modifications and responded with comments on November 15, 2001. An agreement on the proposed modifications was reached via conference call between FPC-Tx and EPA on March 5, 2002. MFG, Inc. (Formosa’s contractor) prepared a new Groundwater Sampling and Analyses Plan (GWSAP) based on the approved modifications to the IMP. Changes to the existing program included:

- A modified analytical program eliminating analyses for total organic carbon (TOC) and semivolatile organic compounds (SVOCs) and reducing the number of metals analyses;
- A modified conceptual model of the facility including four water bearing zones as opposed to the two units described in previous documents;
- A change from traditional sampling with inertial pumps to the EPA-approved method of **low-flow sampling**;
- A reduced sampling frequency from quarterly to semi-annually with the exception of wells located along the down-gradient edge of the plume near the property boundary; and
- A modified and condensed quarterly report.

FPC-Tx implemented the modified program in 2002. Based on the groundwater monitoring program completed in 2002, FPC-Tx proposed additional modifications to the program. These changes consisted of the following:

- Metals analyses were eliminated as part of the interim measures monitoring program;
- All groundwater monitoring wells will be sampled in the first quarter of each year; and

- Monitoring wells located near the down-gradient property boundary, near the perimeter of the known plume, and located at locations critical to monitor potential vertical migration of impacted groundwater will be sampled every quarter.

EPA verbally approved these additional modifications via conference call on December 31, 2002. FPC-Tx implemented the additional modifications to the program in 2003. FPC-Tx received formal written acceptance in an EPA letter dated January 8, 2007. Modifications to the groundwater program were a result of a detailed evaluation of the 10 quarters of data from 1st quarter 1999 to 2nd quarter 2001. Detected concentrations of semivolatiles were below TRRP Tier 1 Class 2 groundwater ingestion protective concentration levels. Metals analyses were eliminated because samples with detectable concentrations of antimony, arsenic, beryllium, lead and thallium were detected in less than 5% of the samples collected.

The interim measures groundwater recovery and remediation system at FPC-Tx consists of six recovery wells (RS-1, RS-2, RS-3, RS-4, RS-5, and RS-6) in Zone A, two recovery wells in Zone B (RS-1 and RD-3), and one recovery well located in Zone C Upper (RD-1). Based on well construction logs, recovery well RS-1 appears to be screened across both Zone A and Zone B. The recovery wells are equipped with pneumatic or electric pumps that pump groundwater to a dedicated steam stripper. Recovered groundwater processed through the steam stripper is discharged through the plant permitted wastewater Outfall 001.

Outfall 001 discharges via pipeline to Lavaca Bay/Chocolate Bay in segment 2453 of the Bays and Estuaries. Formosa operates other outfalls (002 – 012) as described in their TPDES permit (WQ 0002436000).

The existing steam air stripper used in the IM groundwater treatment is located in the VCM plant. The steam stripper units are designed to separate and recover ethylene dichloride (EDC or 1,2 DCA) from an EDC-saturated water process stream. In the early stages of the Interim Measures, the water contained near saturation levels of EDC ranging from about 4,000 to 9,000 mg/L with lower levels of other VOCs. Recent quarterly reports indicate a much lower EDC ranges (from 10 - 280 mg/L). Actual performance of the steam stripper at the FPC-Tx facility is determined by analyzing samples from the feed water entering the stripper (influent) and comparing with samples exiting the steam stripper (effluent). This system is a closed-loop system which means that steam condensate is collected and sampled. EPA approved the process of treating groundwater using a steam air stripper because of the extensive experience FPC-Tx has with steam stripping, the availability of the equipment at the facility and that FPC-Tx could recover EDC for reuse as a product. Compliance records of upset conditions are kept to record high levels of EDC when they enter the stripper overloading the stripping capacity of the unit. Treated groundwater that does not comply is re-circulated through the stripper for additional treatment.

FPC-Tx plant areas under the EPA Order are described in the sections below. Corrective actions on other plant areas north of the VCM area are under the jurisdiction of the Texas Commission on Environmental Quality (TCEQ).

Former Waste Water Treatment Area

Currently, there are two Zone A recovery wells operating in the WWT area, RS-2 and RS-6. Zone A monitoring wells P-18, P-56 and P-57, located at the down-gradient edge of the monitored area, each had detectable concentrations of VOC in the third quarter 2008. Although groundwater in the vicinity of monitoring wells P-56 and P-57 may be controlled by recovery well RS-6, monitoring well P-18 is likely located beyond the capture zone created by RS-6 and RS-2. There are no recovery wells operating in the deeper water bearing zones in the WWT area. Groundwater samples from two monitoring wells in Zone B (D-32 and D-33) contained VOC concentrations in excess of the detection limit during the 2008 third quarter sampling event.

VCM Area

The current recovery system in the VCM area includes recovery wells in Zone A, Zone B, and

Zone C. Based on a review of the third quarter 2008 potentiometric and analytical data, the following conclusions can be reached:

Zone P – Zone P monitoring wells are screened in the perched water table. There are no recovery wells located in Zone P which is hydraulically connected to Zone A.

Zone A - Recovery wells RS-4 and RS-5, located near the down-gradient property boundary, represent the down-gradient control of the Zone A EDC plume. FPC-Tx completed a Zone A groundwater investigation of the property south of State Highway 35 in 2007 and no VOCs were detected in Zone A.

Zone B - The down-gradient extent of the EDC plume in Zone B does not appear to be adequately defined between recovery well RS-1 and the property boundary, thus it is not possible to determine if recovery well RS-1 is adequate to control horizontal migration of the plume in this zone.

Zone C - Recovery well RD-1 is a highly productive well with a significant cone-of-depression. Horizontal migration of the EDC plume in this area may be adequately controlled by this well; however, VOC concentrations at D-41 increased during the last three quarters prior to third quarter 2008. This could be an indication of horizontal migration beyond the control of RD-1 or the vertical migration may indicate that the existing groundwater recovery system in the shallower zones may not be adequate to control the vertical migration of the EDC plume into the lower water-bearing zones.

