FIFTH FIVE-YEAR REVIEW REPORT FOR CRYSTAL CHEMICAL CO. SUPERFUND SITE HARRIS COUNTY, TEXAS

September 2020

Prepared by

U.S. Environmental Protection Agency
Region 6
Dallas, Texas

FIFTH FIVE-YEAR REVIEW REPORT
CRYSTAL CHEMICAL CO. SUPERFUND SITE
EPA ID#: TXD990707010
HARRIS COUNTY, TEXAS

This memorandum documents the U.S. Environmental Protection Agency's performance, determinations and approval of the Crystal Chemical Co. Superfund site (Site) fifth five-year review under Section 121 (c) of the Comprehensive Environmental Response, Compensation, and Liability Act, 42 U.S. Code Section 9621 (c), as provided in the attached fifth Five-Year Review (FYR) Report.

Summary of the Fifth Five-Year Review Report

This FYR summarizes the current status of the remedy at the Site. The Site is located in southwest Houston, Harris County, Texas, and the area surrounding the Site is primarily used for commercial, light industry, and residential purposes. Crystal Chemical produced arsenical, phenolic and amine-based herbicides on the Site from 1968 to 1981. Facility operations contaminated soil and groundwater on the Site and adjacent properties with arsenic. A Record of Decision (ROD) was signed for the Site in September 1990, selecting both a soil and groundwater remedy. The soil remedy was amended through a ROD amendment in 1992. The final site soil remedy called for on-site consolidation and capping of arsenic-contaminated soils. The constructed cap effectively contains contaminants by preventing infiltration of rainwater and preventing direct contact with contaminated soils. The groundwater remedy called for pumping and treating the part of the arsenic plume amenable to arsenic removal. The groundwater remedy also called for the construction of a slurry wall around the remaining portion of the arsenic plume where it was determined that removal of the arsenic is technically impracticable. The construction of the slurry wall and accompanying ground water pressure relief system (PRS) was completed in August 2003. The remedy is protective in the short term. Contaminated soils are consolidated and capped. Groundwater in the area is not being used for drinking water purposes. The City of Houston provides drinking water for the area.

Environmental Indicators

Human Exposure Status: Human Exposure Under Control
Contaminated Groundwater Status: Groundwater Migration Under Control
Site-Wide Ready for Reuse: Sitewide Ready for Anticipated Use

Actions Needed

The following actions must be taken for the remedy to be protective over the long term:

- Determine the need for the Ground Water Treatment Plant (GWTP) and PRS.
- Evaluate and implement additional monitoring to delineate the extent of arsenic levels above the remediation goal of 50 µg/L and the current MCL of 10 µg/L for areas outside of the slurry wall, and determine stability of contaminants. Update the groundwater monitoring plan to include additional monitoring and the lowered action level for arsenic.
- Once the arsenic plume has been delineated, implement TRRP compliant institutional controls to restrict land use and use of contaminated groundwater to be protective in the long term.
- Evaluate and implement additional monitoring within the 100 foot zone to delineate the arsenic plume to the current MCL, and determine stabilty of contaminants. In addition, update the groundwater monitoring plan, as necessary.

Determination

I have determined that the remedy for the Crystal Chemical Co. Superfund site is protective in the short term. This Five-Year Review Report specifies the actions that need to be taken for the remedy to be protective over the long term.

WREN STENGER

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Wren Stenger
Director, Superfund Division
U.S. Environmental Protection Agency, Region 6

Date

CONCURRENCES

FIFTH FIVE-YEAR REVIEW REPORT
CRYSTAL CHEMICAL CO. SUPERFUND SITE
EPA ID#: TXD990707010
HARRIS COUNTY, TEXAS

Ashley Howard

Ashley Howard
Remedial Project Manager

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Date

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Chief, Superfund Branch, Office of Regional Counsel

Date

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ISSUES/RECOMMENDATIONS

FIFTH FIVE-YEAR REVIEW REPORT
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Issues and Recommendations Identified in the FYR:

OU(s):	**Issue Category: Remedy Performance**			
	Issue: The active components of the groundwater remedy are no longer operating.			
	Recommendation: Determine the need for the GWTP and PRS.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party/Support Agency**	**Milestone Date**
No	Yes	EPA	EPA	9/30/2024

OU(s):	**Issue Category: Remedy Performance**			
	Issue: Groundwater concentrations outside of the TI zone exceed the remediation goal of 50 µg/Land/or the current MCL of 10 µg/L.			
	Recommendation: Evaluate and implement additional monitoring to delineate the extent of arsenic levels above the remediation goal of 50 µg/L and the current MCL of 10 µg/L for areas outside of the slurry wall, and determine stabilty of contaminants. Update the groundwater monitoring plan to include additional monitoring and the lowered action level for arsenic.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party/Support Agency**	**Milestone Date**
No	Yes	PRP	EPA	9/30/2024

OU(s):	Issue Category: Institutional Controls			
	Issue: No institutional control is in place for protection of the monofill cap, for protection of the groundwater containment features, to restrict use to commercial/industrial, or to restrict groundwater usage for the area outside of the TI zone. The arsenic plumes must be delineated before a Texas Risk Reduction Program (TRRP) compliant Restricted Covenant can be put in place.			
	Recommendation: Once the arsenic plume has been delineated, implement TRRP compliant institutional controls to restrict land use and use of contaminated groundwater to be protective in the long term.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party/Support Agency**	**Milestone Date**
No	Yes	PRP	EPA	9/30/2024

OU(s):	Issue Category: Monitoring			
	Issue: Arsenic concentrations in the 100-ft sand zone were found to be above the current MCL indicating some communication between the 35- and 100-ft zones.			
	Recommendation: Evaluate and implement additional monitoring within the 100ft zone to delineate the arsenic plume to the current MCL, and determine stability of contaminants. In addition, update the groundwater monitoring plan, as necessary.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party/Support Agency**	**Milestone Date**
No	Yes	PRP	EPA	9/30/2024

Table of Contents

Tables

Figures

LIST OF ABBREVIATIONS AND ACRONYMS

ARAR	Applicable or Relevant and Appropriate Requirement
bgs	Below Ground Surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CIC	Community Involvement Coordinator
EPA	United States Environmental Protection Agency
ESD	Explanation of Significant Differences
FYR	Five-Year Review
GWBU	Groundwater Bearing Unit
GWTP	Groundwater Treatment Plant
IC	Institutional Control
MCL	Maximum Contaminant Level
mg/kg	Milligrams per Kilogram
µg/L	Micrograms per Liter
MSD	Municipal Settings Designation
NCP	National Contingency Plan
NPL	National Priorities List
O&M	Operation and Maintenance
PRP	Potentially Responsible Party
PRS	Pressure Relief System
RAO	Remedial Action Objective
ROD	Record of Decision
RPM	Remedial Project Manager
TI	Technical Impracticability
TCEQ	Texas Commission on Environmental Quality
TRRP	Texas Risk Reduction Program
UPRR	Union Pacific Railroad

I. INTRODUCTION

The purpose of a five-year review (FYR) is to evaluate the implementation and performance of a remedy to determine if the remedy is and will continue to be protective of human health and the environment. The methods, findings and conclusions of reviews are documented in FYR reports such as this one. In addition, FYR reports identify issues found during the review, if any, and document recommendations to address them.

The U.S. Environmental Protection Agency (EPA) is preparing this FYR pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121, consistent with the National Contingency Plan (NCP) (40 CFR Section 300.430(f)(4)(ii)), and considering EPA policy.

This is the fifth FYR for the Crystal Chemical Co. Superfund site (the Site). The triggering action for this statutory review is the completion date of the previous FYR. The FYR has been prepared because hazardous substances, pollutants or contaminants remain at the Site above levels that allow for unlimited use and unrestricted exposure (UU/UE).

The Site consists of one operable unit (OU) addressed in this FYR. EPA remedial project manager (RPM) Ashley Howard led the FYR. Participants included Texas Commission on Environmental Quality (TCEQ) project managers Terry Andrews and Christopher Siegel, and two EPA FYR contractors from Skeo. Union Pacific Railroad (UPRR), the potentially responsible party (PRP) was notified of the initiation of the FYR. The review began on 8/30/2019.

Site Background

The Site is located at 10985 Westpark Drive (formerly 3502 Rogerdale Road), in southwest Houston, Harris County, Texas (Figure 1). The Site consists of a monofill cap area and adjacent parcels where remedial features and groundwater contamination remain (Figure 2). The Site is bounded to the west by the Harris County Flood Control District drainage ditch (No. D124-00-00).

Crystal Chemical produced arsenical, phenolic and amine-based herbicides on the Site from 1968 to 1981. Facility operations contaminated soil and groundwater on the Site and adjacent properties with arsenic. From 1968 to 1979, Crystal Chemical leased a 6.8-acre tract from Southern Pacific Transportation Company (Southern Pacific, now UPRR). In 1979, Crystal Chemical purchased the property. In 1981, Crystal Chemical ceased operations, filed for bankruptcy and abandoned the Site. Except for investigation and remedial activities, there have been no operations on site since September 1981. The area surrounding the Site is primarily used for commercial, light industry, and residential purposes. Appendix A lists resources used in the development of this FYR Report. Appendix B provides the Site's chronology of events.

Two shallow groundwater sand zones are located under the Site at about 15 and 35 feet below ground surface (bgs). A third water-bearing zone is located under the Site at about 100 feet bgs. A clay confining layer is located beneath the 35-foot zone that reduces the potential for vertical migration between the 35-foot zone and the 100-foot zone and deeper water-bearing zones. The 15-foot zone is discontinuous and is generally present along Westpark Drive. The 35-foot and 100-foot zones are continuous at and in the vicinity of the Site. Public water supplies are available at and around the Site.

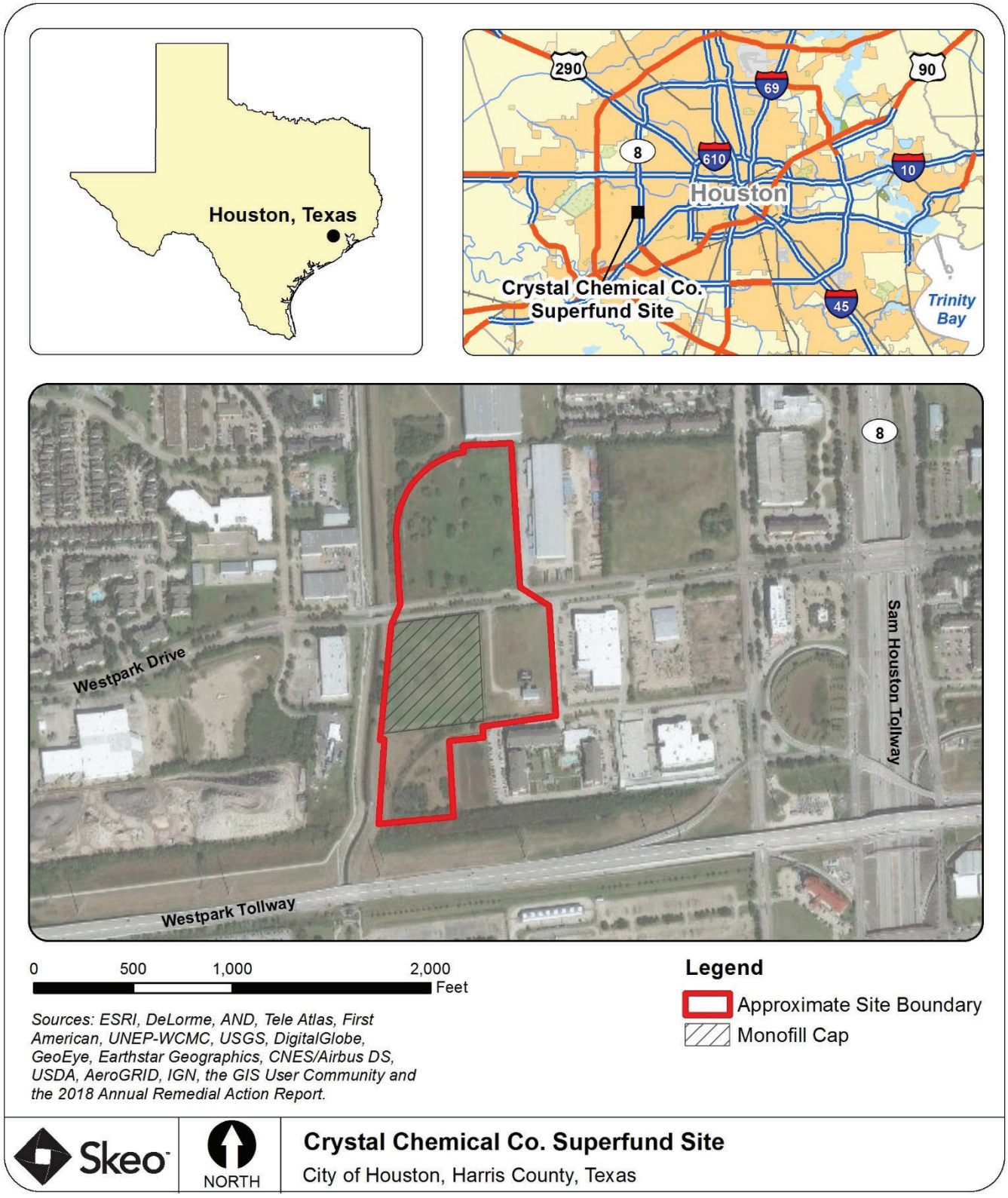
FIVE-YEAR REVIEW SUMMARY FORM

SITE IDENTIFICATION		
Site Name: Crystal Chemical Co.		
EPA ID: TXD990707010		
Region: 6	**State:** TEXAS	**City/County:** Houston/Harris

SITE STATUS	
NPL Status: Final	
Multiple OUs? No	**Has the Site achieved construction completion?** Yes

REVIEW STATUS
Lead agency: EPA
Author name: Ashley Howard, with additional support provided by Skeo
Author affiliation: EPA Region 6
Review period: 8/30/2019 - 8/31/2020
Date of site inspection: 12/4/2019
Type of review: Statutory
Review number: 5
Triggering action date: 9/25/2015
Due date *(five years after triggering action date)*: 9/25/2020

Figure 1: Site Vicinity Map



Disclaimer: This map and any boundary lines within the map are approximate and subject to change. The map is not a survey. The map is for informational purposes only regarding EPA's response actions at the Site.

II. RESPONSE ACTION SUMMARY

Basis for Taking Action

Operations at the Crystal Chemical facility during the late 1970s resulted in several violations of state of Texas environmental standards. In 1976, the Site was subject to repeated flooding, which carried arsenic-contaminated wastewaters off site. In 1978, Crystal Chemical applied for an on-site deep well injection permit to dispose of process wastewaters, which was denied.

EPA and TCEQ completed a remedial investigation and feasibility study to define the types and extent of contamination at the Site in 1984. Findings indicated that arsenic and phenol were detected in surface and subsurface soil and groundwater. The studies identified two principal threats – contaminated soil and shallow groundwater. The contaminated soil was determined to be a principal threat at the site because of direct contact, ingestion and inhalation risks, and because of the soil's impact on groundwater. The contaminated shallow groundwater was also determined to be a principal problem at the Site because of the potential exposure of the public to site contaminants and because of the threat of migration of contaminants to deeper zones of groundwater.

