

DOCUMENTATION OF ENVIRONMENTAL INDICATOR DETERMINATION

Interim Final 2/5/99

RCRA Corrective Action**Environmental Indicator (EI) RCRIS code (CA725)****Current Human Exposures Under Control**

Facility Name: Former Cities Service Refinery
Facility Address: 2500 Rear East Chicago Avenue, East Chicago, Indiana
Facility EPA ID #: INR 000 123 927

1. Has **all** available relevant/significant information on known and reasonably suspected releases to soil, groundwater, surface water/sediments, and air, subject to RCRA Corrective Action (e.g., from Solid Waste Management Units (SWMU), Regulated Units (RU), and Areas of Concern (AOC)), been **considered** in this EI determination?

 X If yes - check here and continue with #2 below.
 If no - re-evaluate existing data, or
 If data are not available skip to #6 and enter "IN" (more information needed) status code.

BACKGROUND**Definition of Environmental Indicators (for the RCRA Corrective Action)**

Environmental Indicators (EI) are measures being used by the RCRA Corrective Action program to go beyond programmatic activity measures (e.g., reports received and approved, etc.) to track changes in the quality of the environment. The two EIs developed to-date indicate the quality of the environment in relation to current human exposures to contamination and the migration of contaminated groundwater. An EI for non-human (ecological) receptors is intended to be developed in the future.

Definition of "Current Human Exposures Under Control" EI

A positive "Current Human Exposures Under Control" EI determination ("YE" status code) indicates that there are no "unacceptable" human exposures to "contamination" (i.e., contaminants in concentrations in excess of appropriate risk-based levels) that can be reasonably expected under current land - and groundwater-use conditions (for all "contamination" subject to RCRA corrective action at or from the identified facility (i.e., site-wide)).

Relationship of EI to Final Remedies

While Final remedies remain the long-term objective of the RCRA Corrective Action program the EIs are near-term objectives which are currently being used as Program measures for the Government Performance and Results Act of 1993, GPRA). The "Current Human Exposures Under Control" EI are for reasonably expected human exposures under current land- and groundwater-use conditions ONLY, and do not consider potential future land- or groundwater-use conditions or ecological receptors. The RCRA Corrective Action program's overall mission to protect human health and the environment requires that Final remedies address these issues (i.e., potential future human exposure scenarios, future land and groundwater uses, and ecological receptors).

Duration/Applicability of EI Determinations

EI Determinations status codes should remain in RCRIS national database ONLY as long as they remain true (i.e., RCRIS status codes must be changed when the regulatory authorities become aware of contrary information).

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2. Are groundwater, soil, surface water, sediments, or air **media** known or reasonably suspected to be “contaminated”¹ above appropriately protective risk-based “levels” (applicable promulgated standards, as well as other appropriate standards, guidelines, guidance, or criteria) from releases subject to RCRA Corrective Action (from SWMUs, RUs or AOCs)?

	<u>Yes</u>	<u>No</u>	<u>?</u>	<u>Rationale / Key Contaminants</u>
Groundwater	X			Metals, SVOCs, VOCs
Air (indoors) ²		X		
Surface Soil (e.g., <2 ft)	X			TPH
Surface Water		X		
Sediment		X		
Subsurface. Soil (e.g., >2 ft)		X		
Air (outdoors)		X		

_____ If no (for all media) - skip to #6, and enter “YE,” status code after providing or citing appropriate “levels,” and referencing sufficient supporting documentation demonstrating that these “levels” are not exceeded

X If yes (for any media) - continue after identifying key contaminants in each “contaminated” medium, citing appropriate “levels” (or provide an explanation for the determination that the medium could pose an unacceptable risk), and referencing supporting documentation.

_____ If unknown (for any media) - skip to #6 and enter “IN” status code.

Rationale and Reference(s):

“Contamination” has been identified through comparison of the RFI soil and groundwater characterization data with conservative risk-based screening levels, as shown in Table 5.1a (perimeter soil), Table 5.1b (interior soil), Table 5.2a (perimeter groundwater), and Table 5.2b (interior groundwater) of the RFI Report.