G. Soil Contamination

Contaminated soil associated with the release areas (the VCM area and the former WWT area) were evaluated as part of the RFI and SRFI. The 1992 and 1994 closure reports describe soil removal efforts associated with each SWMU. EPA requested FPC-Tx to review this data to determine an appropriate soil remediation strategy for the corrective measure in these areas. FPC-Tx submitted a Current Conditions Technical Memorandum final report in August 2008 to evaluate the volume of unsaturated soils (soil above the groundwater table) compared to the volume of soil that is below the groundwater table (saturated soil). Saturated soils are typically most economically handled via groundwater treatment and management strategies. Review of the data, as reported in the CCTM, revealed soil samples collected from the interior of the Surge and Emergency Basins (in the WWT area) are representative of unsaturated soil conditions. The thickness of unsaturated soil beneath the basins is estimated to range between 2 and 6 feet. The volume of unsaturated soil was estimated at 2,400 cubic yards. A pilot treatability study (Section V.F.) will be conducted in the area of unsaturated soils to determine if contaminants can be treated insitu as opposed to conducting a removal and offsite disposal.

H. Former Brookings Property

The 335-acre tract of land south of State Hwy 35, formerly owned by the Brookings family was purchased by FPC-Tx on October 24, 2005. Historical groundwater investigation data indicated that impacted groundwater may have migrated southeast of Hwy 35. FPC-Tx conducted an investigation in August through October 2007 to determine the extent of the groundwater contamination in Zone A (to a depth of 30 feet) and determine the hydraulic characteristics of Zone A near recovery well RS-6. The following activities were conducted during this investigation:

- Review of historical aerial photographs
- High resolution resistivity survey (3,950 linear feet)
- Eighteen direct push borings
- Installation of temporary wells at boring locations for groundwater sampling
- Groundwater sample analysis for VOCs
- Step-draw down test and pumping test at RS-6.

Conclusions from this investigation revealed the presence of a relatively thick sand channel near well RS-4 (shown in Figure 3 of the October 2007 Groundwater Investigation Report – Former Brookings Property); however, subsequent resistivity lines to the south on the former Brookings property reveal that the prominent sand channel lessens in sand and moisture content,

indicative of a typical facies change from a silty sand to a silty clay. There is no indication that a significant sand channel exists to the south of RS-6. EDC was not detected in any Zone A groundwater samples collected from the former Brookings property, however, contaminants may exist in Zone B or C. Compliance wells will be installed for each zone to delineate the groundwater compliance areas (See Section IV, CAO 1). If contaminants are found in the B and/or C Zone, the point of compliance may be Cox Creek to ensure that contaminants in groundwater are not released to Cox Creek.

III. SUMMARY OF SITE RISK

This section provides a summary of the human health and environmental risks associated with releases to soil, groundwater, and surface water at FPC-Tx. Contaminants in soil and ground water were screened relative to a target carcinogenic risk of 1E-05 (1 in 100,000 cancer risk). The evaluations provide the basis for taking action and identify the contaminants and **exposure pathways** that need to be addressed. Exposure pathways were analyzed as part of the CCTM report of August 2008, and the conceptual site model is provided in the final Risk Management Plan (October 2009).

Surface/Subsurface Soil Exposure pathways

In general, there are two potentially complete exposure pathways associated with impacted soil: 1) direct contact with impacted soil during subsurface construction activities, and 2) leaching of chemicals of concern from impacted soil to groundwater and subsequent potential offsite receptor exposure to impacted groundwater. The TRRP screening tables define **protective concentration levels** (PCLs) for each route of exposure. [^{Tot}**Soil**$_{Comb}$ is the TRRP screening value for direct exposure, and ^{Gw}**Soil**$_{Ing}$ is the screening value for the leaching to groundwater exposure pathway]. **Chemicals of concern** (COCs) at six SWMUs exceeded the soil screening value for the direct contact exposure pathway (^{Tot}Soil$_{Comb}$). (See Section IV, CAO 3). COCs at nine SWMUs were reported at concentrations less than the direct exposure value, but exceeded the PCL for the protection of groundwater. (Section IV;CAO 3).

Table 1: Soil COCs and TRRP PCLs

Soil COC	^{Tot}**Soil**$_{Comb}$	^{Gw}**Soil**$_{Ing}$
1,2-DCA or EDC	22 ppm	0.014 ppm
1,1- DCA	8200 ppm	55 ppm
1,1-dichloroethylene	6400 ppm	0.05 ppm
Cis-1,2-dichloroethylene	6400 ppm	0.25 ppm
Trans-1,2-dichloroethylene	1200 ppm	0.49 ppm
chlorobenzene	1000 ppm	1.1 ppm
tetrachloroethylene	360 ppm	0.050 ppm
1,1,2-TCA	35 ppm	0 020 ppm
trichloroethylene	310 ppm	0.034 ppm
Vinyl chloride	15 ppm	0.022 ppm
benzene	180 ppm	0.026 ppm
chloroform	26 ppm	3.0 ppm

Groundwater Exposure Pathways

Groundwater contaminant plumes are located at the VCM plant and at the former WWT area. Concentrations of contaminants in groundwater are reported above the **maximum contaminant limits (MCL)** for drinking water. Chemicals of concern can leach from saturated and unsaturated soils to shallow Zone A groundwater and subsequently to deeper water-bearing Zones B and C. There is no groundwater use on site; however, both shallow and deeper groundwater could potentially migrate offsite. The down-gradient property located between State Hwy 35 and Cox Creek was purchased by FPC-Tx in 2005 (former Brookings property). Three wells on this property are classified as oil field service wells, and the fourth well is classified as an industrial use well. In February 1995 the City of Point Comfort began using surface water from nearby Lake Texana.

Chemicals of concern retained for groundwater monitoring are included in Table 2. FPC conducted

a groundwater well survey indicating well locations and well usages for offsite wells within a 1.5-mile radius. The results are in the October 2009 RMP report. The EPA is also conducting a residential well survey for offsite users of local groundwater in the Fall of 2009.

Table 2: Groundwater COCs and MCLs(ppb)

1,2-DCA or EDC	5.0
1,1- DCA	No MCL established
1,1, DCE	7.0
Trans-1,2-DCE	100.0
Cis-1,2-DCE	70.0
Vinyl chloride	2.0
chloroform	80.0
benzene	5.0
TCE	5.0
1,1,2-TCA	5.0
Tetrachloroethene (PCE)	5.0

Surface Water and Sediment

Surface water, sediments and organisms were collected and tested as part of the Geochemical and Environmental Research Group (GERG) of Texas A&M University, August 1990. This report indicated that volatile organic compounds (VOCs) were found in low concentrations in the surface water and sediment samples. Impacted groundwater could affect Cox Creek if shallow groundwater discharges to Cox Creek. FPC-Tx installed stream gauges along Cox Creek to collect stream elevation data in 2008. Preliminary stream elevation data indicates a higher surface water level at downgradient locations on the former Brooking property as compared to the shallow groundwater elevations at FPC-Tx. This could indicate the dam at Cox Creek (near the ALCOA site) is causing a reversal of the hydraulic gradient back towards FPC-Tx and further indicates Cox Creek could be a losing stream downgradient of FPC-Tx. A study by the USGS Biological Resources Division, Marine Ecotoxicology Research Station, Texas A&M University – Corpus Christi, Center for Coastal Studies (1999) focused on the sediment quality of Lavaca Bay. The purpose of the study was to determine the potential ecotoxicological impacts of contaminants, using sensitive sediment toxicity tests in conjunction with chemical analyses. Twenty-four stations were sampled, with test station number 18 situated close to the Formosa outfall 001 in Lavaca Bay. This station showed the highest total organic carbon (TOC) with a 1.27 TOC percentage.