Based on the data collected during the remedial investigation, EPA determined that if no action was taken to address the soil and groundwater contamination, hazardous substances could be released from the Site and endanger public health or the environment.

Response Actions

In September 1981, Crystal Chemical filed for bankruptcy and abandoned the Site. EPA conducted an emergency removal action to stabilize the Site from 1981 to 1983. During the first phase of the EPA emergency cleanup, about 600,000 gallons of wastewater were removed from the ponds and disposed of at an off-site commercial waste disposal facility. About 99,000 gallons of arsenic trioxide were sold and, with the exception of concrete pads, the Site was left vacant. The top foot of soil was removed and mixed with lime, then deposited back into the wastewater ponds. EPA placed a temporary cap, which included a plastic cover topped by a layer of clay, over the area to limit the infiltration of water into contaminated soil. EPA added the Site to the National Priorities List (NPL) in 1983.

A Record of Decision (ROD) was signed for the site in September 1990, selecting both a soil and groundwater remedy. The soil remedy was amended through a ROD amendment in 1992.

Soil

The soil remedy in the Site's 1990 ROD called for excavation of off-site soils contaminated with arsenic, treatment of soils using an innovative treatment technology (in-situ vitrification), and capping the entire Site after the soil treatment finished. Due to unavailability of the treatment technology, EPA selected a new soil remedy of soil consolidation and capping in the 1992 ROD Amendment.

The remedial action objectives (RAOs) for the soil are to eliminate potential exposure via ingestion, inhalation or direct contact with contaminants and by reducing the potential for the soil to act as a continued source for surface water and groundwater contamination.

The 1992 ROD Amendment described the selected remedy as follows:

- Excavate about 55,000 cubic yards of off-site soils with arsenic concentrations exceeding 30 milligrams per kilogram (mg/kg).[1] Backfill off-site excavated areas to previously existing grades.

[1] The level of 30 mg/kg was determined to represent a safe health-based action level. The only other contaminant found at the Site that may be of concern was phenol. Remediation levels assuming chronic daily exposure to protect against noncarcinogenic effects were calculated for the phenolic compounds. The remediation levels were calculated to be 420,000 mg/kg for an adult and 50,000 mg/kg for a child. The remediation levels for phenolics have no significant effect on the volumes of soil or groundwater requiring remediation at the Site.

- Place excavated soils into a monofill on the Site.
- Install a multi-layer low permeability cap over the Site after excavated off-site soils have been placed on site.
- Implement site access and land use restrictions.

Groundwater
The groundwater remedy specified in the 1990 ROD called for extraction and treatment of arsenic-contaminated groundwater. The RAO is to reduce the amount of contamination to human health-based standards to eliminate or minimize the risks associated with the contaminated shallow groundwater. The 1990 ROD also included several contingency measures that could be implemented if an extraction and treatment system would not yield the groundwater remediation goal.

The remediation goal specified in the 1990 ROD for the affected groundwater zones was 50 micrograms per liter (µg/L), the maximum contamination level (MCL) for arsenic at that time.

During design for the groundwater remedy, EPA determined that restoration of the groundwater would be technically impracticable for parts of the Site. EPA implemented contingency remedies and selected groundwater containment within a slurry wall constructed around the parts of the Site where groundwater could not be restored. EPA waived the that the requirement for groundwater restoration to the MCL of 50 µg/L for arsenic in this containment area. EPA recorded the technical impracticability (TI) zone and slurry wall as part of the remedy in a 1997 Explanation of Significant Differences.

The extent of the TI zone was defined as that part of the Site north of the southern boundary that contains arsenic in shallow groundwater at a concentration greater than 50 µg/L. The TI zone extends from the water table to the base of the 35-foot zone, a depth of 50 to 60 feet bgs. Groundwater in the southernmost part of the Site was not defined in the TI zone. The area of the TI zone encompasses the monofill area and most of the northern parcel, and extends slightly into the northern portion of southern parcel. Extraction and treatment of arsenic-contaminated groundwater remained the selected remedy for the rest of the Site, as specified in the 1990 ROD (recovery well RW-1 and monitoring wells MW-30 and MW-33).

Status of Implementation

Southern Pacific (now UPRR) was identified as a PRP. The company had previously owned the site property and performed the remedial design of the groundwater remedy pursuant to an administrative order on consent, and the groundwater remedial action and the soil remedial design/remedial action pursuant to a Unilateral Administrative Order.

Soil
The PRPs began soil remedial activities in August 1992. The remediation consisted of excavating about 55,000 yards of soil with arsenic concentrations greater than 30 mg/kg. The excavated soils were consolidated into a monofill (Figure 2). The monofill was covered with an engineered cap consisting of a geocomposite clay liner covered by 18 inches of buffer soil and 6 inches of seeded topsoil. The geocomposite clay liner consists of a 20-millimeter high-density polyethylene flexible membrane liner with a bentonite backing.

After excavation finished, the excavation areas were backfilled with clean fill from off-site sources. A security fence with locking gate was installed to prevent access to the Site. Construction of the soil remedy finished in September 1995.

Groundwater
The groundwater remedy for the Site consists of a groundwater recovery and treatment system and a groundwater containment system. Construction of the groundwater treatment plant (GWTP) finished in November 1996, with major modifications completed in May 1998. Construction of the groundwater containment system finished in several phases from 1995 to 2003.

Groundwater Recovery and Treatment
The groundwater recovery and treatment system consists of a recovery well (designated RW-1) located south of the monofill, a GWTP east of the monofill on the UPRR-owned 5-acre tract, and an effluent storage and discharge system. RW-1 is located outside the southern tip of the TI zone. Construction of the GWTP finished in October 1996, followed by pilot testing and startup operations. In January 2010, as part of a phytohydraulic pilot test, RW-1 and the GWTP were temporarily shut down. EPA is currently reviewing the PRPs' proposal to decommission the GWTP.

Groundwater Containment
The groundwater containment remedy is meant to horizontally isolate the 15-foot and 35-foot zones through a slurry wall, a natural subsurface levee and a pressure relief system (PRS). The subsurface levee consists of low-permeability clay that serves as a natural barrier to groundwater migration along the northwestern boundary of the plume on the northern parcel (formerly owned by the Levy Estate). The bentonite slurry wall was installed along the eastern boundary of the plume on the 12.5-acre tract, under Westpark Drive, and along the western, southern and eastern edges of the monofill. Figure 2 shows the locations of the slurry wall and natural subsurface levee.

The depth of the slurry wall ranges from about 39 feet along the eastern segments to 52 feet along the western edge of the monofill. Testing was performed during construction to ensure that at least 2 feet of the slurry wall penetrated into the clay layer underneath the 35-foot zone. The eastern and northern portions of the slurry wall and most of the PRS, including performance monitoring wells, were installed in 2002. Construction of the groundwater remedy finished when the final section of the PRS beneath Westpark Drive was installed in August 2003.

Because the slurry wall is designed to prevent contaminated groundwater from migrating beyond the limits of the slurry wall, rainfall that seeps into the ground surface within the limits of the wall adds to the volume of water within the wall. The rainfall results in a gradual increase in the water level inside the slurry wall and hydraulic gradient from the inside of the wall outward. The southern part of the slurry wall containment area is covered by the soil monofill and a multilayer cap, which effectively prevents infiltration of rainfall into the subsurface environment. The property to the north is not covered by an impermeable cap and recharge can occur. The PRS was added to prevent the buildup of a hydraulic head inside the slurry wall to effectively control rising water levels caused by water recharge.

The PRS consists of six pairs of performance monitoring wells screened in the 35-foot zone. Five of the PRS well pairs are located on the 12.5-acre tract, and one pair is located on the GWTP property. Groundwater elevations at each pair of PRS wells are monitored to assess the hydraulic head at the groundwater containment barrier. Groundwater is pumped from the interior wells as necessary to regulate the hydraulic head inside the water containment barrier. Groundwater recovered from the PRS wells is pumped to the GWTP for treatment and discharge.

The groundwater extraction and treatment system operated until January 2010, when the evaluation of a phytohydraulic pilot test was started using eucalyptus trees in the southern portion of the Site, south of recovery well RW-1. The goal of the test was to evaluate if discernable changes would be observed in water levels, flow direction and arsenic migration after extraction at RW-1 ceases. As part of the test, the groundwater treatment system operations were temporarily suspended in January 2010 and have not yet been restarted. EPA has not made a formal determination regarding modifying the groundwater remedy. Currently, the effectiveness of the groundwater containment system is assessed through annual inspections of the slurry wall/PRS and annual monitoring of the performance wells.

The PRPs are currently doing additional work to further delineate groundwater contamination across the site. Results of this work will determine if the UPRR will proceed with a request for a TI zone expansion in the southern parcel (former Shearton Tract).

Figure 2: Site Features Map

Institutional Control (IC) Review

Table 1 and Figure 1 describe the institutional controls at the Site. The 2002 ROD Amendment calls for land use restrictions to protect the integrity of the monofill cap. No institutional controls are in place for the monofill cap, or for the remedial features on the northern parcel. UPRR has drafted a deed notice for the northern parcel, which is currently under review by EPA. A final Texas Risk Reduction Program (TRRP) compliant institutional control including the contaminated groundwater outside the TI zone will be completed once the groundwater plume has been delineated and assessed; the completion date for the final institutional control is estimated as 2024.

An Industrial Solid Waste Certification of Remediation notes that contaminants of concern remaining at the Site in groundwater require post-closure care or engineering control measures for groundwater. The Industrial Solid Waste Certification of Remediation was filed as a deed notice with the County Clerk of Harris County in March 2006. In addition, UPRR received Municipal Settings Designation (MSD) certification from TCEQ in June 2012, prohibiting the use of affected groundwater within the slurry wall.

Table 1: Summary of Planned and/or Implemented Institutional Controls (ICs)

Media, Engineered Controls, and Areas That Do Not Support UU/UE Based on Current Conditions	ICs Needed	ICs Called for in the Decision Documents	Impacted Parcel(s)	IC Objective	Title of IC Instrument Implemented and Date (or planned)
Soil	Yes	Yes	0111320000086 (Monofill Cap)	Restrict disturbance of the monofill cap.	Planned 2024 Restrictive Covenant
		No	0111290000066 (Northern parcel; former Levy tract)	Protect groundwater containment remedial features.	Planned 2021 Deed Notice for northern parcel only Planned 2024 Restrictive Covenant
Groundwater	Yes	No	0111320000086 (Monofill Cap)	Prohibit groundwater use.	2006 Deed Notice 2012 MSD Planned 2021 Deed Notice for northern parcel only Planned 2024 Restrictive Covenant

Figure 3: Institutional Control Map

Disclaimer: This map and any boundary lines within the map are approximate and subject to change. The map is not a survey. The map is for informational purposes only regarding EPA's response actions at the Site.

Systems Operations/Operation and Maintenance (O&M)

Activities related to the soil remedy include routine inspections and maintenance of the monofill cap. The monofill was completed in September 1995 and is in Year 25 of its operation and maintenance (O&M) phase. Current activities related to the soil remedy include routine inspections and maintenance of the monofill cap. EPA approved the performance of an annual monofill cap inspection in a letter dated April 10, 2017. Based on the results of the annual inspection, the monofill cap integrity is being properly maintained to meet the RAO.

Activities related to the groundwater remedy include routine inspections, repairs as necessary, and maintenance of the containment system and groundwater monitoring activities as follows:

- Groundwater monitoring of a select group of 15-foot zone wells.
- Groundwater monitoring of all 35-foot zone wells associated with the performance of the groundwater containment system and other select 35-foot zone wells.
- Groundwater monitoring of all three 100-foot zone wells.
- Annual physical inspections of:
    - Settling of the slurry wall cap.
    - Leaks in the PRS pipe.
    - Operation of the pumps.
    - The condition of well vaults and sumps.

Routine plant O&M activities include replacement of piping, pumps and valves as necessary to maintain groundwater recovery operations. These activities were presented in the quarterly progress reports submitted in 2018 to EPA and TCEQ. No significant repairs, replacement activities or events were noted during the period. As previously noted, operation of recovery well RW-1 and the GWTP system was suspended in January 2010. The remaining recovered groundwater was treated and discharged, with periodic inspection and maintenance or repairs of pumps, piping and tanks performed as necessary.

The PRP recommended the removal or relocation of several compliance or monitoring wells in the northern tract area during a meeting with EPA in January 2016, and in a Supplemental Investigation Work Plan and Groundwater Monitoring Plan Addendum submitted by UPRR in February 2016. EPA approved these recommended changes in a letter dated April 10, 2017. UPRR relocated 35-foot zone wells MW-SW-8A and MW-SW12 in July 2017, plugging and abandoning the original locations. In addition, 35-foot zone wells MW-SW7, MW-SW8, MW-SW9, MW-SW10, MW-SW11, MW-8, MW-17A and MW-23 were plugged and abandoned in July 2017.

Southern area monitoring wells MW-16, MW-17, MW-18, MW-19 and MW-36 were installed in June 2018.

III. PROGRESS SINCE THE PREVIOUS REVIEW

This section includes the protectiveness determinations and statements from the 2015 FYR Report as well as the recommendations from the 2015 FYR Report and the status of those recommendations.

Table 2: Protectiveness Determinations/Statements from the 2015 FYR Report

OU #	Protectiveness Determination	Protectiveness Statement
1	Protective	The remedy for arsenic impacted soils at the Crystal Chemical Company Superfund Site is protective of human health and the environment and will remain so provided the action items identified in the FYR Report are addressed as described above. The soil cleanup levels for arsenic have not changed. The arsenic levels exceeding human health protective levels are contained in the on-site monofill.
2	Short-term Protective	The remedy for the groundwater is protective in the short term. Groundwater in the area is not being used for drinking water purposes. The City of Houston provides drinking water for the area. Addressing the action items described above will ensure the long-term protection of human health and the environment.