Data for this EI includes RFI soil and groundwater data collected between July 2020 and August 2021, supplemental groundwater data collected between August 2021 and June 2023, and six additional soil samples collected to support a Light Non-Aqueous Phase Liquid (LNAPL) Degradation Pilot Study.

As discussed in Section 4 of the RFI Report, the screening levels are based on a combination of the 2019 Indiana Department of Environmental Management (IDEM) screening levels and United States Environmental Protection Agency (EPA) Maximum Contaminant Levels (MCLs), in accordance with the Site’s Corrective Action Framework (CAF). Perimeter sample results were initially screened using residential criteria to identify the potential for off-Site migration. Sample locations that are internal to the property were screened using industrial screening levels, because

Footnotes:

¹ “Contamination” and “contaminated” describes media containing contaminants (in any form, NAPL and/or dissolved, vapors, or solids, that are subject to RCRA) in concentrations in excess of appropriately protective risk-based “levels” (for the media, that identify risks within the acceptable risk range).

² Recent evidence (from the Colorado Dept. of Public Health and Environment, and others) suggest that unacceptable indoor air concentrations are more common in structures above groundwater with volatile contaminants than previously believed. This is a rapidly developing field and reviewers are encouraged to look to the latest guidance for the appropriate methods and scale of demonstration necessary to be reasonably certain that indoor air (in structures located above (and adjacent to) groundwater with volatile contaminants) does not present unacceptable risks.

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the current use of the property is commercial/industrial.

Soil results (surface and subsurface) were evaluated as either perimeter or interior samples. In accordance with the CAF, perimeter soil sample results were compared to the following screening levels:

- IDEM, 2019 Screening Level Table A-6, Direct Contact Soil Exposure, Residential
- IDEM, 2019 Screening Level Table A-6, Direct Contact Soil Exposure, Commercial/Industrial

In accordance with the CAF, interior soil sample results were compared to the following screening levels:

- IDEM, 2019 Screening Level Table A-6, Direct Contact Soil Exposure, Commercial/Industrial

Surface soil results collected as part of the LNAPL Degradation Pilot Study were compared to the EPA regional screening level (RSL) for Total Petroleum Hydrocarbons (TPH), aromatic high TPH that is protective of commercial/industrial direct contact, consistent with other interior locations.

Groundwater results were similarly evaluated as either perimeter or interior samples. In accordance with the CAF, perimeter groundwater sample results were compared to the following screening levels:

- EPA Drinking Water MCL or, if an MCL was not available the IDEM 2019 Screening Levels Table A-6, Groundwater, Tap, Residential
- IDEM, 2019 Screening Level Table A-6, Vapor Exposure, Groundwater, Residential (protective of vapor intrusion from groundwater)
- IDEM, 2019 Screening Level Table A-6, Vapor Exposure, Groundwater, Commercial/Industrial (protective of vapor intrusion from groundwater)

In accordance with the CAF, interior groundwater sample results were compared to the following screening levels:

- IDEM, 2019 Screening Level Table A-6, Vapor Exposure, Groundwater, Commercial/Industrial (protective of vapor intrusion from groundwater)

The perimeter locations defined in the RFI are as follows: GSH-MW01-20, GSH-MW03-20, GSH-MW05-20, GSH-MW06-20, GSH-MW10-20, and GSH-MW12-20. The interior locations defined in the RFI are as follows: GSH-MW02-20, GSH-MW04-20, GSH-MW07-20, GSH-MW08-20, GSH-MW09-20, GSH-MW11-20, and GSH-MW13-20.

Oil-stained soils have been observed in discrete intermittent areas on the interior of the property. OXY submitted a work plan to complete a LNAPL degradation pilot study on October 31, 2021. EPA approved the work plan via email on May 16, 2022. The purpose of the pilot study was to evaluate the potential effectiveness of a commercial product known as FFT to accelerate the biodegradation of hydrocarbons. Pre-study and post-study soil samples were collected and analyzed for TPH to assess the effectiveness of the FFT. The results of the pilot study were that the application of FFT on surface soil staining may not be viable at this site. It was determined that FFT was not viable because a decrease in TPH concentrations was not measured between pre- and post-treatment. A letter summarizing the methodology and results of the pilot study was submitted to EPA on January 18, 2023.