Ecological Risk

To evaluate the potential ecological risks at the FPC-Tx facility, the Ecological Exclusion worksheet that is part of the Region 6 Corrective Action Strategy was completed and can be found in the October 2009 RMP. Preliminary results indicate that an ecological risk assessment is not warranted at this time. As part of the performance monitoring requirements, EPA proposes to have FPC monitor surface water and sediment quality and will conduct further assessments as needed, described in the approved contingency plans (Section V.C.)

IV. CORRECTIVE ACTION OBJECTIVES and REMEDIAL GOALS

The **corrective action objectives (CAO's**) are developed by the EPA and are based on current and reasonably anticipated land and groundwater uses. It is EPA's policy to determine protective media cleanup objectives for groundwater remedies considering the use, value, and vulnerability of the groundwater resource, and all potential pathways that could result in human or ecological exposure to contaminants. Typically, the groundwater use designation is the starting point for determining the appropriate reasonable expected uses and exposures to evaluate risks and identify groundwater cleanup levels. Shallow groundwater resources in the area of FPC-Tx have been classified by the TCEQ as Class II having a beneficial use for agricultural and municipal/industrial use. To determine the value of an aquifer, EPA reviews the potential impact on the underlying aquifer, the potential discharge to surface water, and potential exposures to indoor

air. There is some evidence that shallow groundwater may discharge to surface water (no impacts are known at this time); however, because of the volatile nature of the site contaminants the human and ecological exposure risk is low. Potential for contaminated indoor air from the affected groundwater at FPC-Tx is high due to the volatile nature of the contaminants and the shallow depth to groundwater. FPC-Tx will mitigate potential indoor air exposures through the use of engineered controls and institutional controls, as applicable (see Section V. E).

Corrective Action Objective 1: The groundwater cleanup objective is to contain the plume, rather than returning the groundwater to its maximum beneficial use throughout the plume. **The groundwater point of compliance (POC) for FPC-Tx will be at the Facility boundary (including the former Brookings property), where concentrations of chemicals of concern must be less than or equal to the maximum contaminant limits (MCLs) for drinking water**. **(In the event an MCL is not established for a chemical of concern, a risk-based action level will be developed.)**
EPA is proposing to address the groundwater areas of contamination as groundwater areas of concern (AOCs) at FPC-Tx. For the purpose of defining the groundwater plumes at FPC-Tx, there are two AOCs identified – the former WWT area and the VCM plant (**Figures 3 and 4**). In the development of the Performance Monitoring Plan for FPC-Tx (See Section V.A.), EPA will review and approve locations of **sentinel wells** along the boundary of each AOC. Preliminary boundaries for AOC 1 and AOC 2 are shown in Figures 3 and 4. The actual boundary of each AOC will be determined when the sentinel wells for each zone (which will serve as an alarm system to trigger contingency plans) are installed. The sentinel well system will serve as performance monitoring wells to show that the plumes are contained. Protective concentration levels (or "trigger levels") to be maintained at each sentinel well for each groundwater zone will be developed in the Performance Monitoring Plan that will be reviewed and approved by the EPA. Sentinel well groundwater data will be presented in the Performance Review Plan (the 3-year performance review of the selected remedy). Beyond the AOC boundary where trigger levels will measure the containment objective, FPC-Tx will submit for EPA's approval, locations for POC wells which may be located at the facility boundary or other area under control of FPC-Tx, or at the point where groundwater discharges to surface water. The POC wells must show that COC concentrations are at MCLs.

Corrective Action Objective 2: To support the final groundwater cleanup objective, FPC-Tx must remove or treat source material in soils and/or groundwater to the extent practicable. **Using TRRP, soils with concentrations of COCs in excess of the soil saturation limit (C_{sat}) must be addressed, and groundwater with concentrations of COCs in excess of 1% solubility must be addressed through removal or treatment.**
Removal or treatment of **source material** in subsurface soils that could leach into groundwater will enhance the attainment of the corrective action objectives for groundwater. FPC-Tx is investigating a method by which source material in the subsurface can be treated **insitu** to reduce the contaminant release to groundwater from source material. If the treatment process proves itself through a pilot program, FPC-Tx will propose to set up a "treatment cell" or "treatment barrier" to address appropriate areas for each AOC.

Corrective Action Objective 3: **For the protection of on-site worker dermal contact or ingestion of COCs in soils, FPC-Tx will control or mitigate risks to appropriate TRRP industrial screening levels for surface and subsurface soils (see Table 1). Using TRRP guidance, risk associated with soil concentrations in excess of the $^{GW}Soil_{Ing}$ will be mitigated.**