Table 3: Status of Recommendations from the 2015 FYR Report

Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date (if applicable)
No institutional control is in place for protection of the monofill cap in perpetuity.	File a deed notice for cap protection in perpetuity.	Ongoing	The PRPs are proceeding with implementation of institutional controls to restrict access and protect the monofill capped soils in perpetuity. Plan to include in 2024 Restrictive Covenant.	NA
No surface water samples were collected during the review period. The O&M Plan notes that surface water samples were to be collected annually from three discharge points.	Collect surface water samples as specified in the O&M Plan.	Considered But Not Implemented	EPA approved a 2016 O&M Plan update requesting to discontinue surface water sampling.	April 2017
Monofill cap inspections are not performed in April and October of each year, as specified in the O&M Plan.	Perform the routine monofill cap inspections as scheduled.	Completed	Updated in 2016 O&M and now performed.	May 2016
The remediation goal in effect for the area outside of the TI waiver zone is 0.050 mg/L, while the current MCL for arsenic is 0.010 mg/L (EPA 2014).	Additional monitoring points are necessary to delineate the extent of arsenic levels above the remediation goal of 0.050 mg/L and the current MCL of 0.010 mg/L for areas outside of the slurry wall. Once the arsenic plume is defined, it may be necessary to	Ongoing	The PRPs are currently doing additional work to further delineate groundwater contamination across the site. Once the arsenic plume is defined, and a decision regarding the TI boundary extension is made, it may be necessary to amend the decision document for this area to be protective in the long-term.	NA

Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date (if applicable)
	amend the decision document for this area to be protective over the long term.		EPA has requested the groundwater monitoring plan be updated to include the current MCL of 0.010 mg/L, and for the current MCL to be used for accessing remedy performance.	
The southern, downgradient extent of arsenic exceeding the remediation goal or the MCL in the 35-foot zone has not been defined. As the zone is not defined, it is not possible to determine if the MSD covers the extent of the arsenic plume.	Additional monitoring points are necessary to delineate the extent of arsenic levels above the remediation goal of 0.050 mg/L and the current MCL of 0.010 mg/L for areas outside of the slurry wall. Once the arsenic plume is defined, it may be necessary to amend the MSD to include the affected area.	Ongoing	The PRPs completed a supplemental investigation intended to confirm the delineation of impacted groundwater in the southern area (former Shearton Tract). Permanent wells were installed at the four temporary well locations and an additional location at the southwest corner of the Shearton Tract parcel was added to facilitate four quarterly groundwater monitoring events to confirm groundwater delineation. EPA, TCEQ, UPRR, and GHD met on October 1, 2019 and agreed additional monitoring wells will be installed and quarterly sampling will continue to collect additional data. The PRPs are currently doing additional work to further delineate groundwater contamination across the site.	NA
Well protective casings, vaults, and pads continue to deteriorate.	Assess the condition of all well protective casings, covers and concrete pads, and perform maintenance and repairs as necessary.	Completed	The PRPs assessed all wells and completed repairs as needed.	October 2015
Arsenic concentrations in the 100-foot sand zone were found to be above the MCL indicating some communication between the 35-foot and 100-foot zones.	Continue to monitor arsenic concentrations in the 100-foot sand zone.	Ongoing	Sampling is ongoing for the 100-foot zone. MW-28A in 2015/2016 started to see an increase in arsenic. Due to concerns about the integrity of the well, the PRPs plugged and abandoned the well and installed a new well outside the containment area within the 100ft zone. Sampling is occuring annually Additional data needed for plume delineation. The PRPs are currently doing additional work to further delineate groundwater contamination across the site.	N/A

Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date (if applicable)
The pressure relief system (PRS) used to maintain containment inside the slurry wall is inactive and the EPA has not determined whether containment is being currently maintained.	Based on the information provided by the PRPs, the EPA needs to assess the need for the currently inactive pressure relief system or other method for maintaining containment inside the slurry wall.	Completed	O&M Plan was updated for the PRS and slurry wall to be inspected annually to confirm the PRS can be reactivated, if needed.	May 2016

IV. FIVE-YEAR REVIEW PROCESS

Community Notification, Community Involvement and Site Interviews

A public notice was made available by a newspaper posting in the *Houston Chronicle* on 1/1/2020 (Appendix C). It stated that the FYR was underway and invited the public to submit any comments to the EPA. The results of the review and the report will be made available at the Site's information repository, Judson Robinson Westchase Library, located at 3223 Wilcrest Drive, Houston, Texas 77042.

During the FYR process, interviews were conducted to document any perceived problems or successes with the remedy implemented to date**.** The interviews are summarized below.

The site's TCEQ Project Manager, Christopher Siegel, stated that the project will meet cleanup goals and will be ready for reuse once additional groundwater assessment is complete and adequate Texas Risk Reduction Rules (TRRP) compliant institutional controls are in place. He highlighted the need to delineate and determine the extent of groundwater contamination in the 35-foot and 100-foot GWBUs, noting that the distance between current monitoring wells is too great to define the extent of the plume. With regards to remedy performance, he stated that the Site does not appear to have actual or probable exposures to receptors, however, additional delineation is needed to implement required TRRP compliant institutional controls.

UPRR's O&M Contractor, Brian Carter, notes that overall the Site has been properly maintained and UPRR timely addresses any issues that arise. Regarding performance of the remedy, he concludes the cap is effective in eliminating human contact with soil and UPRR is preparing an evaluation of the effectiveness of the slurry wall as a remedy for groundwater. Additionally, he notes the current MSD and upcoming deed restriction address groundwater ingestion concerns. He highlights the Site has progressed on evaluation of groundwater flow and control, with further evaluation of Site conditions underway to evaluate control of affected groundwater within the site boundaries. He states that UPRR has significantly reduced overall arsenic concentrations in the shallow groundwater and continues to evaluate fluctuations in both the 35-foot and 100-foot zones. During the current groundwater assessment, site inspections are occuring weekly, as well as oversight of waste removal activities at the GWTP. Otherwise, he states GHD inspects the Site at least twice annually, but typically with more frequent inspections in the summer months to monitor plant growth and cap conditions. He also notes other routine communication and activities at the site, such as annual site inspections, Quarterly Progress Reports, Annual Remedial Action Reports, and other inspections and site visits.

The PRP was contacted to provide an interview but declined to participate.

An employee of a nearby retirement community was interviewed by the RPM. The employee said that they had seen people pass through the area, but had not seen anyone on site. The only concern they had was the periodic overgrowth on the fence line that made it difficult to see traffic when turning onto Westpark Drive from the property.

Data Review

Groundwater Monitoring Program

This FYR includes review of annual groundwater monitoring data from 2015-2019, as well as the additional quarterly monitoring conducted in 2018 and 2019 in the former Shearton tract area. Annual groundwater monitoring is conducted in the three shallowest water-bearing zones – the 15-foot, 35-foot and 100-foot sand zones. Sampling results and plume maps are included in Appendix F.

15-Foot Zone

Sampling in the 15-foot zone includes arsenic analysis at MW-21. The arsenic result for MW-21 in 2019 sampling event was 2.45 µg/L (December 2019), below the remedial goal of 50 µg/L and current MCL of 10 µg/L.

35-Foot Zone

Groundwater samples were collected and analyzed for arsenic annually from the exterior wells and from the Shearton Tract monitoring wells. Reported concentrations for the five exterior performance monitoring wells installed in the 35-foot zone ranged from 2.67 µg/L in MW-SW6 to 3.5 µg/L in MW-SW2, with all wells being below 5 µg/L, except for MW-SW12, with concentrations up to 34 µg/L. Arsenic concentrations in the five 35-foot zone performance monitoring wells surrounding the slurry wall have been below the ROD cleanup goal of 50 µg/L since installation of these wells in late 2003. The four interior performance wells (MW-SW1, MW-SW3, MW-SW5, MW-20), are required to be sampled once every five years and will be sampled in 2020.

100-Foot Zone

Arsenic concentrations for the 100-foot zone wells MW-31A and MW-32A have remained below the current MCL of 10 µg/L, with the highest detections being 6.58 µg/L in 2018 (MW-32A). MW-28A, located within the contained area, was sampled in 2015 and 2016 with concentrations of 68.5 µg/L and 68.6 µg/L, respectively. After those sampling events, the well was plugged and abandoned due to concerns about the integrity of the well. A replacement 100-foot well was installed but is located outside the containment area (Figure 4). Sampling from the new location outside of the containment area indicates lower concentrations, but some still exceeding the current MCL of 10 µg/L (16.3 µg/L in 2017, 13.6 µg/L in 2018, and 9.8 µg/L in 2019). EPA is evaluating the need for additional 100-foot monitoring to confirm no communication between the 35- and 100-foot zones.

Former Shearton Tract Area Assessment

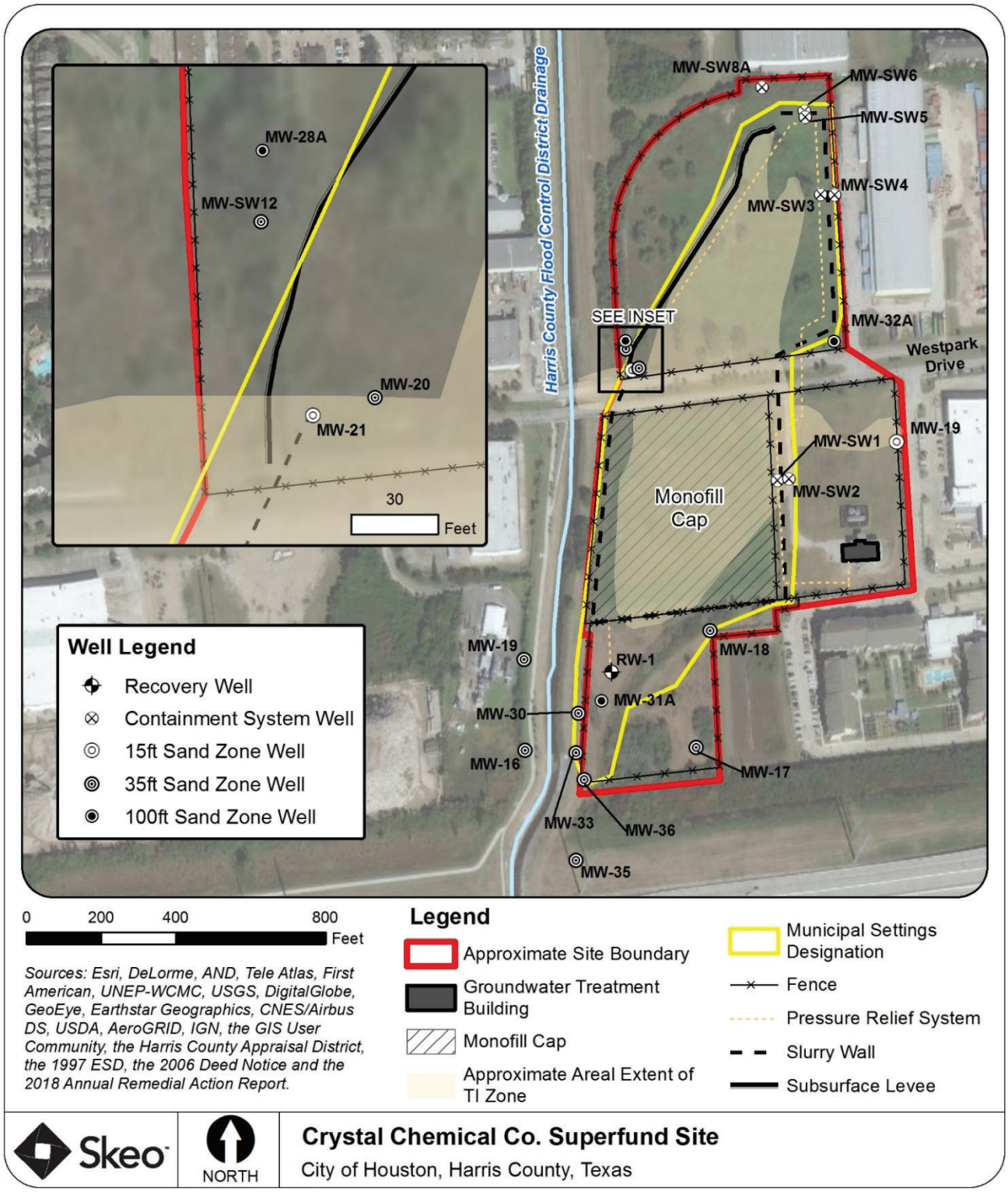
The PRPs submitted a Work Plan for additional groundwater assessment and monitoring to EPA for review and approval in May 2018. After EPA approval, UPRR implemented the proposed Shearton Tract Work Plan well installation in June 2018 and initiated four quarterly groundwater sampling events. Specifically, the requested revisions included installation of permanent monitoring wells in the former Shearton Tract area to confirm horizontal delineation of the arsenic-impacted groundwater plume and characterize groundwater conditions over a one-year period. In addition, the 2003 sampling plan was amended to account for additional annual groundwater monitoring at the new Shearton Tract well locations.

Shearton Tract monitoring wells MW-16, MW-17, MW-18, MW-19 and MW-36 were installed in June 2018. Groundwater samples were collected from the total of nine monitoring wells (MW-16, MW-17, MW-18,

MW-19, MW-30, MW-33, MW-35, MW-36, RW-1) in June 2018, August 2018, November 2018 and February 2019. During all four of the groundwater monitoring events, arsenic concentrations ranged from 0.616 J µg/L (MW-18, February 2019) to 3.98 µg/L (MW-16, August 2018), all below the current arsenic MCL of 10 µg/L. However, downgradient well MW-35 had reported a high concentration of 62 µg/L in August 2018, and most recently reported a concentration of 21 µg/L (February 2019), exceeding the current MCL of 10 µg/L. Additional monitoring will be conducted to further assess plume delineation prior to considering any modifications of the groundwater remedy or TI zone.

EPA recently received Additional Groundwater Delineation and Assessment Work Plan. This draft work plan is under review but will not be included in this FYR. The EPA provided comments to UPRR in an October 2019 meeting expressing concern over apparent increasing arsenic concentrations in groundwater at the Site and the apparent lack of delineation of the groundwater plume on the Shearton Tract in the 35-foot (ft) zone, as well as the potential that arsenic concentrations have migrated to the 100-ft zone beneath the Levy Tract. It was agreed that additional Site assessment of the Shearton Tract area groundwater plume would be necessary to consider groundwater remedy performance and possible expansion of the TI waiver area.

Figure 4: Monitoring Well Map



Disclaimer: This map and any boundary lines within the map are approximate and subject to change. The map is not a survey. The map is for informational purposes only regarding EPA's response actions at the Site.

Site Inspection

The site inspection took place on December 4, 2019. In attendance were EPA RPM Ashley Howard, TCEQ representative Terry Andrews, Kevin Peterburs from UPRR, Michael Wisniowiecki from GHD (PRP contractor), and Treat Suomi and Jill Billus from Skeo (EPA FYR support contractor). The purpose of the site inspection was to assess the protectiveness of the remedy. Photographs from the site inspection and a site inspection checklist are included in appendices D and E.

Site inspection participants first toured the groundwater treatment plant. The plant is inactive and has been since 2010. Groundwater and other chemicals remain in tanks and drums in the building. The PRP's contractor is cleaning the facility and plans to properly dispose of off site or recycle, where possible, the contents of the tanks and drums. Some of the equipment in the facility, such as electrical boxes, appeared rusted.

Site inspection participants also walked the perimeter of the monofill cap. The grassed cap was in good condition with no signs of subsidence or erosion. An animal burrow was observed on the eastern side of the cap but did not appear to have penetrated the geomembrane layer. A locked and gated fence surrounds the perimeter of the monolith. Vegetation, including poison ivy and some woody growth, was observed growing on or next to the fence, but did not appear to affect its integrity.

Site inspection participants also walked the former Shearton tract south of the monofill and the former Levy tract north of Westpark Drive. The eucalyptus trees on the former Shearton tract appeared stressed; however, some new growth was observed at the base of the trees. All site monitoring wells and recovery well RW-1 were located during the site inspection. Several of the concrete well pads were in poor condition, with cracks or subsidence observed. The well cover was missing at MW-32A. A bollard at new well MW-35 on the Centerpoint Energy right-of-way also appeared to have been knocked down. The vault for RW-1 was unlocked.

EPA and Skeo personnel also visited the designated site repository, Robinson-Westchase Neighborhood Library, located at 3223 Wilcrest Drive, Houston, Texas 77042. No site documents were available for review.

V. TECHNICAL ASSESSMENT

QUESTION A: Is the remedy functioning as intended by the decision documents?

Question A Summary:

Based on review of documents and the site inspection, the selected soil remedy has been completed in accordance with the 1990 ROD and 1992 ROD Amendment and is functioning as intended. Cleanup goals and performance standards were achieved as documented by the annual inspection reports, and O&M is occurring to ensure continued achievement of the RAOs. Currently the Monofill cap is inspected as part of O&M and is in good condition, however, there are not institutional controls in place to protect the integrity of the cap in the long term. The groundwater remedy is not currently being implemented as called for in the ROD.