In response to EPA's comments on the RFI Report, OXY submitted a proposed work plan on September 30, 2022, to install two off-Site monitoring wells (GSH-MW16-22 and GSH-MW17-22) to delineate potential impacts beyond GSH-MW06-20 and confirm groundwater flow. The work plan also included one on-Site monitoring well (GSH-MW14-22) and one monitoring well on the southwestern perimeter of the property (GSH-MW15-22) to verify current benzene concentrations in the area surrounding GSH-MW06-20. EPA approved the work plan on October 27, 2022, and the wells were installed on November 9, 2022. Based on initial data from GSH-MW15-22, OXY submitted a work plan on December 22, 2022, proposing the installation of one additional off-Site monitoring well (GSH-MW18-23) to delineate potential impacts beyond GSH-MW15-22 (similar to the rationale for the installation of GSH-MW16-22 and GSH-MW17-22). EPA approved the work plan on December 23, 2023, and GSH-MW18-23 was installed on February 14, 2023.

The perimeter and interior soil sampling results were compared to the above screening levels and are presented in the RFI Report in Table 5.1a and Table 5.1b, respectively. There were no soil concentrations of chemicals at either the perimeter or interior of the Site that exceeded their respective screening levels.

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The soil samples collected in May and June 2022 to support the LNAPL degradation study were analyzed for TPH and compared to an RSL of 220 milligrams per kilogram (mg/kg). These samples from the interior of the Site exceeded the screening levels for TPH. However, these samples were collected from a visible stained area of approximately 400 square feet, which is interior to the property.

Groundwater sampling was completed as part of the RFI in August 2020, November 2020, March 2021, and June 2021. Perimeter and interior groundwater results were compared to the above screening levels and are presented in the RFI Report in Table 5.2a and Table 5.2b, respectively. Supplemental groundwater data was collected over eight quarterly events and two additional targeted sampling events, associated with additional well installations, between August 2021 and June 2023. Supplemental groundwater data was screened similarly and submitted in the quarterly progress reports. Groundwater concentrations that exceed the screening levels and therefore meet the definition of contamination are shown in the tables. Five metals (arsenic, cobalt, iron, manganese, and thallium), two semi-volatile organic compounds (SVOCs) (2-methylnaphthalene and naphthalene), and two volatile organic compounds (VOCs) (benzene and methylene chloride) exceeded the residential groundwater screening levels at the perimeter of the property. These constituents exceeded the residential screening levels at the southwestern property boundary. Currently, there are no drinking water wells in the vicinity of the monitor wells in these areas. One SVOC (naphthalene) and one VOC (benzene) exceeded the commercial/industrial groundwater screening levels at the interior of the property. These exceedances are bounded by additional wells to the south, southwest, and west where the concentrations did not exceed commercial/industrial screening levels.