Figure 3* Preliminary AOC 1 boundary *** (Figures taken from 2008 CCTM Report)**

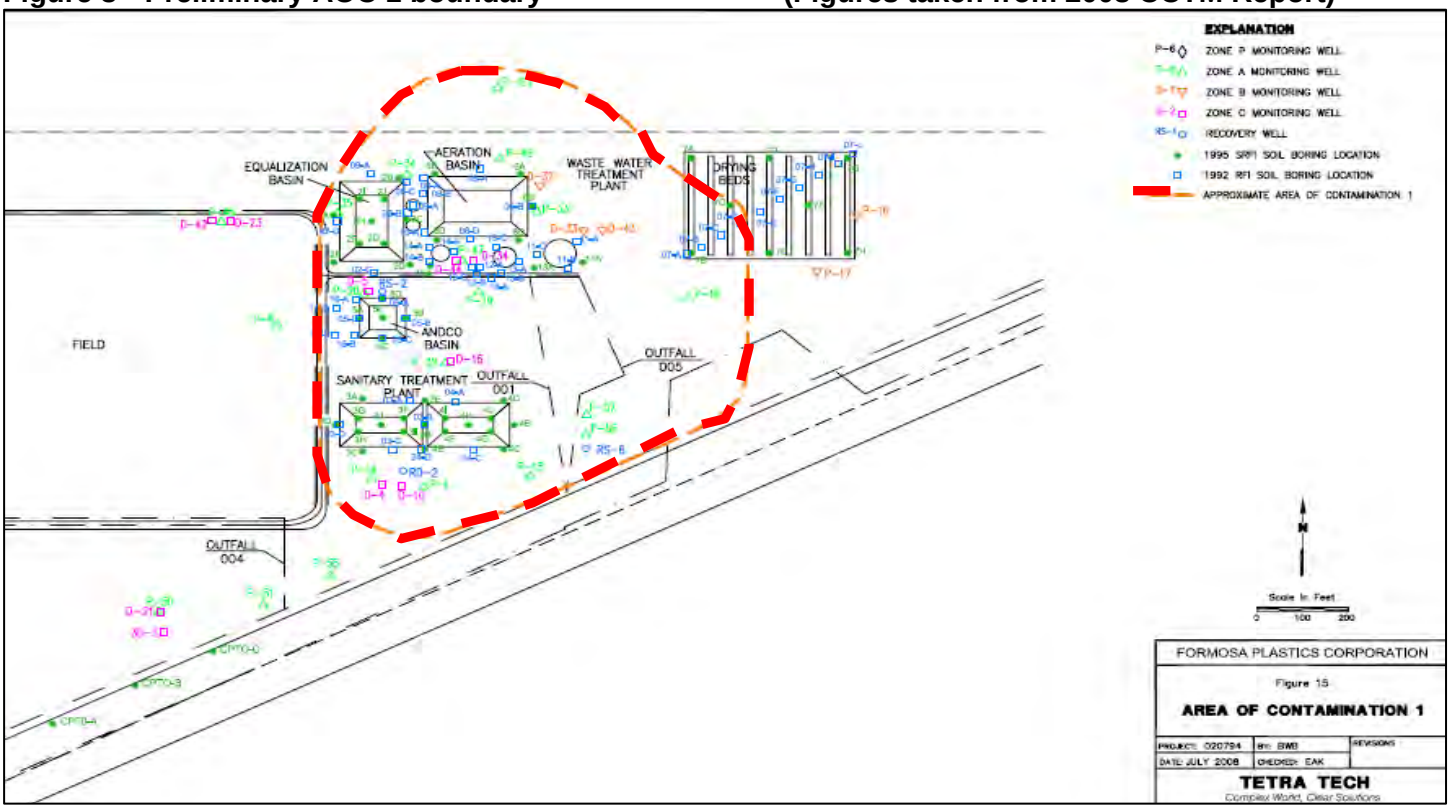
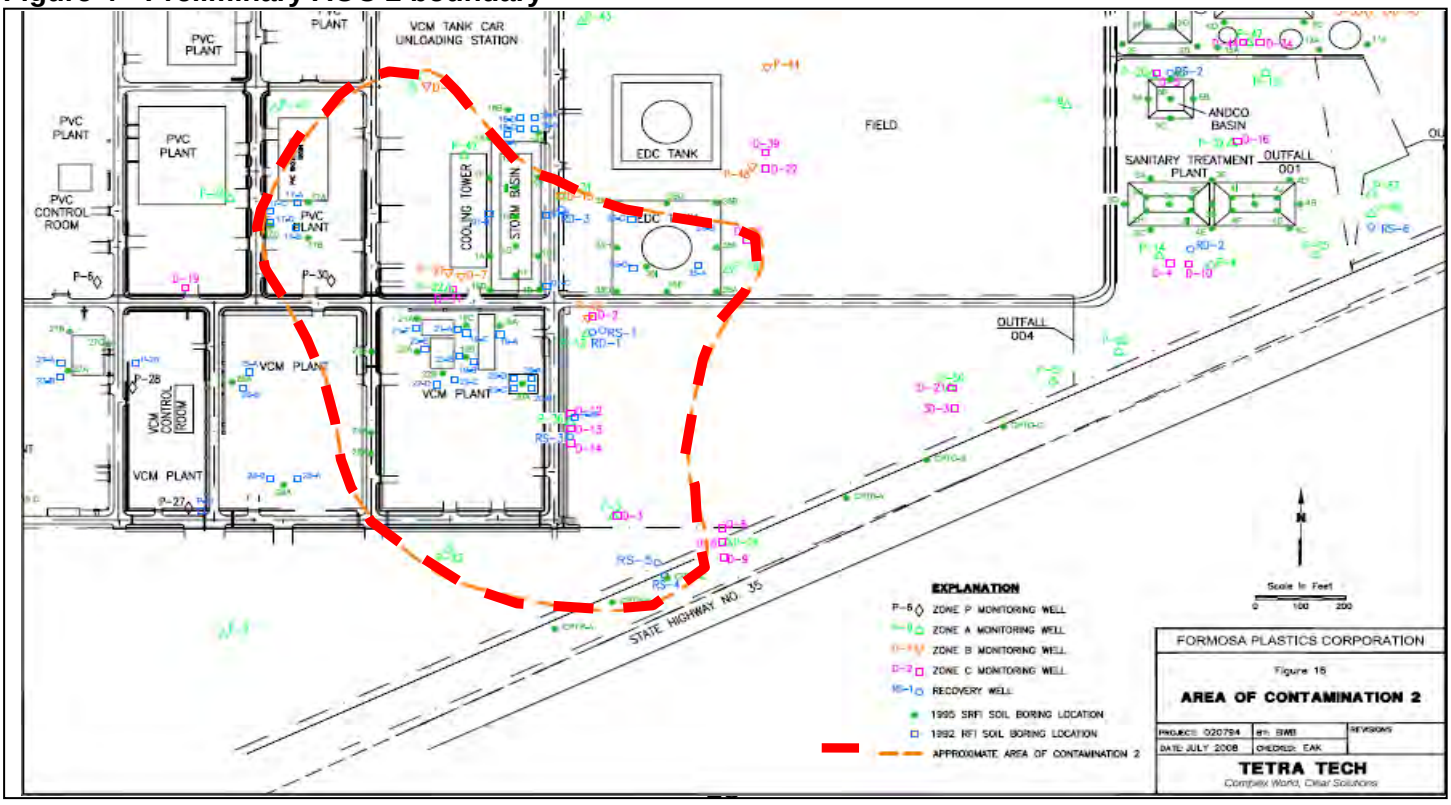


Figure 4* Preliminary AOC 2 boundary



Areas with exposed soils will be remediated/or controlled as necessary to protect to the appropriate TRRP industrial screening levels for surface soils. Other areas under construction may be capped to prevent exposures. Data from investigation or construction sampling at SWMUs will confirm that appropriate cleanup levels are attained. Any active SWMUs associated with past releases (SWMU 17 PVC had EDC soil concentrations of 450 ppb which may be contributing to groundwater contamination) will be re-engineered with secondary containment or other proper containment structures, as necessary to mitigate potential releases. If subsurface soils are being addressed through a removal action, then confirmation sampling will confirm the attainment of the appropriate TRRP cleanup level protective of groundwater. Any residual contamination left in place above cleanup levels must be managed to prevent exposures. If saturated soils and groundwater are being addressed through treatment, then treatment must continue until appropriate cleanup levels are attained. Data from corrective measures at SWMUs will confirm that appropriate cleanup levels are attained. The data will be presented in 3-year remedy Performance Reviews.