Currently, activities related to the groundwater remedy include routine inspections and maintenance of the containment system and continued monitoring. Groundwater monitoring and cap inspections are ongoing. A review of monitoring data indicates that the groundwater containment remedy in the TI zone is meeting objectives.

As a result of concerns about the southern extent of the arsenic plume not being fully defined, new monitoring wells were installed. Based on the ongoing arsenic plume delineation and concentration stability, the PRP may proceed with a request to extend the TI zone to include the southern parcel. Should the TI zone be extended, EPA will consider permanent decommissioning and removal of the GWTP. EPA will issue a decision document to update the TI zone, if appropriate.

The PRP will continue to review the long-term effectiveness of the current groundwater remedial approach. EPA agreed to the 2010 suspension of groundwater recovery from RW-1, operation of the GWTP, and operation of the PRS. Based on information provided by the PRPs, EPA will determine the need for reactivating the PRS or if another method for maintaining containment inside the slurry wall is necessary.

Groundwater in the area is not being used for drinking water purposes. The City of Houston provides drinking water for the area. Institutional controls are in place to prevent use of contaminated groundwater within the slurry wall and an environmental covenant is expected to be filed in 2024 to restrict activities on the monofill cap. Additional institutional controls are needed to protect the remedial features on the Levy tract and to prevent use of contaminated groundwater sitewide.

QUESTION B: Are the exposure assumptions, toxicity data, cleanup levels and remedial action objectives (RAOs) used at the time of the remedy selection still valid?

Question B Summary:

Applicable or relevant and appropriate requirements (ARARs) review indicated that the maximum contaminant level (MCL) for arsenic has become more stringent. Current monitoring data indicate that arsenic contamination exceeds the current MCL in areas outside of the slurry wall. The remedial goals for groundwater are based on MCLs developed under the Safe Drinking Water Act. The remedial goal of 50 µg/L for arsenic selected in the ROD is based on the MCL value in 1990. The MCL for arsenic was changed from 50 µg/L to 10 µg/L in 2001. UPRR will implement TRRP complaint institutional controls once the arsenic plumes are delineated to the current MCL. There is no current usage of the Site groundwater. While the previous arsenic standard of 50 µg/L is no longer valid and is not protective, the change in the arsenic standard to 10 µg/L does not call into question the protectiveness of the remedy for the site.

There are no complete exposure pathways for contaminated soils. Site investigations determined the average background concentration of arsenic in western soils (6.1 mg/kg). The cleanup goal of 30 mg/kg was determined to represent a safe health-based action level. The cleanup goal remains within EPA's acceptable risk range. The soil arsenic levels exceeding human health protective levels are contained in the on-site monofill. Once groundwater arsenic plumes are delineated, UPRR will implement TRRP complaint institutional controls to restrict future land use nonresidential (i.e., industrial/commercial) purposes.

QUESTION C: Has any other information come to light that could call into question the protectiveness of the remedy?

No, no other information has come to light that could call into question protectiveness of the remedy. Post-Hurricane Harvey soil and groundwater samples were collected from the Site in September 2017. Arsenic concentrations were consistent with historical samples from the Site and are all below ROD cleanup goals.

VI. ISSUES/RECOMMENDATIONS

Issues/Recommendations
OU(s) without Issues/Recommendations Identified in the FYR:
None

OU(s):	**Issue Category: Remedy Performance**			
	Issue: The active components of the groundwater remedy are no longer operating.			
	Recommendation: Determine the need for the GWTP and PRS.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party/Support Agency**	**Milestone Date**
No	Yes	EPA	EPA	9/30/2024

OU(s):	**Issue Category: Remedy Performance**			
	Issue: Groundwater concentrations outside of the TI zone exceed the remediation goal of 50 µg/Land/or the current MCL of 10 µg/L.			
	Recommendation: Evaluate and implement additional monitoring to delineate the extent of arsenic levels above the remediation goal of 50 µg/L and the current MCL of 10 µg/L for areas outside of the slurry wall, and determine stability of contaminants. Update the groundwater monitoring plan to include additional monitoring and the lowered action level for arsenic.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party/Support Agency**	**Milestone Date**
No	Yes	PRP	EPA	9/30/2024

OU(s):	Issue Category: Institutional Controls			
	Issue: No institutional control is in place for protection of the monofill cap, for protection of the groundwater containment features, to restrict use to commercial/industrial, or to restrict groundwater usage for the area outside of the TI zone. The arsenic plumes must be delineated before a Texas Risk Reduction Program (TRRP) compliant Restricted Covenant can be put in place.			
	Recommendation: Once the arsenic plume has been delineated, implement TRRP compliant institutional controls to restrict land use and use of contaminated groundwater to be protective in the long term.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party/Support Agency**	**Milestone Date**
No	Yes	PRP	EPA	9/30/2024

OU(s):	Issue Category: Monitoring			
	Issue: Arsenic concentrations in the 100-ft sand zone were found to be above the current MCL indicating some communication between the 35- and 100-ft zones.			
	Recommendation: Evaluate and implement additional monitoring within the 100ft zone to delineate the arsenic plume to the current MCL, and determine stability of contaminants. In addition, update the groundwater monitoring plan, as necessary.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party/Support Agency**	**Milestone Date**
No	Yes	PRP	EPA	9/30/2024

Other Findings

In addition, the following are recommendations that were identified during the FYR and improve site management, but do not affect current and/or future protectiveness:

- Well protective casings, vaults, and pads continue to deteriorate. Need to assess the condition of all well protective casings, covers, and concrete pads and perform maintenance and repairs as necessary.
- Periodic overgrowth on fence line. Cut overgrowth on fence line as appropriate.
- There were no site related documents available at the designated site repository. Ensure site documents are made available in the site repository.

VII. PROTECTIVENESS STATEMENT

Protectiveness Statement(s)		
Operable Unit:	*Protectiveness Determination:* Short-term Protective	*Planned Addendum Completion Date:* Click here to enter a date

Protectiveness Statement: The remedy at the Site currently protects human health and the environment in the short term because contaminated soils are consolidated and capped, groundwater in the area is not being used for drinking water purposes and the City of Houston provides drinking water for the area. However, in order for the remedy to be protective over the long term, the following actions need to be taken in order to ensure protectiveness:

- Determine the need for the Ground Water Treatment Plant (GWTP) and Pressure Relief System (PRS),
- Evaluate and implement additional monitoring to delineate the extent of arsenic levels above the remediation goal of 50 µg/L and the current MCL of 10 µg/L for areas outside of the slurry wall, and determine stability of contaminants. Update the groundwater monitoring plan to include additional monitoring and the lowered action level for arsenic,
- Once the arsenic plume has been delineated, implement TRRP compliant institutional controls to restrict land use and use of contaminated groundwater to be protective in the long term,
- Evaluate and implement additional monitoring within the 100ft zone to delineate the arsenic plume to the current MCL, and determine stability of contaminants. In addition, update the groundwater monitoring plan, as necessary.

VIII. NEXT REVIEW

The next FYR Report for the Crystal Chemical Co. Superfund site is required five years from the completion date of this review.

APPENDIX A – REFERENCE LIST

Environmental Protection Agency (EPA). 1990. CERCLA Record of Decision for Crystal Chemical Company Site, Houston, Texas. September 27, 1990.

EPA. 1992. Amended CERCLA Record of Decision for Crystal Chemical Company Site, Houston, Texas. June 16, 1992.

EPA. 1997. Explanation of Significant Difference for Record of Decision: Crystal Chemical Company Superfund Site, Houston, Texas. March 19, 1997.

EPA. 2000. Five-Year Review Report for the Crystal Chemical Company Site, Houston, Harris County, Texas. September 25, 2000.

EPA. 2005. Second Five-Year Review Report for the Crystal Chemical Company Site, Houston, Harris County, Texas. September 29, 2005.

EPA. 2010. Third Five-Year Review Report for the Crystal Chemical Company Site, Houston, Harris County, Texas. September 30, 2010.

EPA. 2015. Fourth Five-Year Review Report for the Crystal Chemical Company Site, Houston, Harris County, Texas. September 25, 2015.

GHD. 2018 EPA Docket No. CERCLA VI-15-92 – Crystal Chemical Site, Houston, Texas: 2018 Annual Remedial Action Report for Soil and Ground Water Remedies. January 25, 2019.

GHD. 2019. Summary Shearton Tract Groundwater Monitoring Report Crystal Chemical NPL Site, Houston, Texas. March 29, 2019.

GHD. 2020. Summary Shearton Tract Groundwater Monitoring Report Crystal Chemical NPL Site, Houston, Texas. January 28, 2020.

APPENDIX B – SITE CHRONOLOGY

Table B-1: Site Chronology

Event	Date
Crystal Chemical began production of arsenical-, phenolic- and amine-based herbicides	1968
Flooding occurred at the Site, causing runoff from process and material storage areas	June 1976
Crystal Chemical filed for bankruptcy and abandoned the Site	September 1981
EPA initiated the following emergency removal action activities to stabilize the Site: Disposed of pond wastewater. Treated top 12 inches of pond soil with lime and placed soil back in ponds. Installed temporary cap. Sold arsenic trioxide that was stored on site. Disassembled, decontaminated, and sold buildings and process equipment.	September 1981 through February 1983
EPA listed the Site on the NPL	September 1983
EPA took measures to further control surface water runoff and site access by constructing drains and fencing, and placing additional fill on site	1983
The Texas Department of Water Resources, through a cooperative agreement with EPA, initiated a site characterization study	1983
The Texas Department of Water Resources completed an initial feasibility study	June 1984
EPA and the Texas Department of Water Resources completed an addendum feasibility study modifying the selected remedy as a response to public concerns on cost	December 1984
EPA took additional measures to further control surface water runoff and site access by constructing additional drains and fencing, and placing fill on site	1988
EPA signed the ROD for the Site	September 1990
EPA entered into an Administrative Order of Consent with Southern Pacific for the groundwater remedy at the Site	March 1992
EPA signed the ROD Amendment	June 1992
EPA issued a Unilateral Administrative Order to Southern Pacific addressing the remedial design/remedial action for the Site	September 1992
Southern Pacific implemented the Remedial Action Operation and Maintenance Plan to ensure the long-term integrity of the multi-layer cap	November 1994
EPA approved the Soil Remedial Action Documentation Report summarizing the construction of the soil remedy design	January 1995
PRPs completed construction of the GWTP	November 1996
EPA signed the Explanation of Significant Differences for the groundwater remedy	March 1997
UPRR purchased 12.5-acre tract north of Westpark Drive from Levy estate	April 2000
EPA issued Site's first FYR Report	September 2000
UPRR purchased western 3.8 acres of the Shearton Tract located south of the Site	December 2004
PRPs completed installation of phytohydraulic control pilot test	March 7, 2005
EPA issued Site's second FYR Report	September 2005
COH ordinance 2008-253 for MSD for groundwater at the Site was approved	March 2008
PRPs temporarily suspended GWTP operations	January 2010
EPA issued Site's third FYR Report	September 2010
UPRR received MSD certification from TCEQ prohibiting the use of affected groundwater at the Site	June 25, 2012
TCEQ submitted the MSD Certificate for the Site to UPRR	July 12, 2012
EPA issued Site's fourth FYR Report	September 2015

APPENDIX C – PRESS NOTICE

Crystal Chemical Co. Superfund Site
Public Notice
U. S. Environmental Protection Agency, Region 6

January 2020

The U.S. Environmental Protection Agency Region 6 (EPA) will be conducting the fourth five-year review of remedy implementation and performance at the Crystal Chemical Co. Superfund site (Site) in Houston, Texas. In the 1970s, arsenic-containing herbicides were manufactured on-site. As a result of facility operations, soil and groundwater on the site and adjacent properties were impacted by arsenic. The site-wide remedy included excavation, on-site consolidation and capping of off-site arsenic-contaminated soil; groundwater extraction and treatment; and groundwater containment to prevent contaminant migration. The five-year review will determine if the remedies are still protective of human health and the environment. The five-year review is scheduled for completion in June 2020.
The report will be made available to the public at the following local information repository:

Judson Robinson Westchase Library
3223 Wilcrest Drive
Houston, Texas 77042-3349
(832) 393-2011

Site status updates are available on the Internet at
www.epa.gov/superfund/crystal-chemical

All media inquiries should be directed to the EPA Press Office at (214) 665-2200

For more information about the Site, contact:

Ashley Howard, U.S. EPA Remedial Project Manager
Phone: (214) 665-7597; 1-800-533-3508
Email: howard.ashley@epa.gov

Edward Mekeel, U.S. EPA Community Involvement Coordinator
Phone: (214) 665-2252
Email: mekeel.edward@epa.gov

APPENDIX D – SITE INSPECTION CHECKLIST

FIVE-YEAR REVIEW SITE INSPECTION CHECKLIST

I. SITE INFORMATION

Site Name: Crystal Chemical Co.	**Date of Inspection:** 12/03/2019
Location and Region: Houston, TEXAS, 6	**EPA ID: TXD990707010**
Agency, Office or Company Leading the Five-Year Review: EPA	**Weather/Temperature:** Sunny and 70 degrees Fahrenheit

Remedy Includes: (check all that apply)

- ☒ Landfill cover/containment
- ☐ Access controls
- ☒ Institutional controls
- ☒ Groundwater pump and treatment
- ☐ Surface water collection and treatment
- ☐ Other: _____
- ☐ Monitored natural attenuation
- ☒ Groundwater containment
- ☒ Vertical barrier walls

Attachments: ☒ Inspection team roster attached ☒ Site map attached

II. INTERVIEWS (check all that apply)

1. **O&M Site Manager** _____ (Name) _____ (Title) _____ (Date)
   Interviewed ☐ at site ☐ at office ☐ by phone Phone: _____
   Problems, suggestions ☐ Report attached: _____

2. **O&M Staff** _____ (Name) _____ (Title) _____ (Date)
   Interviewed ☐ at site ☐ at office ☐ by phone Phone: _____
   Problems/suggestions ☐ Report attached: _____

3. **Local Regulatory Authorities and Response Agencies** (i.e., state and tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices). Fill in all that apply.