Benzene concentrations in groundwater exceeded the IDEM Commercial/Industrial Vapor Value of 120 micrograms per liter (ug/L) at four interior wells and the EPA Drinking Water MCL of 5 ug/L at two perimeter wells at the southwestern property boundary. In the interior, the results have been consistent through the quarterly RFI and post-RFI sampling events, with the exception of the sample collected in June 2021 (fourth quarterly event) from GSH-MW11-20 which had elevated concentrations of benzene, compared to previous sampling results. A re-sampling was conducted in August 2021 and analyzed for TCL VOCs. The results of the re-sample confirmed that the fourth quarterly event result was anomalous, and, through a further review of the results, it appears likely related to elevated total suspended solids (TSS) levels. At perimeter well GSH-MW06-20 on the southwestern property boundary adjacent to Gary Road, groundwater exceeded the EPA Drink Water MCL for benzene, but concentrations have been consistent through the quarterly RFI and post-RFI sampling events. As discussed in Section 3.5 of the RFI Report, groundwater flow radiates outwards from the center of the Site towards Gary Road. Three additional monitoring wells were installed downgradient of GSH-MW06-20 on the south side of Gary Road to delineate benzene: monitoring wells GSH-MW16-22, GSH-MW17-22, and GSH-MW18-23. The results for groundwater samples collected from these wells confirmed that benzene concentrations did not exceed screening levels and therefore are not crossing Gary Road. The exceedances of the other constituents at the perimeter of the property were generally less than twice the screening levels, except for those at GSH-MW06-20. The three wells downgradient of GSH-MW06-20 had no SVOC or VOC concentrations that exceeded the screening levels with the exception of a minor exceedance of screening levels for naphthalene at GSH-MW18-23, demonstrating that impacts do not cross Gary Road. There are also no drinking wells within one mile of the Site nor residential properties immediately downgradient of contaminated groundwater, so contaminated groundwater is not expected to impact off-Site residents.

In addition, a statistical evaluation was completed on the 12 rounds of groundwater data for parameters that exceeded the EPA MCL/IDEM-Tap (protective of drinking water), IDEM-Vapor-residential (protective of vapor intrusion), and/or IDEM-Vapor-commercial/industrial (protective of vapor intrusion) screening level in at least one sample. The evaluation was performed using the Mann-Kendall Trend Test, and the magnitude of any statistically significant trends identified was described by computation of Sen's Slope. Statistical trend analyses of parameter concentrations over time for facility related constituents (SVOCs and VOCs), where conducted, show that concentrations are stable or decreasing. The statistical evaluation is to be presented in the Corrective Measures Proposal (CMP).

LNAPL was not observed in any of the monitoring wells but has been observed in six sewer system infrastructure manholes during routine inspections at locations MH-28, MH-43, MH-48, MH-96, MH-99, and MH-117. If LNAPL migrates through the Industrial Sewer System, it is treated through CITGO's oil-water separator and monitored via

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the conditions of the associated National Pollution Discharge Elimination System (NPDES) permit.

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3. Are there **complete pathways** between “contamination” and human receptors such that exposures can be reasonably expected under the current (land- and groundwater-use) conditions?

Summary Exposure Pathway Evaluation Table

Potential **Human Receptors** (Under Current Conditions)

“Contaminated” Media	Residents	Workers	Day-Care	Construction	Trespassers	Recreation	Food ³
Groundwater	<u>No</u>	<u>Yes</u>	<u>No</u>	<u>Yes</u>			<u>No</u>
Air (indoors)	<u>--</u>	<u>--</u>	<u>--</u>				
Soil (surface, e.g., <2 ft)	<u>No</u>	<u>Yes</u>	<u>No</u>	<u>Yes</u>	<u>Yes</u>	<u>No</u>	<u>No</u>
Surface Water	<u>--</u>	<u>--</u>			<u>--</u>	<u>--</u>	<u>--</u>
Sediment	<u>--</u>	<u>--</u>			<u>--</u>	<u>--</u>	<u>--</u>
Soil (subsurface e.g., >2 ft)				<u>--</u>			<u>--</u>
Air (outdoors)	<u>--</u>	<u>--</u>	<u>--</u>	<u>--</u>	<u>--</u>		

Instructions for Summary Exposure Pathway Evaluation Table:

1. Strike-out specific Media including Human Receptors’ spaces for Media which are not “contaminated” as identified in #2 above.
2. enter “yes” or “no” for potential “completeness” under each “Contaminated” Media -- Human Receptor combination (Pathway).

Note: In order to focus the evaluation to the most probable combinations some potential “Contaminated” Media - Human Receptor combinations (Pathways) do not have check spaces (“___”). While these combinations may not be probable in most situations they may be possible in some settings and should be added as necessary.

_____ If no (pathways are not complete for any contaminated media-receptor combination) - skip to #6, and enter “YE” status code, after explaining and/or referencing condition(s) in-place, whether natural or man-made, preventing a complete exposure pathway from each contaminated medium (e.g., use optional Pathway Evaluation Work Sheet to analyze major pathways).