Corrective Action Objective 4: **The corrective action objective for surface water and sediment is to assure protection of human and ecological receptors by monitoring contaminant levels in surface water features associated with AOCs.** Surface water/sediment sampling locations will be proposed in the Performance Monitoring Plan. Sampling results must confirm that contaminant levels are protective of human health and the environment. Because of the volatile nature of chlorinated VOCs at FPC-Tx, elevated levels are not expected in surface water. Surface water and sediment data will be presented in the 3-year Performance Review of the selected remedy. If monitoring data reports contaminants at levels that present an unacceptable human health or ecological risk associated with exposure to COCs, then FPC-Tx must implement the contingency plans as described in Section V.C.

GREEN REMEDIATION / ECOLOGICAL ENHANCEMENT GOALS

During all phases of corrective measures, FPC-Tx will reduce energy requirements by using energy efficient equipment and processes. Opportunities for using renewable energy will be considered to power remediation activities, such as solar-powered pumps. Remediation approaches that reduce resource use and impact on air, water adjacent lands and public health will be considered in all phases of the final remedy**.**

During all phases of corrective measures, FPC-Tx will incorporate waste minimization and recycling of materials to the maximum extent feasible. Following final remediation of the former WWT area, FPC-Tx will evaluate green remediation technologies, such as the use of vegetative covers to close out the structural units of the former WWT plant.

To protect and enhance the ecological habitat for the acquired Brookings Property, FPC-Tx will evaluate ecological enhancements, such as restoring native grasses on the pasturelands, and restoring native habitat for birds, fish and other aquatic species in Cox Creek. Based on the property location, EPA is aware that studies may need to be conducted to assure that an attractive nuisance is not inadvertently created. The Wildlife Habitat Council is available to review the ecological conditions and settings of the site and can make recommendations to protect and enhance conditions for wildlife. [Please look into joining the effort described in this WHC presentation: **http://www.wildlifehc.org/ewebeditpro/items/O57F4847.pdf]**

V. PERFORMANCE-BASED MEASURES TO ENSURE PROTECTIVENESS

All reports described below will be part of the Corrective Measures Implementation (CMI) work plan required under the 1991 EPA Order. EPA replaced the requirements for a CMS with the RMP (EPA letter dated April 24, 2009). This performance-based decision document further describes the intent to add the following reports to Task XI CMI Program Plan: Performance

Monitoring Plan, Performance Review Plan, Contingency Plan, the Site Management Plan, and the Treatability Study/SWMU Corrective Measures Plan. (The EPA Order describes the submittal of a Program Management Plan and a Community Relations Plan). The additional plans are necessary for the success of the final remedy, considered by the EPA to be additional work as described under Section IX. A. 6. of the EPA Order. The schedule for implementation is outlined in Appendix B of this document.

A. Performance Monitoring Plan

As part of the CMI Plan, FPC-Tx will be required to submit, for agency approval a ***Performance Monitoring Plan*** which outlines periodic sampling of groundwater, soils, surface water and sediment to measure the effectiveness of the remedy in achieving the corrective action objectives. EPA is proposing an optimization of the monitoring well system already in place to ensure effective compliance monitoring. This will include additional monitoring well installations to effectively monitor compliance at the POC. If groundwater extraction continues to be part of the remedy to meet the corrective action objectives, then additional groundwater recovery wells may be needed, as well. The optimization program will also make sure that the monitoring wells are screened in proper intervals for detection of contaminants of concern. Recovery wells will need to be screened in appropriate intervals to ensure maximum contaminant extraction. The *Performance Monitoring Plan* will also measure the effectiveness of the remedy and will outline a clear definition of the monitoring frequency, sampling locations and data interpretation.

B. Performance Review Plan

As part of the CMI Plan, FPC-Tx will be required to submit, for agency review and approval a ***Performance Review Plan***. This plan is a 3-year assessment of progress towards achieving the corrective action objectives, including a summary of the effectiveness and efficiency of the preferred alternative for the remedy. It will also include recommendations for any needed changes in performance monitoring and the adequacy and effectiveness of land use controls. The *Performance Review Plan* needs a clear decision logic that defines 1) contingency plans to implement when CAO's are not being met, 2) a plan for phase-out of performance monitoring as risk is reduced and 3) contingency plans to address any potential changes in land use.

C. Contingency Plan

As part of the CMI Plan, FPC-Tx is required to submit, for agency review and approval a ***Contingency Plan*** which provides response actions to address any new releases or poor performance of the selected remedy. Failure to achieve the CAO's will trigger a contingency plan to correct the course of the remedy or to re-assess performance measures. FPC-Tx will conduct a Treatability Study (Section VI.F.) to study an alternative technology to the interim measures groundwater pump and treat system currently in operation to remove and treat contaminated groundwater. The Contingency plan will outline other viable technologies, as well as an optimization plan for the pump and treat system that can be utilized to meet the CAO's.

D. Community Relations Plan

As part of the CMI Plan, FPC-Tx is required to submit, for agency review and approval a ***Community Relations Plan*** (CRP) which will outline various ways that FPC-Tx will communicate to the public and keep the public informed about the overall effectiveness of the preferred remedy, and of any needed changes or modifications to the preferred remedy to meet the CAO's. An important part of the CRP will be to keep the public informed of the final treatment technology for soils and groundwater.