   Agency TCEQ
   Contact Terry Andrews _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)
   Problems/suggestions ☐ Report attached: _____

   Agency _____
   Contact _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)
   Problems/suggestions ☐ Report attached: _____

   Agency _____
   Contact _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)
   Problems/suggestions ☐ Report attached: _____

   Agency _____
   Contact _____ (Name) _____ (Title) _____ (Date) _____ (Phone No.)
   Problems/suggestions ☐ Report attached: _____

   Agency _____

Contact _____ _____ _____ _____
Name Title Date Phone No.
Problems/suggestions ☐ Report attached: _____

4. **Other Interviews** (optional) ☐ Report attached: _____

Union Pacific

III. ON-SITE DOCUMENTS AND RECORDS VERIFIED (check all that apply)

1. **O&M Documents**

☒ O&M manual	☒ Readily available	☐ Up to date	☐ N/A
☐ As-built drawings	☐ Readily available	☐ Up to date	☒ N/A
☒ Maintenance logs	☒ Readily available	☒ Up to date	☐ N/A

Remarks: _____

2. **Site-Specific Health and Safety Plan** ☒ Readily available ☒ Up to date ☐ N/A

☒ Contingency plan/emergency response plan ☒ Readily available ☒ Up to date ☐ N/A

Remarks: _____

3. **O&M and OSHA Training Records** ☒ Readily available ☒ Up to date ☐ N/A

Remarks: _____

4. **Permits and Service Agreements**

☐ Air discharge permit	☐ Readily available	☐ Up to date	☒ N/A
☒ Effluent discharge	☒ Readily available	☒ Up to date	☐ N/A
☐ Waste disposal, POTW	☐ Readily available	☐ Up to date	☒ N/A
☐ Other permits: _____	☐ Readily available	☐ Up to date	☒ N/A

Remarks: _____

5. **Gas Generation Records** ☐ Readily available ☐ Up to date ☒ N/A

Remarks: _____

6. **Settlement Monument Records** ☐ Readily available ☐ Up to date ☒ N/A

Remarks: _____

7. **Groundwater Monitoring Records** ☒ Readily available ☒ Up to date ☐ N/A

Remarks: _____

8. **Leachate Extraction Records** ☐ Readily available ☐ Up to date ☒ N/A

Remarks: _____

9. **Discharge Compliance Records**

☐ Air	☐ Readily available	☐ Up to date	☒ N/A
☒ Water (effluent)	☐ Readily available	☐ Up to date	☐ N/A

Remarks: There are not currently water discharge compliance records because there is no discharge since the stopping of the GWTP operation. The PRPs do maintain the discharge permit in case of a need to resume operation of the GWTP and discharge in the future.

10. **Daily Access/Security Logs** ☐ Readily available ☐ Up to date ☒ N/A

Remarks: _____

IV. O&M COSTS

1. **O&M Organization**

☐ State in-house ☐ Contractor for state

☐ PRP in-house ☒ Contractor for PRP

☐ Federal facility in-house ☐ Contractor for Federal facility

☐ _____

2. **O&M Cost Records**

☐ Readily available ☐ Up to date

☐ Funding mechanism/agreement in place ☒ Unavailable

Original O&M cost estimate: _____ ☐ Breakdown attached

Total annual cost by year for review period if available

From: _____ Date	To: _____ Date	_____ Total cost	☐ Breakdown attached
From: _____ Date	To: _____ Date	_____ Total cost	☐ Breakdown attached
From: _____ Date	To: _____ Date	_____ Total cost	☐ Breakdown attached
From: _____ Date	To: _____ Date	_____ Total cost	☐ Breakdown attached
From: _____ Date	To: _____ Date	_____ Total cost	☐ Breakdown attached

3. **Unanticipated or Unusually High O&M Costs during Review Period**

Describe costs and reasons: _____

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. **Fencing Damaged** ☐ Location shown on site map ☒ Gates secured ☐ N/A

Remarks: _____

B. Other Access Restrictions

1. **Signs and Other Security Measures** ☐ Location shown on site map ☐ N/A

Remarks: _____

C. Institutional Controls (ICs)

D. Implementation and Enforcement

Site conditions imply ICs not properly implemented ☐ Yes ☒ No ☐ N/A

Site conditions imply ICs not being fully enforced ☐ Yes ☒ No ☐ N/A

Type of monitoring (e.g., self-reporting, drive by): drive by

Frequency: during the FYR

Responsible party/agency: EPA

Contact _____ _____ _____ _____

Name Title Date Phone no.

Reporting is up to date ☒ Yes ☐ No ☐ N/A

Reports are verified by the lead agency ☒ Yes ☐ No ☐ N/A

Specific requirements in deed or decision documents have been met ☐ Yes ☐ No ☒ N/A

Violations have been reported ☐ Yes ☒ No ☐ N/A

Other problems or suggestions: ☒ Report attached

2. **Adequacy** ☐ ICs are adequate ☒ ICs are inadequate ☐ N/A

Remarks: PRPs are working to place insitutional controls on the capped area. In addition, institutional controls are needed to protect the remedy on the northern property and the full extent of groundwater contamination.

D. General

1. **Vandalism/Trespassing** ☐ Location shown on site map ☒ No vandalism evident

Remarks: Evidence of a homeless camp was seen outside the fence and outside the fence perimeter. There was no evidence that the Site had been breached by trespassers.

2. **Land Use Changes On Site** ☐ N/A

Remarks: The northern parcel of the Site is listed for sale.

3. **Land Use Changes Off Site** ☐ N/A

Remarks: Development has been occurring in the area and there is now a senior living apartment facility south of the Site.

VI. GENERAL SITE CONDITIONS

A. Roads ☒ Applicable ☐ N/A

1. **Roads Damaged** ☐ Location shown on site map ☒ Roads adequate ☐ N/A

Remarks: _____

B. Other Site Conditions

Remarks: The Site is well maintained. The grass was mowed and access to all wells was made possible by mowing.

VII. LANDFILL COVERS ☒ Applicable ☐ N/A

A. Landfill Surface

1. **Settlement** (low spots) ☐ Location shown on site map ☒ Settlement not evident

Area extent: _____ Depth: _____

Remarks: _____

2.	**Cracks**	☐ Location shown on site map	☒ Cracking not evident
	Lengths: _____	Widths: _____	Depths: _____
	Remarks: _____		
3.	**Erosion**	☐ Location shown on site map	☒ Erosion not evident
	Area extent: _____		Depth: _____
	Remarks: _____		
4.	**Holes**	☐ Location shown on site map	☐ Holes not evident
	Area extent: _____		Depth: Diagonal, so the complete depth was not observable, but appeared to be at least 10-12 inches deep.
	Remarks: There was one hole from a burrowing animal. The O&M contractor indicated they would get out and perform any needed repairs.		
5.	**Vegetative Cover**	☒ Grass	☒ Cover properly established
	☒ No signs of stress	☐ Trees/shrubs (indicate size and locations on a diagram)	
	Remarks: _____		
6.	**Alternative Cover** (e.g., armored rock, concrete)		☒ N/A
	Remarks: _____		
7.	**Bulges**	☐ Location shown on site map	☒ Bulges not evident
	Area extent: _____		Height: _____
	Remarks: _____		
8.	**Wet Areas/Water Damage**	☒ Wet areas/water damage not evident	
	☐ Wet areas	☐ Location shown on site map	Area extent: _____
	☐ Ponding	☐ Location shown on site map	Area extent: _____
	☐ Seeps	☐ Location shown on site map	Area extent: _____
	☐ Soft subgrade	☐ Location shown on site map	Area extent: _____
	Remarks: _____		
9.	**Slope Instability**	☐ Slides	☐ Location shown on site map
	☒ No evidence of slope instability		
	Area extent: _____		
	Remarks: _____		
B. Benches		☐ Applicable	☒ N/A
	(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)		
1.	**Flows Bypass Bench**	☐ Location shown on site map	☐ N/A or okay
	Remarks: _____		
2.	**Bench Breached**	☐ Location shown on site map	☐ N/A or okay

Remarks: _____

3. **Bench Overtopped** ☐ Location shown on site map ☐ N/A or okay

Remarks: _____

C. Letdown Channels ☐ Applicable ☒ N/A

(Channel lined with erosion control mats, riprap, grout bags or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1. **Settlement** (Low spots) ☐ Location shown on site map ☐ No evidence of settlement

Area extent: _____ Depth: _____

Remarks: _____

2. **Material Degradation** ☐ Location shown on site map ☐ No evidence of degradation

Material type:_____ Area extent: _____

Remarks: _____

3. **Erosion** ☐ Location shown on site map ☐ No evidence of erosion

Area extent: _____ Depth: _____

Remarks: _____

4. **Undercutting** ☐ Location shown on site map ☐ No evidence of undercutting

Area extent: _____ Depth: _____

Remarks: _____

5. **Obstructions** Type: _____ ☐ No obstructions

☐ Location shown on site map Area extent: _____

Size: _____

Remarks: _____

6. **Excessive Vegetative Growth** Type: _____

☐ No evidence of excessive growth

☐ Vegetation in channels does not obstruct flow

☐ Location shown on site map Area extent: _____

Remarks: _____

D. Cover Penetrations ☐ Applicable ☒ N/A

1. **Gas Vents** ☐ Active ☐ Passive

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition

☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A

Remarks: _____

2. **Gas Monitoring Probes**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition

☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A

Remarks: _____

3. **Monitoring Wells** (within surface area of landfill)

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition

☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A

Remarks: _____

4. **Extraction Wells Leachate**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition

☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A

Remarks: _____

5. **Settlement Monuments** ☐ Located ☐ Routinely surveyed ☐ N/A

Remarks: _____

E. Gas Collection and Treatment ☐ Applicable ☒ N/A

1. **Gas Treatment Facilities**

☐ Flaring ☐ Thermal destruction ☐ Collection for reuse

☐ Good condition ☐ Needs maintenance

Remarks: _____

2. **Gas Collection Wells, Manifolds and Piping**

☐ Good condition ☐ Needs maintenance

Remarks: _____

3. **Gas Monitoring Facilities** (e.g., gas monitoring of adjacent homes or buildings)

☐ Good condition ☐ Needs maintenance ☐ N/A

Remarks: _____

F. Cover Drainage Layer ☐ Applicable ☒ N/A

1. **Outlet Pipes Inspected** ☐ Functioning ☐ N/A

Remarks: _____

2. **Outlet Rock Inspected** ☐ Functioning ☐ N/A

Remarks: _____

G. Detention/Sedimentation Ponds ☐ Applicable ☒ N/A

1. **Siltation** Area extent: _____ Depth: _____ ☐ N/A

☐ Siltation not evident

Remarks: _____

2. **Erosion** Area extent: _____ Depth: _____

☐ Erosion not evident

Remarks: _____

3. **Outlet Works** ☐ Functioning ☐ N/A

Remarks: _____

4. **Dam** ☐ Functioning ☐ N/A

Remarks: _____

H. Retaining Walls ☐ Applicable ☒ N/A

1. **Deformations** ☐ Location shown on site map ☐ Deformation not evident

   Horizontal displacement: _____ Vertical displacement: _____

   Rotational displacement: _____

   Remarks: _____

2. **Degradation** ☐ Location shown on site map ☐ Degradation not evident

   Remarks: _____

I. Perimeter Ditches/Off-Site Discharge ☒ Applicable ☐ N/A

1. **Siltation** ☐ Location shown on site map ☒ Siltation not evident

   Area extent: _____ Depth: _____

   Remarks: _____

2. **Vegetative Growth** ☐ Location shown on site map ☐ N/A

   ☒ Vegetation does not impede flow

   Area extent: _____ Type: _____

   Remarks: The O&M contractor believed that the perimeter ditches had been there since before the remedy. They were filled with vegetation and the O&M contractor indicated there are no issues with surface water drainage.

3. **Erosion** ☐ Location shown on site map ☒ Erosion not evident

   Area extent: _____ Depth: _____

   Remarks: _____

4. **Discharge Structure** ☐ Functioning ☒ N/A

   Remarks: _____

VIII. VERTICAL BARRIER WALLS ☒ Applicable ☐ N/A

1. **Settlement** ☐ Location shown on site map ☒ Settlement not evident

   Area extent: _____ Depth: _____

   Remarks: _____

2. **Performance Monitoring** Type of monitoring: _____

   ☒ Performance not monitored

   Frequency: _____ ☐ Evidence of breaching

   Head differential: _____

   Remarks: _____

IX. GROUNDWATER/SURFACE WATER REMEDIES ☒ Applicable ☐ N/A

A. Groundwater Extraction Wells, Pumps and Pipelines ☒ Applicable ☐ N/A

1. **Pumps, Wellhead Plumbing and Electrical**

   ☐ Good condition ☐ All required wells properly operating ☐ Needs maintenance ☐ N/A

   Remarks: Have not been operational for years and would likely need maintenance to become operational again.

2. **Extraction System Pipelines, Valves, Valve Boxes and Other Appurtenances**

☐ Good condition ☐ Needs maintenance

Remarks: Have not been operational for years and would likely need maintenance to become operational again.

3. **Spare Parts and Equipment**

☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided

Remarks: Have not been operational for years and would likely need maintenance to become operational again.

B. Surface Water Collection Structures, Pumps and Pipelines ☐ Applicable ☒ N/A

1. **Collection Structures, Pumps and Electrical**

☐ Good condition ☐ Needs maintenance

Remarks: _____

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes and Other Appurtenances**

☐ Good condition ☐ Needs maintenance

Remarks: _____

3. **Spare Parts and Equipment**

☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided

Remarks: _____

C. Treatment System ☒ Applicable ☐ N/A

1. **Treatment Train** (check components that apply)

☐ Metals removal ☐ Oil/water separation ☐ Bioremediation

☐ Air stripping ☐ Carbon adsorbers

☐ Filters: _____

☐ Additive (e.g., chelation agent, flocculent): _____

☐ Others: _____

☐ Good condition ☐ Needs maintenance

☐ Sampling ports properly marked and functional

☐ Sampling/maintenance log displayed and up to date

☐ Equipment properly identified

☐ Quantity of groundwater treated annually: _____

☐ Quantity of surface water treated annually: _____

Remarks: Have not been operational for years and would likely need maintenance to become operational again.

2. **Electrical Enclosures and Panels** (properly rated and functional)

☐ N/A ☒ Good condition ☐ Needs maintenance

Remarks: _____

3. **Tanks, Vaults, Storage Vessels**

☐ N/A ☒ Good condition ☐ Proper secondary containment ☐ Needs maintenance

Remarks: _____

4. **Discharge Structure and Appurtenances**

☐ N/A ☐ Good condition ☐ Needs maintenance

Remarks: Have not been operational for years and would likely need maintenance to become operational again.

5. **Treatment Building(s)**

☐ N/A ☐ Good condition (esp. roof and doorways) ☒ Needs repair

☐ Chemicals and equipment properly stored

Remarks: It is in fair condition but is being cleaned up. The building is showing signs of wear and tear from years of not being maintained while the system has not been used.

6. **Monitoring Wells** (pump and treatment remedy)

☒ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☐ Good condition

☐ All required wells located ☒ Needs maintenance ☐ N/A

Remarks: Some wells need maintenance. The well pads in some cases were cracking and looked to be showing the effects of some settling.

D. Monitoring Data

1. **Monitoring Data**

☒ Is routinely submitted on time ☐ Is of acceptable quality

2. **Monitoring Data Suggests:**

☐ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

E. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition

☐ All required wells located ☐ Needs maintenance ☒ N/A

Remarks: _____

X. OTHER REMEDIES

If there are remedies applied at the site and not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is designed to accomplish (e.g., to contain contaminant plume, minimize infiltration and gas emissions).

The active components of the groundwater remedy are not currently in use (GWTP and PRS). EPA, TCEQ, and the PRPs are working together to collect data to determine if these components are needed. Depending on the outcome of this assessment, it may be necessary to amend the decision document for this area to be protective in the long-term. Additional institutional controls are needed to ensure long-term protectiveness.

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

Overall, the Site is well maintained. Some wells had cracking and settlement evident around the well pads.

C. Early Indicators of Potential Remedy Problems

Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future.

	None noted.
D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. None noted.