 X If yes (pathways are complete for any “Contaminated” Media - Human Receptor combination) - continue after providing supporting explanation.

_____ If unknown (for any “Contaminated” Media - Human Receptor combination) - skip to #6 and enter “IN” status code.

Rationale and Reference(s):

Soil

Complete potential exposure pathways:

- Incidental ingestion, dermal contact, and outdoor inhalation of vapor and particulates by routine workers, maintenance workers, construction workers, and trespassers

Incomplete potential exposure pathways (not carried forward):

- Vapor intrusion by routine workers was not considered a complete pathway because there are no buildings on-Site.

³ Indirect Pathway/Receptor (e.g., vegetables, fruits, crops, meat and dairy products, fish, shellfish, etc.)

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Groundwater

Complete potential exposure pathways:

- Incidental ingestion and dermal contact by maintenance workers and construction workers
- Inhalation of vapor outdoors by routine workers, maintenance workers, construction workers, and trespassers

Incomplete potential exposure pathways (not carried forward):

- Vapor intrusion by routine workers was not considered a complete pathway because there were no buildings on-Site.
- Potable and non-potable water use by routine workers were not considered complete pathways because the groundwater is not currently used, and institutional controls will be established as part of corrective measures to prevent exposure for on-Site routine workers. Additionally, there are also no drinking wells within one mile of the Site nor residential properties immediately downgradient of the groundwater contaminated with VOCs and SVOCs, so contaminated groundwater is not expected to impact off-Site residents.

Note, as presented in the CAF, no ecologically relevant habitat is present at the Former Cities Services Refinery; therefore, no ecological risk assessment was completed.

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4. Can the **exposures** from any of the complete pathways identified in #3 be reasonably expected to be **“significant”**⁴ (i.e., potentially “unacceptable” because exposures can be reasonably expected to be: 1) greater in magnitude (intensity, frequency and/or duration) than assumed in the derivation of the acceptable “levels” (used to identify the “contamination”); or 2) the combination of exposure magnitude (perhaps even though low) and contaminant concentrations (which may be substantially above the acceptable “levels”) could result in greater than acceptable risks)?

 X If no (exposures cannot be reasonably expected to be significant (i.e., potentially “unacceptable”) for any complete exposure pathway) - skip to #6 and enter “YE” status code after explaining and/or referencing documentation justifying why the exposures (from each of the complete pathways) to “contamination” (identified in #3) are not expected to be “significant.”

 If yes (exposures could be reasonably expected to be “significant” (i.e., potentially “unacceptable”) for any complete exposure pathway) - continue after providing a description (of each potentially “unacceptable” exposure pathway) and explaining and/or referencing documentation justifying why the exposures (from each of the remaining complete pathways) to “contamination” (identified in #3) are not expected to be “significant.”

 If unknown (for any complete pathway) - skip to #6 and enter “IN” status code

Rationale and Reference(s):

Soil exposures

As discussed above in Question 2, TPH in surface soil samples collected as part of the LNAPL Degradation Pilot Study exceeded the EPA RSL for TPH, aromatic high TPH that is protective of commercial/industrial direct contact, consistent with other interior locations. However, the hazardous constituents in TPH (VOCs and SVOCs) were analyzed in the vicinity of this 400 square foot area. Cumulative cancer risk and hazard index (HI) estimates were calculated for potential reasonable maximum exposure (RME) to hazardous constituents detected in soil in the risk assessment in the RFI (Section 6). In the risk assessment, the routine workers were conservatively used as a surrogate for trespassers because trespassers have lower exposure than routine workers. As shown in Appendix J of the RFI Report and below, the upper-bound cumulative cancer risk and HI estimates meet EPA’s RME limits. Thus, it is assumed that risk calculations for hazardous constituents in this TPH would result in cumulative cancer risk and HI estimates that meet EPA’s RME limits.