E. Site Management Plan for Worker Protection from Release Areas

FPC-Tx must implement institutional controls in the form of a site-wide ***Site Management Plan*** as part of the CMI plan to protect construction workers from contaminants in surface and subsurface soils and groundwater for all construction and

excavation activities. The Site Management Plan will describe internal procedures for obtaining permits for excavation, proper protective clothing and equipment for contractors or FPC-Tx personnel, and all health and safety protocols that will be followed for excavation activities. The Site Management Plan will also include plans for engineering controls and institutional controls for mitigation of indoor air, including a description of control rooms that are currently situated above any known groundwater-contaminated areas (AOCs). Mitigation for indoor air at these buildings will include the following engineering controls: venting along foundations or positive pressure inside the buildings. EPA has developed a document to present the "state of the science" regarding management and treatment of vapor intrusion into building structures. The document can be found at http://www.clu-in.org/download/char/600r08115.pdf EPA also proposes the use of any appropriate land use controls (LUCs) to ensure that exposures to residual contaminants in soil or groundwater are not incurred. All land use controls will be described in the Site Management Plan which specifies the implementation and maintenance of land use controls. The effectiveness and adequacy of land use controls will be reviewed and documented as part of the 3-year *Performance Review Plan.*

F. Treatability Study/SWMU Corrective Measures at Former WWT plant

EPA requested that FPC-Tx conduct a ***Treatability Study*** to determine if the source areas in the VCM and former WWT plant can be treated using **insitu** (in place) **bioremediation** or other insitu treatment processes. Insitu bioremediation is a treatment of contaminated soils and groundwater in place to enhance the natural degradation of contaminants by adding bacteria and nutrients to speed up the breakdown process of hydrocarbons. Insitu bioremediation is a relatively new technology that is showing promising results at many RCRA sites. A Treatability Study workplan will be incorporated as part of the CMI workplans. If the Treatability Study and sampling results from the implementation of a pilot study (field test) support insitu treatment as a viable approach to address contaminated soil and groundwater, FPC-Tx may propose to implement this technology on a full scale basis, which may replace or supplement the pump and treat system currently operating. If the pilot test proves that current insitu treatment technologies are not applicable for the FPC-Tx location, then FPC will be required to optimize the pump and treat system in place (as described in the Contingency Plan), or FPC-Tx may propose another remedial option to support the attainment of the CAO's. The final corrective measures for the SWMUs will be addressed concurrently with the proposal for soil and groundwater treatment.

Following the approval of the RFI in January 2007, the EPA set forth a schedule of activities leading up to this decision document. First (Phase 1), FPC-Tx completed the study of the former Brookings property and second (Phase 2) FPC-Tx completed the 2008 Current Conditions Technical Memorandum which compiled the current conceptual site model. FPC-Tx will implement a Treatability Study in 2010 according to the EPA-approved schedule (April 2004). Final corrective measures for each SWMU will follow the approved schedule in the Final 2009 RMP.

FORMOSA PLASTICS **POINT COMFORT, TEXAS** **RCRA CORRECTIVE ACTION** **PUBLIC MEETING** Thursday, October 15, 2009 at 7:00 PM **Calhoun High School** **210 Sandcrab Blvd** **Port Lavaca, Tx**	**FOR MORE INFORMATION:** If you have questions, please contact: **Ms. Nancy Fagan,** Project Manager U.S. EPA (6PD-O) 1445 Ross Avenue Dallas, Texas 75202-2733 (214) 665-8385 Fagan.nancy@epa.gov

GLOSSARY OF TERMS

Administrative Record - A collection of documents that includes sampling analyses, reports, communications and other supporting information that form the basis for the remedy selection.

Aerobic bioremediation – a process of adding nutrients to groundwater in a rich oxygen environment to speed up the natural process in which bacteria breaks down chemicals.

Anaerobic bioremediation – a process of adding nutrients to groundwater in a low oxygen environment to speed up the natural process in which bacteria breaks down chemicals.

Aquifer - A layer of permeable rock, sand, or gravel below the ground's surface that can supply usable quantities of ground water to wells and springs. An aquifer can be a source of drinking water.

Area of contamination (AOC) – An EPA policy that allows certain discrete areas of generally dispersed contamination to be considered a RCRA unit. Consolidation and insitu treatment of hazardous waste within the AOC does not create a new point of generation for RCRA purposes. Under the AOC policy, the site owner may consolidate and treat contaminated soil within the AOC.

Carbon tetrachloride – a compound consisting of one carbon and four chlorine atoms commonly used in solvents.

Chemicals of concern (COCs) – After risk screening, the contaminants that have the potential to pose a significant risk are labeled COCs.

Cis-1,2 DCE (cis-1,2-dichloroethene) - a chemical that is one of the natural breakdown products of trichloroethane (TCE).

Conceptual Site Model (CSM) – Part of the Data Quality Objective process that presents a three-dimensional picture of site conditions at a discrete point in time that conveys what is known about the facility, releases, release mechanisms, contaminant fate and transport, exposure pathways, potential receptors, and risk.

Corrective Action Objectives (CAOs) – Site-specific objectives that support the performance standards of source control through removal, treatment or containment, statutory/regulatory requirements or final risk goals for the protection of human health and the environment.

Corrective Measures Study (CMS) – A traditional report submitted after the completion of site investigation which serves as an evaluation of the alternatives for cleanup of sites contaminated with hazardous waste.

1, 1-dichloroethane (1,1-DCA) is a chlorinated hydrocarbon. It is a colorless oily liquid with a chloroform-like odor. It is not easily soluble in water, but miscible with most organic solvents.

1,2-dichloroethane (1,2-DCA) or Ethylene Dichloride (EDC) - The chemical compound **1,2-dichloroethane**, commonly known by its old name of ethylene dichloride (EDC), is a chlorinated hydrocarbon, mainly used to produce vinyl chloride monomer (VCM), the major precursor for PVC production. It is a colorless liquid with a chloroform-like odor. 1,2-Dichloroethane is also used generally as an intermediate for other organic chemical compounds, and as a solvent.

Exposure pathway – The course a chemical takes form a source to an exposed receptor. Each exposure pathway includes a source or release from a source, an exposure point, and an exposure route.

Facies changes - The term facies refers to all of the characteristics of a particular rock unit. For example, you might refer to a "tan, cross-bedded oolitic limestone facies". The characteristics of the rock unit come from the depositional environment. Every depositional environment puts its own distinctive imprint on the sediment, making a particular facies. Thus, a facies is a distinct kind of rock for that area or environment.

Fluvial depositional environments – Beach sands and river channel deposits are examples of fluvial transport and deposition, though sediment also often settles out of slow-moving or standing water in lakes and oceans.

Glossary

Ground Water – Water located beneath the ground surface in soil pore spaces and in the fractures of lithologic formations. A unit of rock or an unconsolidated deposit is called an aquifer when it can yield a usable quantity of water.