APPENDIX E – SITE INSPECTION PHOTOS

Monofill cap area

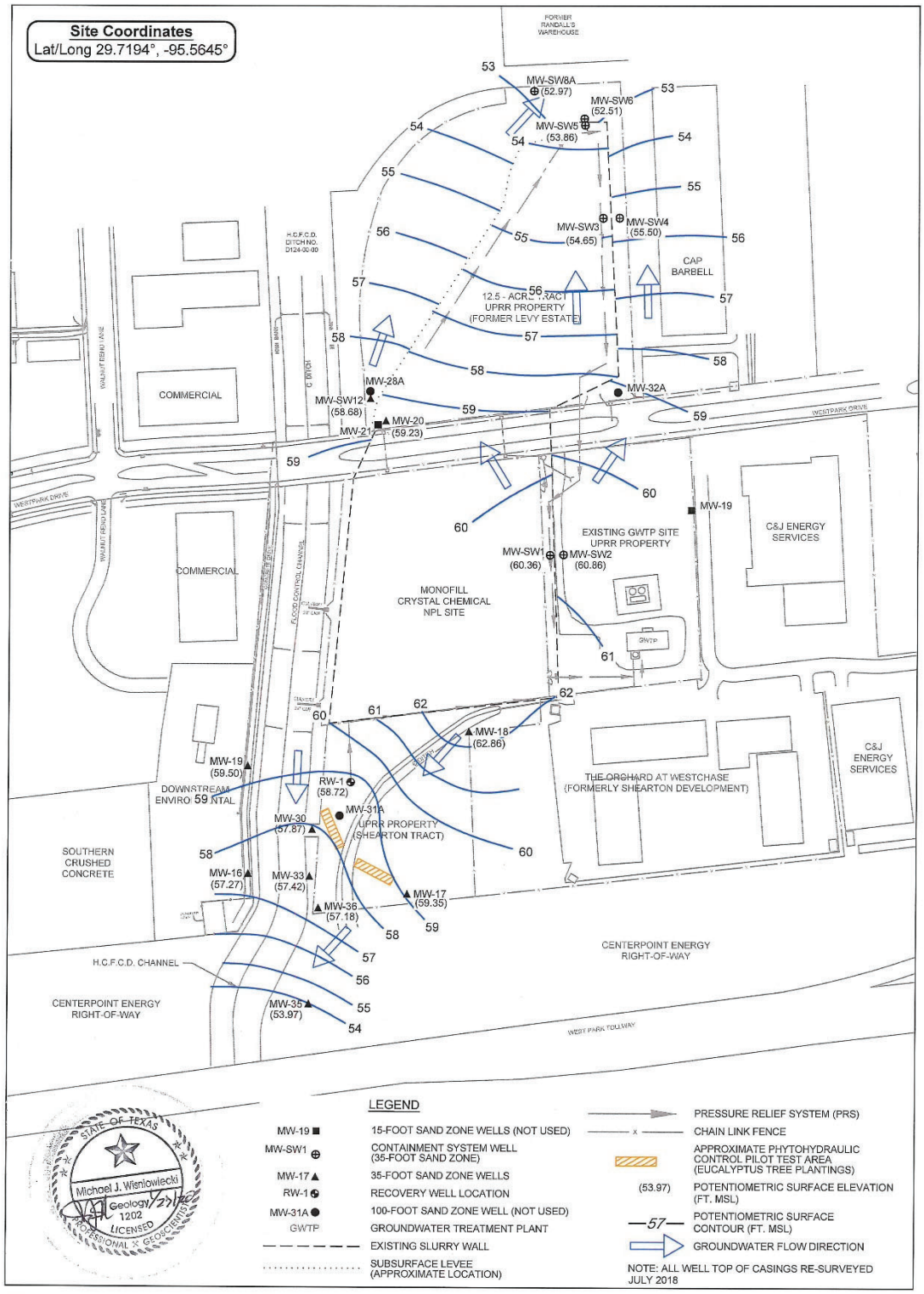
Eucalyptus trees at the southern parcel (former Shearton tract)

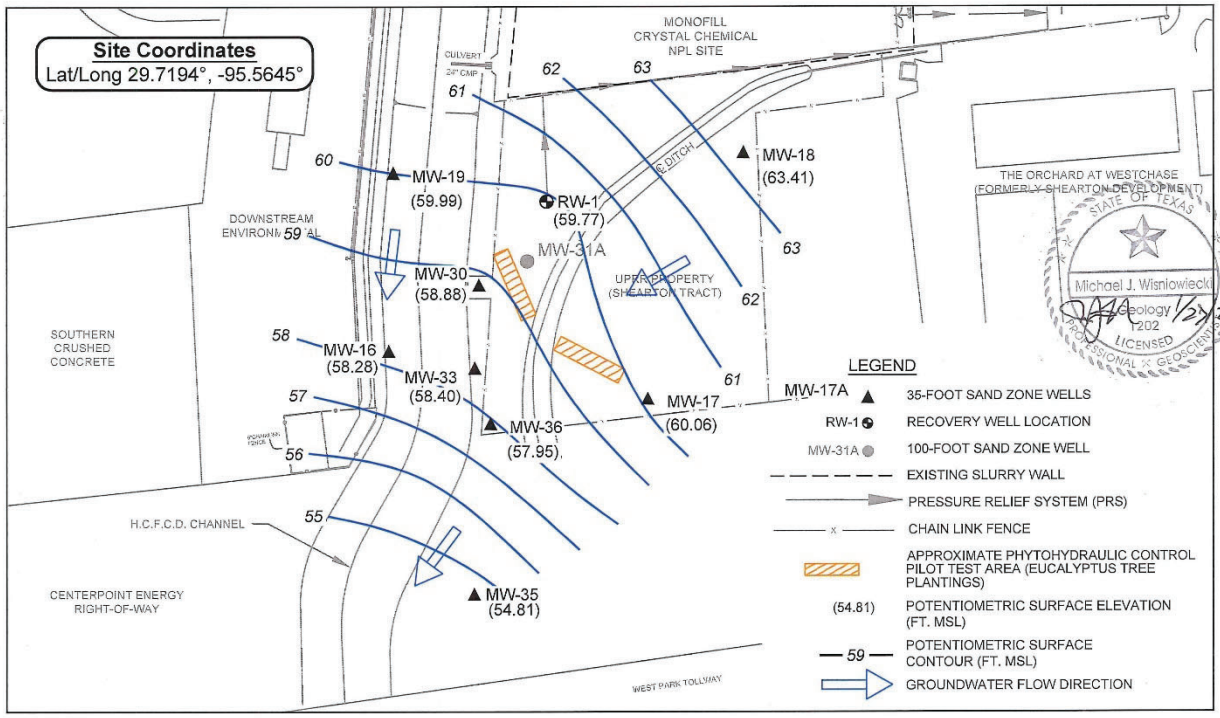
Groundwater treatment plant property

Groundwater treatment plant

Groundwater treatment plant

APPENDIX F – MONITORING DATA


Site Coordinates
Lat/Long 29.7194°, -95.5645°
FORMER RANDALL'S WAREHOUSE
MW-SW8A (52.97)
MW-SW6 (52.51)
MW-SW5 (53.86)
MW-SW3 (54.65)
MW-SW4 (55.50)
CAP BARBELL
12.5 - ACRE TRACT UPRR PROPERTY (FORMER LEVY ESTATE)
H.C.F.C.D. DITCH NO. D124-00-00
COMMERCIAL
WALNUT RENO LANE
WESTPARK DRIVE
MW-28A
MW-SW12 (58.68)
MW-20 (59.23)
MW-21
MW-32A
MW-19
C&J ENERGY SERVICES
EXISTING GWTP SITE UPRR PROPERTY
MW-SW1 (60.36)
MW-SW2 (60.86)
MONOFILL CRYSTAL CHEMICAL NPL SITE
GWTP
MW-18 (62.86)
MW-19 (59.50)
RW-1 (58.72)
DOWNSTREAM ENVIRONMENTAL
MW-30 (57.87)
MW-31A
UPRR PROPERTY (SHEARTON TRACT)
THE ORCHARD AT WESTCHASE (FORMERLY SHEARTON DEVELOPMENT)
SOUTHERN CRUSHED CONCRETE
MW-16 (57.27)
MW-33 (57.42)
MW-36 (57.18)
MW-17 (59.35)
H.C.F.C.D. CHANNEL
CENTERPOINT ENERGY RIGHT-OF-WAY
MW-35 (53.97)
WEST PARK TOLLWAY
LEGEND
MW-19 15-FOOT SAND ZONE WELLS (NOT USED)
MW-SW1 CONTAINMENT SYSTEM WELL (35-FOOT SAND ZONE)
MW-17 35-FOOT SAND ZONE WELLS
RW-1 RECOVERY WELL LOCATION
MW-31A 100-FOOT SAND ZONE WELL (NOT USED)
GWTP GROUNDWATER TREATMENT PLANT
EXISTING SLURRY WALL
SUBSURFACE LEVEE (APPROXIMATE LOCATION)
PRESSURE RELIEF SYSTEM (PRS)
CHAIN LINK FENCE
APPROXIMATE PHYTOHYDRAULIC CONTROL PILOT TEST AREA (EUCALYPTUS TREE PLANTINGS)
(53.97) POTENTIOMETRIC SURFACE ELEVATION (FT. MSL)
57 POTENTIOMETRIC SURFACE CONTOUR (FT. MSL)
GROUNDWATER FLOW DIRECTION
NOTE: ALL WELL TOP OF CASINGS RE-SURVEYED JULY 2018
STATE OF TEXAS
Michael J. Wisniowiecki
Geology
1202
LICENSED
PROFESSIONAL GEOSCIENTIST
0 100 200ft
Coordinate System: STATE PLANE - TEXAS SOUTH CENTRAL
GHD
UNION PACIFIC RAILROAD
10965 WESTPARK DRIVE, HOUSTON, TEXAS
CRYSTAL CHEMICAL NPL SITE
033813-01A
Dec 16, 2019
35-FOOT ZONE POTENTIOMETRIC MAP - NOVEMBER 18, 2019
FIGURE 3
CAD File: I:\CAD\Files\03—\033—\033813-UPRR_Crystal Chem\033813-00(033)\033813-00(033)GN-DL002.dwg



0 50 150ft

Coordinate System:
STATE PLANE -
TEXAS SOUTH CENTRAL

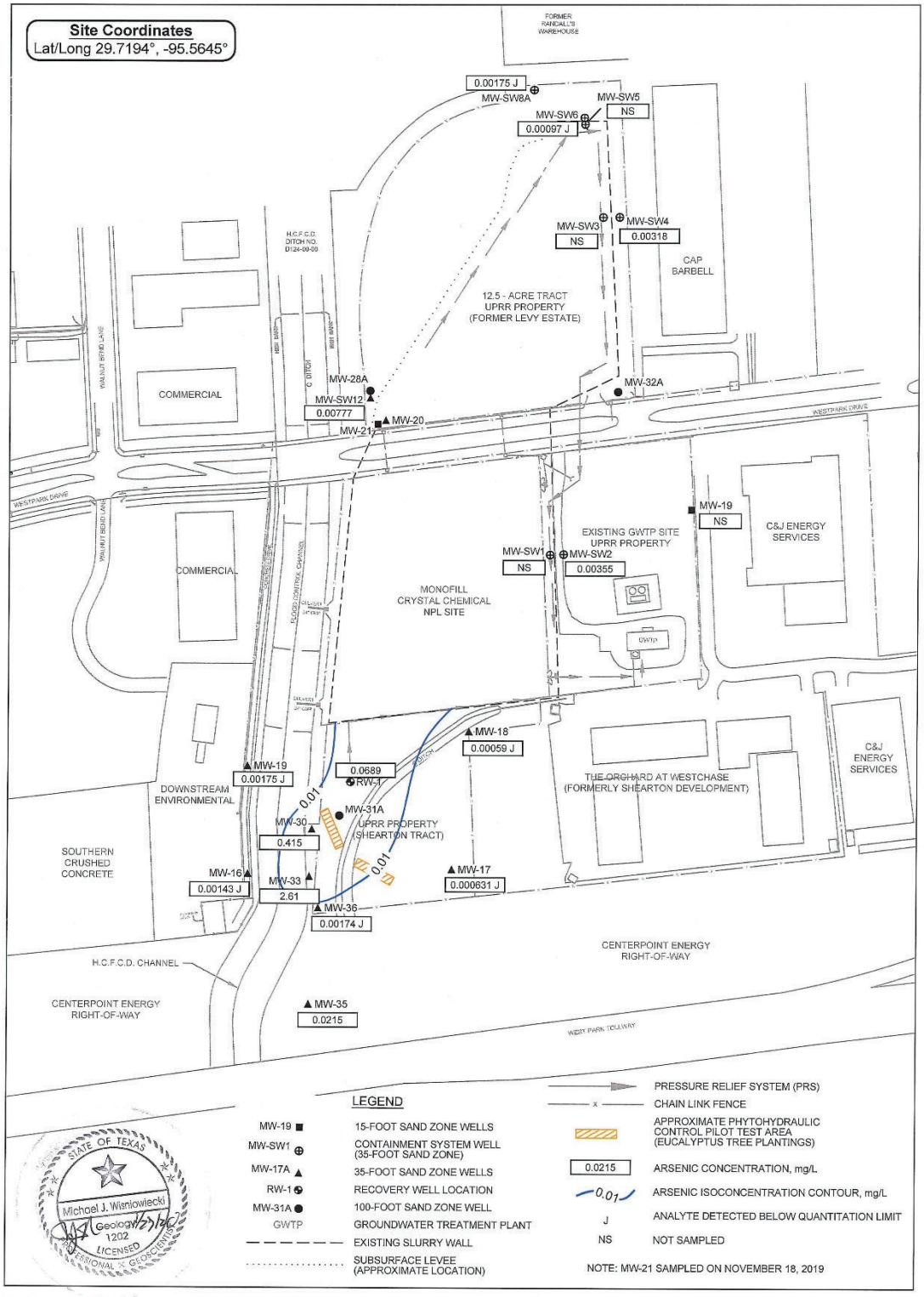
UNION PACIFIC RAILROAD
10965 WESTPARK DRIVE, HOUSTON, TEXAS
CRYSTAL CHEMICAL NPL SITE

033813-01A
Dec 2, 2019

35-FOOT ZONE POTENTIOMETRIC MAP - FEBRUARY 25, 2019
SHEARTON TRACT

FIGURE 3A

CAD File: I:\CAD\Files\03—\033—\033813-UPRR_Crystal Chem\033813-00(033)\033813-01(033)GN-DL004_GG.dwg



UNION PACIFIC RAILROAD
10965 WESTPARK DRIVE, HOUSTON, TEXAS
CRYSTAL CHEMICAL NPL SITE

033813-01A
Dec 4, 2019

ARSENIC CONCENTRATIONS IN 15-FOOT ZONE AND 35-FOOT ZONE GROUNDWATER - NOVEMBER 18, 2019

FIGURE 4

CAD File: I:\CAD\Files\03—\033—\033813-UPRR_Crystal Chem\033813-00(033)\033813-00(033)GN-DL002.dwg