Risk and HI Values for Exposure to Soil:

	Risk	HI
Routine Workers	4 x 10 ⁻⁶	0.1
Maintenance Workers	3 x 10 ⁻⁷	0.07
Construction Workers	7 x 10 ⁻⁷	0.6

Groundwater exposures

Cumulative cancer risk and HI estimates were also calculated for potential RME to groundwater. As shown in Appendix J of the RFI Report and below, none of the receptor populations had an upper-bound cumulative cancer risk or HI that exceeded EPA’s RME limits. Inhalation of vapor was not included in calculations for routine workers or trespassers. Maintenance workers and construction workers act as conservative surrogates for these receptors for

⁴ If there is any question on whether the identified exposures are “significant” (i.e., potentially “unacceptable”) consult a human health Risk Assessment specialist with appropriate education, training and experience.

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the inhalation of vapor outdoor exposure pathway because they are only exposed to the ground surface while maintenance and construction workers are exposed beneath the surface (closer to groundwater). In addition, benzene and methylene chloride are the only VOCs detected above screening levels in groundwater so vapor emission into outdoor air would be minimal for routine workers, trespassers, and off-Site residents.

Risk and HI Values for Exposure to Groundwater:

	Risk	HI
Maintenance Workers	2×10^{-6}	1×10^{-1}
Construction Workers	2×10^{-7}	9×10^{-2}

Because the risk and HI estimates for all exposure pathways are below the EPA's RME limits, no corrective measures, other than the institutional controls discussed in Section 3.8 of the RFI Report, are warranted.

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5. Can the “significant” **exposures** (identified in #4) be shown to be within **acceptable** limits?

_____ If yes (all “significant” exposures have been shown to be within acceptable limits) - continue and enter “YE” after summarizing and referencing documentation justifying why all “significant” exposures to “contamination” are within acceptable limits (e.g., a site-specific Human Health Risk Assessment).

_____ If no (there are current exposures that can be reasonably expected to be “unacceptable”)- continue and enter “NO” status code after providing a description of each potentially “unacceptable” exposure.

_____ If unknown (for any potentially “unacceptable” exposure) - continue and enter “IN” status code

Rationale and Reference(s):

Skipped because of answer to Question 4

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6. Check the appropriate RCRIS status codes for the Current Human Exposures Under Control EI event code (CA725), and obtain Supervisor (or appropriate Manager) signature and date on the EI determination below (and attach appropriate supporting documentation as well as a map of the facility):

 YE YE - Yes, "Current Human Exposures Under Control" has been verified. Based on a review of the information contained in this EI Determination, "Current Human Exposures" are expected to be "Under Control" at the **Former Cities Service Refinery** facility, EPA ID # **INR 000 123 927** (formerly part of IND 095 267 381), located at **2500 Rear East Chicago Avenue, East Chicago, Indiana** under current and reasonably expected conditions. This determination will be re-evaluated when the Agency/State becomes aware of significant changes at the facility.

 NO - "Current Human Exposures" are NOT "Under Control."

 IN - More information is needed to make a determination.

Completed by (signature) _____ Date _____
 (print) _____
 (title) _____

Supervisor (signature) _____ Date _____
 (print) _____
 (title) _____
 (EPA Region or State) _____

Locations where References may be found:

RCRA Facility Investigation Report – October 1, 2021
LNAPL Degradation Pilot Study Results Summary - January 18, 2023
Quarterly Progress Report – Q4-2022 – January 13, 2023 (additional well installation results)
Quarterly Progress Report – Q1-2023 – April 12, 2023 (additional well installation results)
Quarterly Progress Report – Q2-2023 – July 14, 2023 (additional well installation results)

Contact telephone and e-mail numbers

(name) _____
(phone #) _____
(e-mail) _____

FINAL NOTE: THE HUMAN EXPOSURES EI IS A QUALITATIVE SCREENING OF EXPOSURES AND THE DETERMINATIONS WITHIN THIS DOCUMENT SHOULD NOT BE USED AS THE SOLE BASIS FOR RESTRICTING THE SCOPE OF MORE DETAILED (E.G., SITE-SPECIFIC) ASSESSMENTS OF RISK.