Groundwater-saturated units or zones – A subsurface zone in which water fills the interstices and is under pressure greater than atmospheric pressure. Also known as phreatic zone; saturated zone, usually unconsolidated silty sands in the subsurface that have large enough pore spaces to contain water. The shallow zones are usually above a confining layer and recharged through an upgradient exposure to precipitation.

Hydrogeology – the study of the distribution and movement of groundwater in the soil and rocks of the Earth's crust, (commonly in aquifers).

Inorganic - Chemical substances of mineral origin, not of basically carbon structure.

In situ (in place) bioremediation – A process of adding nutrients and/or bacteria directly to groundwater and soils using below-grade (in place) technology to speed up the natural chemical breakdown process.

Interdistributary deposits –sedimentary deposits of sand, silt and clays associated with distributary channels in a fluvial depositional environment.

Laboratory Reporting Limits - there are two distinct classes of reporting limits: **detection limits** and **quantitation limits**. Detection limits refer to a minimum concentration of an analyte that can be measured above the instrument background noise. Thus, when detection limits are used as reporting limits, the laboratory is saying that the analyte is not present at or above the value given. It may be present at a lower concentration, but cannot be "seen" by the instrument. Quantitation limits refer to a minimum concentration of an analyte that can be measured within specified limits of precision and accuracy. They are generally 5-10 times the detection limit. Thus, when quantitation limits are used as reporting limits, the laboratory is saying that the analyte is not present in a sufficient amount to be reliably quantified

Low-flow sampling – An EPA-approved method used to extract groundwater samples from wells using minimal drawdown techniques with the objective to obtain samples that are representative of groundwater conditions. Utilizing this technique minimizes purge water during sampling. [April 1996 EPA Groundwater Issue EPA/540/S-95/504]

Maximum Contaminant Limits (MCL) - Maximum permissible concentration of a contaminant in water which is delivered to any user of a public water system.

Monitoring Wells - Special wells drilled at specific locations on or off a site where ground water can be sampled at selected depths and studied to determine such things as the direction in which ground water flows and the types and amounts of contaminants present.

Natural attenuation or Monitored natural attenuation (MNA) – a process whereby only monitoring of the natural breakdown process takes place. MNA is an accepted remedy only in circumstances where sources of contamination have been removed to the extent practicable, and the environment is conducive to natural chemical breakdown.

No Further Action (NFA) - no further remedial actions are undertaken to address the existing ground water and soil contamination. NFA determinations can be made when the site no longer poses a risk to human health or the environment.

Nonaqueous phase liquid (NAPL) - The term NAPL refers to the undissolved liquid phase of a chemical, such as trichloroethylene (TCE), and not to the aqueous phase dissolved in water. Virtually all NAPLs are organic compounds that are immiscible (resistant to mixing) with water. The distinct interface resulting from the water-NAPL contact does allow some NAPL to dissolve, with the degree of aqueous solubility varying dramatically among NAPL compounds. As NAPL moves through the soil and aquifer, a portion becomes trapped and a portion may continue to migrate. The “free-phase NAPL” is the migrating portion, which can flow into a well. “Residual NAPL” is that portion trapped in the soil or aquifer and no longer migrates as a separate phase. Both residual and free-phase NAPLs are sources of vapors and dissolved contaminants.

Glossary

Non-potable – water that is unsafe or unpalatable to drink because it contains pollutants, chemicals or minerals.

Organics - Compounds which contain carbon. For example, trichloroethylene is an organic compound.

Parts Per Million (ppm)/Parts Per Billion (ppb) - Units of measure used to express concentrations of contaminants. 1 ppm is equal to 1,000 ppb and 1 ppb is equal to 0.001 ppm. Also, 1 ppm is equal to 1 mg/kg or 1 mg/l; 1 ppb is equal to 1 ug/kg or 1 ug/l. As an example, 1 ounce of trichloroethylene in 1 million ounces of water is 1 ppm.

Perchloroethylene (PCE) – stable colorless liquid,nonflammable and nonexplosive with low toxicity; used as an industrial solvent and in metal cleaning. Another name for this chemical is tetrachloroethylene, also sometimes called "perc".

Point of Compliance (POC) – The designated point of compliance (POC) is where the cleanup standard must be met. In groundwater corrective action, the POC is often described as the point at which the facility must meet the MCLs.

Protective Concentration Levels (PCLs) – cleanup standards for the Texas Risk Reduction Program (TRRP).

Potentiometric surface map – a contour map of the water levels that represent the top of a groundwater-bearing zone.

Resource Conservation and Recovery Act (RCRA) - This law authorizes the federal government to respond directly to releases of hazardous waste which may be a threat, or potential threat, to public health and the environment. EPA is responsible for implementing Section 3008(h) of RCRA in the State of New Mexico.

RCRA Facility Investigation (RFI) - An investigation to determine the nature and extent of contamination at a facility.

Risk Management Plan (RMP) – submittal required by the EPA which can replace the requirement for a CMS (see Region 6 Corrective Action Strategy (CAS) November 2008.

Sentinel wells – a system of nested groundwater monitoring wells screened in each saturated zone located a distance away from the plume edge. The wells serve as an early warning that contaminants may not be at MCLs at the point of compliance. Detections above protective levels will trigger contingency plans.

Site constituents – chemicals associated with processes at the site (facility).

Solid waste management units (SWMUs) – Any discernable unit at which solid wastes have been placed at any time, irrespective of whether the unit was intended for the management of solid or hazardous waste. Such units include any area at a facility.

Source area / source material – Source material is defined as material that includes or contains hazardous wastes or hazardous constituents that act as a reservoir for migration of contamination to soil, to groundwater, to surface water, to air, or act as a source for direct exposure. Contaminated groundwater plumes are generally not considered a source material, although non-aqueous phase liquids (NAPL) in the groundwater generally would be viewed as source material.

Split sampling – a term used to describe the collection of samples of any media (groundwater, sediment, soils) where the facility collects a sample, and an agency (federal or state) collects a duplicate sample for identical analyses.

Texas Risk Reduction Program (TRRP) The Texas Risk Reduction Program was promulgated in 1998 as the Texas Commission on Environmental Quality (TCEQ) Corrective Action program. The TCEQ if fully authorized by the US EPA to regulate the RCRA Subtitle C (hazardous waste) program. http://www.tceq.state.tx.us/remediation/trrp/trrp.html

Trans-1,2-dichloroethene - Incompatible with oxidizing agents, bases. Stable, but may decompose on exposure to air, moisture or light. Highly flammable. Harmful if swallowed or inhaled, and in contact with the skin.