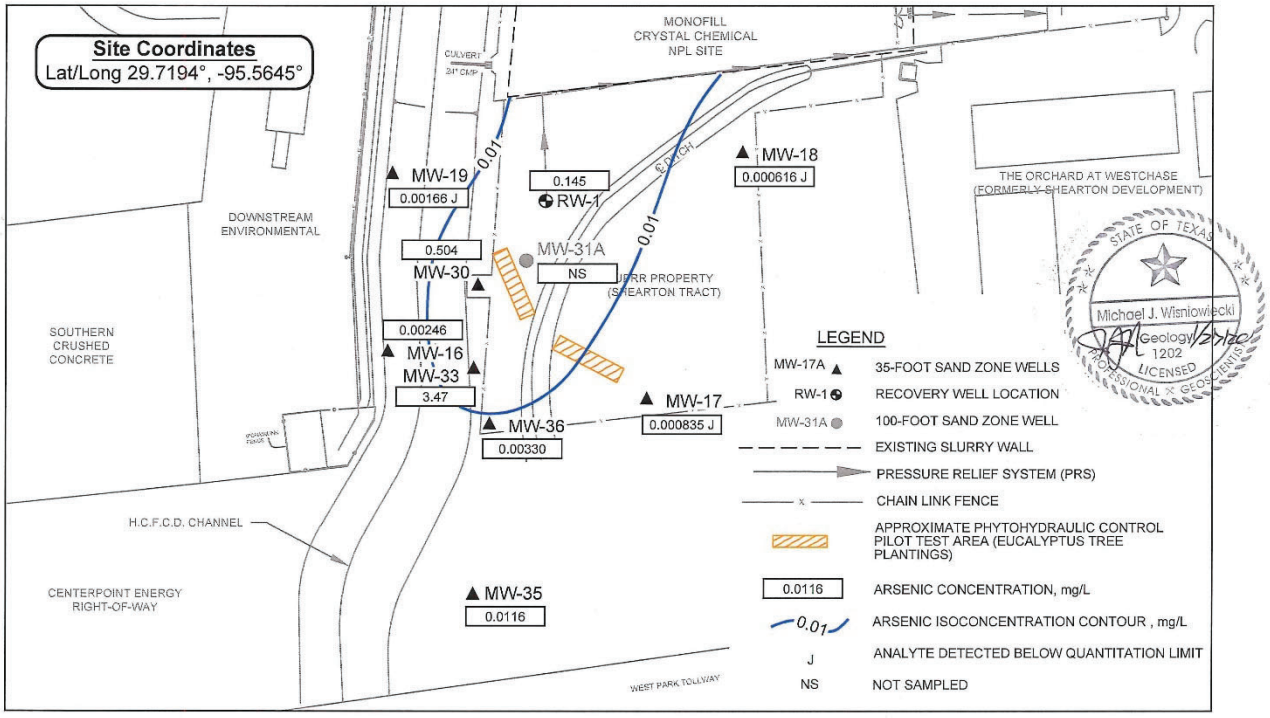

Site Coordinates
Lat/Long 29.7194°, -95.5645°
MONOFILL
CRYSTAL CHEMICAL
NPL SITE
CULVERT
24" CMP
MW-19
0.00166 J
0.01
0.145
RW-1
MW-18
0.000616 J
THE ORCHARD AT WESTCHASE
(FORMERLY SHEARTON DEVELOPMENT)
DOWNSTREAM
ENVIRONMENTAL
0.504
MW-30
MW-31A
NS
UPRR PROPERTY
(SHEARTON TRACT)
SOUTHERN
CRUSHED
CONCRETE
0.00246
MW-16
MW-33
3.47
MW-17
0.000835 J
MW-36
0.00330
H.C.F.C.D. CHANNEL
CENTERPOINT ENERGY
RIGHT-OF-WAY
MW-35
0.0116
WEST PARK TOLLWAY
LEGEND
MW-17A 35-FOOT SAND ZONE WELLS
RW-1 RECOVERY WELL LOCATION
MW-31A 100-FOOT SAND ZONE WELL
EXISTING SLURRY WALL
PRESSURE RELIEF SYSTEM (PRS)
CHAIN LINK FENCE
APPROXIMATE PHYTOHYDRAULIC CONTROL PILOT TEST AREA (EUCALYPTUS TREE PLANTINGS)
0.0116 ARSENIC CONCENTRATION, mg/L
0.01 ARSENIC ISOCONCENTRATION CONTOUR , mg/L
J ANALYTE DETECTED BELOW QUANTITATION LIMIT
NS NOT SAMPLED
STATE OF TEXAS
Michael J. Wisniowiecki
Geology
1202
LICENSED
PROFESSIONAL GEOSCIENTIST
0 50 150ft
Coordinate System:
STATE PLANE -
TEXAS SOUTH CENTRAL
GHD
UNION PACIFIC RAILROAD
10965 WESTPARK DRIVE, HOUSTON, TEXAS
CRYSTAL CHEMICAL NPL SITE
033813-01A
Dec 2, 2019
ARSENIC CONCENTRATIONS IN 35-FOOT ZONE GROUNDWATER
FEBRUARY 25, 2019 - SHEARTON TRACT
FIGURE 4A
CAD File: I:\CAD\Files\03—\033—\033813-UPRR_Crystal Chem\033813-00(033)\033813-01(033)GN-DL004_GG.dwg

Table 6

Cumulative Analytical Results
35-Foot Zone Groundwater Monitor Wells
Crystal Chemical NPL Site, CERCLA VI-15-92
Union Pacific Railroad
Alief (Houston), Texas

Well ID	Date Sampled	Total Arsenic (mg/L)	Remarks
MW-SW1	3/11/2005	0.00675	B
	10/19/2010	0.00829	
	10/16/2015	0.00765	
MW-SW2	12/10/2003	0.0069	B
	3/9/2004	0.0108	
	6/9/2004	<0.0034	
	6/9/2004*	<0.0034	
	9/8/2004	0.0059	B
	9/8/2004*	0.0036	B
	12/2/2004	<0.0034	
	12/2/2004*	<0.0034	
	3/9/2005	<0.0034	
	5/24/2005	0.0030	
	11/15/2005	0.0070	B
	5/31/2006	0.00726	B
	11/1/2006	<0.00324	
	4/4/2007	<0.0031	
	10/11/2007	<0.0031	
	10/14/2008	<0.00328	
	10/16/2009	0.00481	J
	10/19/2010	0.00292	J
	10/14/2011	0.00445	J
	10/1/2012	0.00313	J
	10/11/2013	0.00181	J
	10/17/2014	0.00106	J
	10/16/2015	0.00229	J
	10/24/2016	0.00133	J
	11/1/2017	0.00226	
	11/16/2018	0.00325	
	11/18/2019	0.00355	
MW-SW-3	3/11/2005	0.0171	B
	10/19/2010	0.0179	
	10/16/2015	0.0110	
MW-SW4	12/10/2003	<0.0028	
	3/9/2004	<0.0034	
	6/9/2004	<0.0034	
	9/7/2004	<0.0034	
	12/1/2004	<0.0034	
	3/9/2005	<0.0034	
	5/23/2005	<0.0020	
	11/14/2005	<0.0020	
	5/31/2006	<0.00324	
	10/31/2006	<0.00324	
	4/4/2007	<0.0031	
	10/11/2007	<0.0031	
	10/14/2008	<0.00328	
	10/16/2009	0.00126	J
	10/19/2010	0.00145	J
	10/14/2011	0.00176	J
	10/1/2012	<0.005	
	10/11/2013	<0.0010	
	10/17/2014	<0.0010	
	10/16/2015	0.000985	J
	10/24/2016	0.000921	J
	11/1/2017	0.00126	J
	11/16/2018	0.00236	
	11/18/2019	0.00318	
MW-SW5	3/11/2005	9.05	
	10/19/2010	0.00427	J
	10/16/2015	0.03470	

Table 6

Cumulative Analytical Results
35-Foot Zone Groundwater Monitor Wells
Crystal Chemical NPL Site, CERCLA VI-15-92
Union Pacific Railroad
Alief (Houston), Texas

Well ID	Date Sampled	Total Arsenic (mg/L)	Remarks
MW-SW6	12/10/2003	<0.0028	
	3/9/2004	<0.0034	
	6/9/2004	<0.0034	
	9/7/2004	<0.0034	
	12/1/2004	<0.0034	
	3/10/2005	0.00394	B
	5/23/2005	<0.0020	
	11/14/2005	0.0041	B
	5/31/2006	<0.00324	
	10/31/2006	<0.00324	
	4/5/2007	<0.0031	
	10/11/2007	0.0083	B
	10/14/2008	0.00739	J
	10/16/2009	0.00390	J
	10/16/2009*	0.00393	J
	10/19/2010	0.00753	
	10/14/2011	0.0242	
	10/1/2012	0.00302	J
	10/1/2012*	0.00345	J
	10/11/2013	0.00744	
	10/17/2014	0.00139	J
	10/16/2015	0.00080	J
	10/24/2016	<0.0004	
	11/1/2017	0.00267	
	11/16/2018	0.00283	
	11/18/2019	0.00097	J
MW-SW7	3/10/2005	0.0728	
	10/19/2010	7.88	
	10/16/2015	2.04	
MW-SW8A	12/11/2003	0.0078	B
	3/9/2004	<0.0034	
	6/9/2004	<0.0034	
	9/7/2004	0.0043	B
	12/1/2004	<0.0034	
	3/9/2005	<0.0034	
	5/23/2005	0.0041	B
	11/14/2005	0.0053	B
	5/31/2006	<0.00324	
	11/1/2006	0.00351	B
	4/5/2007	<0.0031	
	10/11/2007	0.0046	B
	10/14/2008	<0.00328	
	10/16/2009	0.00211	J
	10/19/2010	0.00279	J
	10/14/2011	0.00220	J
	10/1/2012	0.00246	J
	10/11/2013	0.00162	J
	10/17/2014	0.00675	
	12/1/2015	0.00735	
	10/24/2016	0.00911	
	11/1/2017 (relocated 7/18/17)	0.00618	
	11/16/2018	0.00279	
	11/18/2019	0.00175	J
MW-SW9	3/10/2005	0.0417	
	10/19/2010	15.1	
	10/16/2015	152	
MW-SW10	12/11/2003	0.0033	B
	3/9/2004	0.0068	B
	6/9/2004	<0.0034	
	9/8/2004	<0.0034	
	12/1/2004	<0.0034	
	3/9/2005	<0.0034	
	5/23/2005	<0.0020	
	11/14/2005	0.0023	B
	5/31/2006	<0.00324	
	11/1/2006	<0.00324	
	4/5/2007	0.00380	B
	10/11/2007	<0.0031	
	10/14/2008	<0.00328	
	10/16/2009	0.00244	J
	10/19/2010	0.00204	J
	10/14/2011	0.00130	J
	10/1/2012	0.00154	J
	10/11/2013	0.00459	J
	10/17/2014	<0.0010	
	10/16/2015	0.00650	
	10/24/2016	0.000618	J

Table 6

Cumulative Analytical Results
35-Foot Zone Groundwater Monitor Wells
Crystal Chemical NPL Site, CERCLA VI-15-92
Union Pacific Railroad
Alief (Houston), Texas

Well ID	Date Sampled	Total Arsenic (mg/L)	Remarks
MW-SW11	3/10/2005	0.0293	
	10/19/2010	0.0672	
	10/16/2015	0.0933	
MW-SW12	12/10/2003	0.0069	B
	3/9/2004*	0.0047	B
	3/9/2004	0.0046	B
	6/9/2004	<0.0034	
	9/8/2004	0.0054	B
	12/1/2004	0.0044	B
	3/9/2005	<0.0034	
	5/23/2005	<0.0020	
	11/14/2005	0.0050	B
	5/31/2006	<0.00324	
	11/1/2006	0.00391	B
	4/5/2007	<0.0031	
	10/11/2007	<0.0031	
	10/14/2008	<0.00328	
	10/16/2009	0.00269	J
	10/19/2010	0.00297	J
	10/14/2011	0.00301	J
	10/1/2012	0.00189	J
	10/11/2013	0.00538	
	10/17/2014	0.00175	J
	10/16/2015	0.00420	J
	10/24/2016	0.00452	J
	11/1/2017 (relocated 7/18/17)	0.0342	
	11/16/2018	0.0124	
	11/18/2019	0.00777	
MW-30	1/27/2010	2.92	
	2/26/2010	0.802	
	3/30/2010	0.472	
	4/24/2010	0.406	
	5/29/2010	0.645	
	6/25/2010	0.981	
	7/31/2010	1.10	
	8/31/2010	0.64	
	9/30/2010	1.10	
	10/19/2010	1.62	
	11/30/2010	1.60	
	12/23/2010	1.54	
	7/20/2012	0.586	
	10/16/2015	0.743	
	10/24/2016	0.638	
	11/1/2017	0.571	
	6/26/2018	0.677	
	8/31/2018	0.834	
	11/16/2018	0.466	
	2/25/2019	0.504	
	11/18/2019	0.415	

Table 6

Cumulative Analytical Results
35-Foot Zone Groundwater Monitor Wells
Crystal Chemical NPL Site, CERCLA VI-15-92
Union Pacific Railroad
Alief (Houston), Texas

Well ID	Date Sampled	Total Arsenic (mg/L)	Remarks
MW-33	12/15/2003	0.872	
	3/9/2004	1.02	
	6/9/2004	0.755	
	9/8/2004	0.83	
	12/1/2004	1.56	
	3/10/2005	<0.0034	
	5/24/2005	0.834	
	11/15/2005	0.701	
	5/31/2006	0.793	
	11/1/2006	0.839	
	4/5/2007	1.78	
	10/11/2007	0.591	
	10/14/2008	0.164	
	10/16/2009	0.114	
	10/19/2010	0.402	
	10/14/2011	0.883	
	7/20/2012	0.116	
	10/1/2012	0.786	
	10/11/2013	0.632	
	10/17/2014	0.466	
	10/16/2015	0.174	
	10/24/2016	0.105	
	11/1/2017	0.792	
	6/26/2018	2.91	
	8/31/2018	4.00	
	11/16/2018	3.71	
	2/25/2019	3.47	
	11/18/2019	2.61	
MW-35	12/6/2017	0.0186	
	6/28/2018	0.0226	
	8/31/2018	0.0622	
	11/16/2018	0.0177	
	2/25/2019	0.0116	
	11/18/2019	0.0215	
MW-36	6/28/2018	0.00388	
	8/31/2018	0.00347	
	11/16/2018	0.00505	
	2/25/2019	0.00330	
	11/18/2019	0.00174	J
TMW-16	12/12/2017	0.00123	J
MW-16	6/28/2018	0.00396	
	8/31/2018	0.00398	
	11/16/2018	0.00313	
	2/25/2019	0.00246	
	11/18/2019	0.00143	J
TMW-17	12/5/2017	0.000524	J
MW-17	6/28/2018	0.001030	J
	8/31/2018	0.000940	J
	11/16/2018	0.00194	J
	2/25/2019	0.00084	J
	11/18/2019	0.000631	J
TMW-18	12/5/2017	0.00142	J
MW-18	6/28/2018	0.00140	J
	8/31/2018	0.00256	
	11/16/2018	0.00206	
	2/25/2019	0.00062	J
	11/18/2019	0.00059	J
TMW-19	12/12/2017	0.00110	J
MW-19	6/28/2018	0.00266	
	8/31/2018	0.00204	
	11/16/2018	0.00295	
	2/25/2019	0.00166	J
	11/18/2019	0.00175	J
RW-1	6/28/2018	0.112	
	8/31/2018	0.246	
	11/16/2018	0.197	
	2/25/2019	0.145	
	11/18/2019	0.0689	

NOTE:
<0.001 = Not Detected at or above the Method Detection Limit (MDL).
B,J - Analyte is an estimated value between the Reporting Limit (RL) and the MDL.
* = Duplicate Sample.