Trichlorethene (TCE) - a clear, nonflammable liquid with a sweet smell. A chlorinated hydrocarbon commonly used as an industrial solvent (a degreaser for metal parts). Most TCE is produced from ethylene. It is unstable in the presence of metal over a prolonged exposure.

Glossary

Volatile hydrocarbons / volatile organic compounds (VOCs) – organic chemical compounds that have high enough vapor pressures under normal conditions to significantly vaporize and enter the atmosphere. VOCs may be natural or synthetic. Like organic chemicals in general, there are millions of different compounds which may be classified as VOCs. The compounds the nose detects as smells are generally VOCs. Modern industrial chemicals such as fuels, solvents, coatings, feedstocks, and refrigerants are usually VOCs.

Vinyl chloride- is the organochloride with the formula CH_2:CHCl. It is also called vinyl chloride monomer, or VCM. This colourless compound is an important industrial chemical chiefly used to produce the polymer polyvinyl chloride (PVC). At ambient pressure and temperature, vinyl chloride is a gas with a sickly sweet odor. It is highly toxic, flammable and carcinogenic. Vinyl chloride is produced on a substantial scale - approximately 31.1 million tons were produced in 2000. Two methods are employed, the hydrochlorination of acetylene and the dehydrochlorination of ethylene dichloride (1,2-dichloroethane). Vinyl chloride is a chemical intermediate, not a final product. Due to the hazardous nature of vinyl chloride to human health there are no end products that use vinyl chloride in its monomer form. Polyvinyl chloride is very stable, storable, and less acutely hazardous than the monomer. Vinyl chloride liquid is fed to polymerization reactors where it is converted from a monomer to a polymer PVC. The final product of the polymerization process is PVC in either a flake or pellet form. Literally, tens of billions of pounds of PVC are sold on the global market each year. From its flake or pellet form PVC is sold to companies that heat and mold the PVC into end products such as PVC pipe and bottles. Until 1974, vinyl chloride was used in aerosol spray propellants. Prior to the removal of vinyl chloride from hair spray the accumulation of vinyl chloride vapor in hair salons may have exceeded the NOAEL (No Observable Adverse Effect Level) exposure guidelines. For more information on vinyl chloride please see http://en.wikipedia.org/wiki/Vinyl_chloride.

Water Table - The upper surface of ground water in an aquifer. The water table marks the boundary between the unsaturated soil and saturated soils of the aquifer.

FORMOSA PLASTICS CORPORATION - TX - PUBLIC COMMENT PERIOD

The 45-day public comment period for the FPC-Tx Facility will begin on October 15, 2009**,** and end on November 30, 2009. Your written comments must be postmarked by November 30, 2009. Please write your comments below, then fold, tape, stamp, and mail this form. EPA will address all comments received during the public comment period in the Final Decision and Response to Comments. If you would like to receive a copy of the Response to Comments, please include your full name and address on the return address form.

FORMOSA PLASTICS POINT COMFORT, TEXAS

RCRA CORRECTIVE ACTION
PUBLIC COMMENT PERIOD

The public comment period for the FPC-Tx begins October 15, 2009. Your comments must be post marked by November 30, 2009, or you may choose to email your comments to Fagan.nancy@epa.gov.

Name _____

Address _____

City _____

State _____Zip_____

U.S. EPA Region 6
Attn: Nancy Fagan Mail Code: 6PD-O
1445 Ross Avenue
Dallas, TX 75202-2733

Appendix A: SWMU Status

TABLE 1
SWMU Status

DRAFT

NO FURTHER ACTION (NFA)

There are no further investigation or corrective action requirements associated with these SWMUs.

8 pH Adjustment Pit	20 Acid tank
9 Primary Clarifier	26 EDC Storage Tank (VT-102)
10 Sludge Thickener	27 Laboratory Wastes Area
11 Final Clarifier	28 Decoking Pit
12 Deep Well	29 Deionization Regeneration Waste Pit
13 Inactive Final Clarifier	30 Boiler Blowdown Sump
14 Sludge Digester	31 Used Oil Storage Area
15 Parshall Flume	32 Empty Container Storage Area
16 Cooling Tower Blowdown	33 Chemical Sewer System
18 Drum Storage Area	34 Storm Water Sewer System

COC Concentration > $^{GW}Soil_{Ing}$ PCL

Concentrations of COCs in soil in excess of the $^{GW}Soil_{Ing}$ PCL may indicate that COCs may leach from soil to underlying groundwater.

WWTP AREA (AOC 1)	***VCM Area (AOC 2)***
2 Equalization Basin	17 PVC Settling Pits
5 Andco Basin	19 Incinerator
6 Aeration Basin	24 EDC Storage Tank (VT-763A)
7 Sludge Drying Beds	25 EDC Storage Tank (VT-763B)
	35 Secondary Containment EDC Tank (VT-732)

COC Concentration > $^{Tot}Soil_{Comb}$ PCL

Concentrations of COCs in soil in excess of the $^{Tot}Soil_{Comb}$ PCL may indicate that COCs represent direct contact risks.

WWTP AREA (AOC 1)	***VCM AREA (AOC 2)***
3 Surge Basin	1 Storm Water Basin
4 Emergency Basin	21 Holding Pit
	22 Inactive Chemical Sewer Pump
	23 VCM Wastewater Pit

TRRP PCLs (mg/kg)	$^{Tot}Soil_{Comb}$	$^{GW}Soil_{Ing}$
Benzene	1.8E+02	2.6E-02
Chlorobenzene	1.0E+03	1.1E+00
Chloroform	2.6E+01	3.0E+00
Dichloroethane, 1,1-	8.2E+03	5.5E+01
Dichloroethane, 1,2-	2.2E+01	1.4E-02
Dichloroethylene, 1,1-	6.4E+03	5.0E-02
Dichloroethylene, cis-1,2-	6.4E+03	2.5E-01
Dichloroethylene, trans-1,2	1.2E+03	4.9E-01
Tetrachloroethylene	3.6E+02	5.0E-02
Trichloroethane, 1,1,2-	3.5E+01	2.0E-02
Trichloroethylene	3.1E+02	3.4E-02
Vinyl chloride	1.5E+01	2.2E-02

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Appendix B: Proposed Schedule of Remedy Implementation

2010 – Treatability Study/AOC Delineation
2011 - Design Plan for Final Remedy
2012 – Remedy construction
2015 – First 3-year Performance Review