Cumulative Arsenic Analytical Results
100-Foot Zone Monitor Wells
Crystal Chemical NPL Site, CERCLA VI-15-92
Union Pacific Railroad
Alief (Houston), Texas

Well Number ID	Date Sampled	Total Arsenic (mg/L)		Dissolved Arsenic (mg/L)	
MW-28A	9/22/1993	0.006		0.004	
	10/27/1993	0.004		0.004	
	11/18/1993	0.003		0.003	
	12/22/1993	0.010		0.007	
	1/17/1994	0.0068		0.0063	
	2/25/1994	0.002		0.004	
	3/30/1994	0.002		0.004	
	6/21/1994	0.002		0.002	
	9/16/1994	<0.002		0.002	
	12/14/1994	0.678		0.022	
	1/3/1995	0.0355		0.0421	
	1/3/1995	0.035		0.0449	
	1/3/1995	<0.005	P	<0.005	P
	1/3/1995	<0.005	R	<0.005	R
	2/13/1995	0.0081		0.0062	
	3/31/1995	0.0047		0.0048	
	3/31/1995	0.0066	D	NA	
	4/27/1995	0.009		0.0067	
	5/25/1995	0.0042		0.0047	
	7/3/1995	0.0033		0.0036	
	7/28/1995	0.0037		0.0035	
	7/28/1995	0.0037	D	NA	
	9/28/1995	0.0026		0.0021	
	1/18/1995	0.0016		0.0018	
	1/18/1996	0.0016	D	NA	
	4/1/1996	0.0018		0.0018	
	4/1/1996	0.0018	D	NA	
	7/5/1996	0.0014		0.0015	
	7/5/1996	0.0019	D	NA	
	9/19/1996	0.0012		<0.0011	
	9/19/1996	<0.0011	D	NA	
	12/26/1996	<0.0011		<0.0011	
	12/26/1996	0.0012	D	NA	
	3/31/1997	<0.0015		<0.0015	
	3/31/1997	<0.0015	D	NA	
	7/3/1997	0.0015		<0.0015	
	7/3/1997	<0.0015	D	NA	
	10/9/1997	<0.0019		<0.0019	
	12/22/1997	0.0029		<0.0019	
	3/18/1998	<0.0040		<0.0040	
	6/25/1998	<0.0040		<0.0040	
	6/25/1998	<0.0040	D	<0.0040	D
	9/17/1998	0.0020		0.002	
	3/10/1999	0.0014		<0.001	
	9/14/1999	<0.001		<0.002	
	9/18/2000	0.0010		0.0010	

Cumulative Arsenic Analytical Results
100-Foot Zone Monitor Wells
Crystal Chemical NPL Site, CERCLA VI-15-92
Union Pacific Railroad
Alief (Houston), Texas

Well Number ID	Date Sampled	Total Arsenic (mg/L)		Dissolved Arsenic (mg/L)	
MW-28A (Cont'd) (relocated July 2017)	9/25/2001	<0.0013		<0.0013	
	9/25/2001	<0.0013		<0.0013	
	9/19/2002	<0.001		<0.001	
	12/12/2003	0.0033	B	NA	
	12/2/2004	<0.0034		NA	
	11/16/2005	0.0027	B	NA	
	11/2/2006	<0.00324		NA	
	10/11/2007	<0.0031		NA	
	10/14/2008	<0.00328		NA	
	10/16/2009	0.00137	J	NA	
	10/19/2010	0.00174	J	NA	
	10/14/2011	0.0162		NA	
	10/1/2012	0.0102		NA	
	10/11/2013	0.0131		NA	
	10/17/2014	0.0248		NA	
	10/16/2015	0.0685		NA	
	1/20/2016	0.0533		NA	
	10/24/2016	0.0686		NA	
	11/1/2017	0.0163		NA	
	11/16/2018	0.0136		NA	
	11/18/2019	0.00980		NA	
MW-31A	1/19/1994	0.0084		0.0082	
	2/2/1994	0.009		0.008	
	2/24/1994	0.002		0.003	
	3/30/1994	0.004		0.002	
	6/20/1994	0.006		0.003	
	9/14/1994	<0.002		0.002	
	12/14/1994	0.018		0.0014	
	3/31/1995	0.017		0.0015	
	7/3/1995	0.017		<0.0011	
	9/28/1995	0.013		0.002	
	1/18/1996	<0.0011		<0.0011	
	4/1/1996	0.0011		0.0012	
	7/5/1996	0.0012		<0.0011	
	9/26/1996	<0.0011		<0.0011	
	12/27/1996	<0.0011		<0.0011	
	3/31/1997	<0.0015		<0.0015	
	7/3/1997	<0.0015		0.0015	
	10/9/1997	<0.0019		<0.0019	
	12/22/1997	0.0040		<0.0019	
	12/22/1997	<0.0021	D	<0.0019	D
	3/18/1998	<0.0040		<0.0040	
	6/25/1998	<0.0040		<0.0040	
	9/24/1998	0.002		0.001	
	3/10/1999	<0.001		0.0013	
	9/14/1999	<0.001		<0.001	
	9/14/1999	<0.001	D	<0.001	D
	9/18/2000	<0.001		<0.001	
	9/25/2001	<0.0013		<0.0013	
	9/19/2002	<0.001		<0.001	
	9/19/2002	<0.001	D	<0.001	D
	12/15/2003	<0.00311		NA	
	12/3/2004	<0.0034		NA	

Cumulative Arsenic Analytical Results
100-Foot Zone Monitor Wells
Crystal Chemical NPL Site, CERCLA VI-15-92
Union Pacific Railroad
Alief (Houston), Texas

Well Number ID	Date Sampled	Total Arsenic (mg/L)		Dissolved Arsenic (mg/L)	
MW-31A (Cont'd)	11/16/2005	0.0020	B	NA	
	11/2/2006	<0.00324		NA	
	10/11/2007	<0.0031		NA	
	10/14/2008	0.00330	J	NA	
	10/16/2009	0.00241	J	NA	
	10/19/2010	0.0019	J	NA	
	10/14/2011	0.0020	J	NA	
	10/1/2012	<0.0013		NA	
	10/11/2013	0.0012	J	NA	
	10/17/2014	0.0011	J	NA	
	10/16/2015	0.0040	J	NA	
	10/24/2016	0.0010	J	NA	
	11/1/2017	0.00172	J	NA	
	11/16/2018	0.00184	J	NA	
	11/18/2019	0.00163	J	NA	
MW-32	12/20/1993	0.009		0.008	
	1/17/1994	0.014		0.016	
	2/25/1994	0.004		0.005	
	3/30/1994	0.006		0.006	
	6/21/1994	0.003		0.003	
	9/14/1994	0.003		0.002	
	12/12/1994	0.0035		0.0037	
	3/30/1995	0.0014	D	NA	
	3/30/1995	0.0016		0.0013	
	7/3/1995	0.0021		0.0014	
	9/28/1995	0.0022		0.0018	
	9/28/1995	0.0024	D	NA	
	1/18/1996	<0.0011		<0.0011	
	4/1/1996	0.0012		0.0017	
	7/5/1996	0.0022		0.0013	
	9/19/1996	<0.0011		<0.0011	
	12/26/1996	0.0017		<0.0011	
	3/31/1997	0.0016		0.0017	
	7/3/1997	0.0028		0.0015	
	10/9/1997	<0.0019		<0.0019	
	10/9/1997	<0.0019	D	<0.0019	D
	12/22/1997	<0.0021		<0.0019	
	3/18/1998	<0.0040		<0.0040	
	3/18/1998	<0.0040	D	<0.0040	D
	6/25/1998	<0.0040		<0.0040	
	9/17/1998	0.002		0.001	
	9/17/1998	0.002	D	0.002	D
	3/10/1999	0.0014		<0.001	
	3/10/1999	0.0017	D	<0.001	
	9/18/2000	0.001		0.001	
	9/18/2000	0.001		0.001	
	9/25/2001	<0.0013		<0.0013	
	9/19/2002	<0.001		<0.001	
	12/12/2003	<0.0028		NA	
	12/3/2004	0.327		NA	

Table 8

Cumulative Arsenic Analytical Results
100-Foot Zone Monitor Wells
Crystal Chemical NPL Site, CERCLA VI-15-92
Union Pacific Railroad
Alief (Houston), Texas

Well Number ID	Date Sampled	Total Arsenic (mg/L)		Dissolved Arsenic (mg/L)
MW-32A*	5/24/2005	0.0052	B	NA
	11/16/2005	0.0091	B	NA
	11/2/2006	0.00456	B	NA
	10/11/2007	0.00360	B	NA
	10/14/2008	<0.00328		NA
	10/16/2009	0.00407	J	NA
	10/19/2010	0.00366	J	NA
	10/14/2011	0.00408	J	NA
	10/1/2012	0.00305	J	NA
	10/11/2013	0.00223	J	NA
	10/17/2014	0.00319	J	NA
	10/16/2015	0.00464	J	NA
	10/24/2016	0.00279	J	NA
	11/1/2017	0.00502		NA
	11/16/2018	0.00658		NA
	11/18/2019	0.00460		NA

NOTES: D = Blind Duplicate Analysis P = Primary Split Sample.
NA = Not Analyzed R = Replicate Split Sample.
<0.001 = *Not Detected* at the Method Detection Limit (MDL).
B, J = estimated value between reporting limit and MDL.
* - MW-32 P&A'd April 2005, replaced by MW-32A.

APPENDIX G – INTERVIEW FORMS

Site Name: Crystal Chemical Co.	
EPA ID:	
Interviewer name: Ashley Howard	**Interviewer affiliation: EPA**
Subject name: Chris Siegel	**Subject affiliation: TCEQ**
Subject contact information: 832-	
Interview date: 7/10/2020	**Interview time: 11:00 a.m.**
Interview location: Online	
Interview format (circle one): In Person Phone Mail Email Other:	
Interview category: State Agency	

1. What is your overall impression of the project, including cleanup, maintenance and reuse activities (as appropriate)? *Overall, the project will meet cleanup goals and will be ready for reuse once groundwater assessment is complete and adequate Texas Risk Reduction Rules (TRRP) compliant institutional controls are in place. The arsenic in groundwater needs additional delineation to the south in the 35-foot groundwater-bearing unit (GWBU), additional delineation north of the levee on the Levy Tract in the 35-foot GWBU, and delineation in the 100-foot GWBU as the distance between monitoring wells is too great to define the extent of the plume. Once TRRP-compliant institutional controls are in place, the site will require maintenance (including groundwater monitoring) to ensure they remain effective.*

2. What is your assessment of the current performance of the remedy in place at the Site? *Overall, the site does not appear to have actual or probable exposures to receptors, but the arsenic in groundwater needs additional delineation to the south and north in the 35-foot GWBU and also in the 100-foot GWBU.*

3. Are you aware of any complaints or inquiries regarding site-related environmental issues or remedial activities from residents in the past five years? *No.*

4. Has your office conducted any site-related activities or communications in the past five years? If so, please describe the purpose and results of these activities. *The TCEQ has provided regulatory support to the EPA for the past 5 years including report reviews and site visits.*

5. Are you aware of any changes to state laws that might affect the protectiveness of the Site's remedy? *The state uses the current Maximum Contaminant Level for arsenic in groundwater as the protective concentration level. The Record of Decision needs to be modified to use the current Maximum Contaminant Level.*

6. Are you comfortable with the status of the institutional controls at the Site? If not, what are the associated outstanding issues? *No, groundwater in the 35-foot and 100-foot GWBUs needs to be delineated to determine the extent of groundwater contamination such that proper institutional controls can be put in place to restrict groundwater use.*

7. Are you aware of any changes in projected land use(s) at the Site? *The Union Pacific Railroad is intending to lease the Levy Tract.*

8. Do you have any comments, suggestions or recommendations regarding the management or operation of the Site's remedy? *The arsenic in groundwater needs additional delineation to the south and north in the*

35-foot GWBU and also in the 100-foot GWBU. Once delineation is complete, institutional controls should be put in place to prevent future use of affected groundwater.

9. Do you consent to have your name included along with your responses to this questionnaire in the FYR report? *Yes*

Site Name: Crystal Chemical Co.	
EPA ID: TXD990707010	
Interviewer name: Ashley Howard	**Interviewer affiliation: U.S. EPA**
Subject name: Brian Carter	**Subject affiliation: GHD Services, Inc.**
Subject contact information: 225-296-6557	
Interview date: No Interview (sent via email)	**Interview time:**
Interview location: N/A	
Interview format (circle one): In Person Phone Mail Email Other:	
Interview category: O&M Contractor	

UPRR's O&M Contractor, GHD, completed this "FIVE-YEAR REVIEW INTERVIEW FORM" at the request of the USEPA. The five year review site visit was conducted on December 4, 2019. USEPA provided this this form to UPRR and GHD on July 27, 2020 to voluntarily fill out based upon their general knowledge of the site.

1. What is your overall impression of the project, including cleanup, maintenance and reuse activities (as appropriate)?

The Site has progressed on evaluation of groundwater flow and control, with further evaluation of Site conditions underway to evaluate control of affected groundwater within the site boundaries. Obtaining deed restrictions and TCEQ Municipal Settings Designation (MSD) of affected groundwater also removes potential groundwater ingestion concerns. The Site has been properly maintained and UPRR timely addresses any issues that arise.

2. What is your assessment of the current performance of the remedy in place at the Site?

The Cap is effective in eliminating human contact with soil. UPRR is preparing an evaluation of the effectiveness of the slurry wall as a remedy.

3. What are the findings from the monitoring data? What are the key trends in contaminant levels that are being documented over time at the Site?

UPRR has significantly reduced overall arsenic concentrations in the shallow groundwater and continues to evaluate fluctuations in both the 35-foot and 100-foot zones.

4. Is there a continuous on-site O&M presence? If so, please describe staff responsibilities and activities. Alternatively, please describe staff responsibilities and the frequency of site inspections and activities if there is not a continuous on-site O&M presence.

GHD currently inspects the site weekly due to the soil and groundwater assessment occurring at the Site as well as waste removal activities at the Groundwater Treatment Plant until the work is complete. Otherwise, GHD inspects the Site at least twice annually, but typically with more frequent inspections in the summer months to monitor plant growth and cap conditions.

Routine communications and activities conducted by GHD include annual site inspections of the Pressure Relief System (PRS), slurry wall and monofill cap; submission of Quarterly Progress Reports summarizing site activities, submission of Annual Remedial Action Reports, coordination and site visits with EPA and TCEQ representatives regarding site issues.

5. Have there been any significant changes in site O&M requirements, maintenance schedules or sampling routines since start-up or in the last five years? If so, do they affect the protectiveness or effectiveness of the remedy? Please describe changes and impacts.

None.

6. Have there been unexpected O&M difficulties or costs at the Site since start-up or in the last five years? If so, please provide details.

None.

7. Have there been opportunities to optimize O&M activities or sampling efforts? Please describe changes and any resulting or desired cost savings or improved efficiencies.

N/A

8. Do you have any comments, suggestions or recommendations regarding O&M activities and schedules at the Site?

None.

9. Do you consent to have your name included along with your responses to this questionnaire in the FYR report?

Yes.