

**DOCUMENTATION OF ENVIRONMENTAL INDICATOR DETERMINATION**

Interim Final 2/5/99

**RCRA Corrective Action**

**Environmental Indicator (EI) RCRIS code (CA750)**

**Migration of Contaminated Groundwater Under Control**

<b>Facility Name:</b>	CITGO Terminal
<b>Facility Address:</b>	2500 East Chicago Avenue, East Chicago, Indiana
<b>Facility EPA ID #:</b>	IND 095 267 381

1. Has **all** available relevant/significant information on known and reasonably suspected releases to the groundwater media, 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 EI 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 "Migration of Contaminated Groundwater Under Control" EI**

A positive "Migration of Contaminated Groundwater Under Control" EI determination ("YE" status code) indicates that the migration of "contaminated" groundwater has stabilized, and that monitoring will be conducted to confirm that contaminated groundwater remains within the original "area of contaminated groundwater" (for all groundwater "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 EI are near-term objectives which are currently being used as Program measures for the Government Performance and Results Act of 1993, GPRA). The "Migration of Contaminated Groundwater Under Control" EI pertains ONLY to the physical migration (i.e., further spread) of contaminated ground water and contaminants within groundwater (e.g., non-aqueous phase liquids or NAPLs). Achieving this EI does not substitute for achieving other stabilization or final remedy requirements and expectations associated with sources of contamination and the need to restore, wherever practicable, contaminated groundwater to be suitable for its designated current and future uses.

**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. Is **groundwater** known or reasonably suspected to be “contaminated”<sup>1</sup> above appropriately protective “levels” (i.e., applicable promulgated standards, as well as other appropriate standards, guidelines, guidance, or criteria) from releases subject to RCRA Corrective Action, anywhere at, or from, the facility?

  X   If yes - continue after identifying key contaminants, citing appropriate “levels,” and referencing supporting documentation.

       If no - skip to #8 and enter “YE” status code, after citing appropriate “levels,” and referencing supporting documentation to demonstrate that groundwater is not “contaminated.”

       If unknown - skip to #8 and enter “IN” status code.

Rationale and Reference(s):

“Contamination” has been identified through comparison of the RFI groundwater characterization data with conservative risk-based screening levels.

Data for this EI includes RFI groundwater data collected August 2020, November 2020, March 2021, and June 2021. 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) and EPA Maximum Contaminant Levels (EPA-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 the current use of the property is commercial/industrial.

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

- U.S. EPA Maximum Contaminant Level (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
- IDEM, 2019 Screening Level Table A-6, Vapor Exposure, Groundwater, Commercial/Industrial

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

The perimeter locations defined in the RFI are as follows: CITGO-MW01-20, CITGO-MW02-20, CITGO-MW03-20, CITGO-MW04-20, CITGO-MW06-20, CITGO-MW08-20, CITGO-MW09-20, CITGO-MW10-20, CITGO-MW11-20, CITGO-MW13-20, CITGO-MW15-20, CITGO-MW17-20, CITGO-MW18-20, and CITGO-MW19-20.

The interior locations defined in the RFI are as follows: CITGO-MW05-20, CITGO-MW07-20, CITGO-MW12-20, CITGO-MW14-20, CITGO-MW16-20, and CITGO-MW20-20.

The perimeter and interior groundwater sampling results were compared to the above screening levels and the

Footnotes:

<sup>1</sup>“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 appropriate “levels” (appropriate for the protection of the groundwater resource and its beneficial uses).

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results are presented in the RFI Report in Table 5.2a and Table 5.2b, respectively. Groundwater concentrations that exceed the screening levels and therefore meet the definition of contamination are shown in the tables. Four metals (arsenic, manganese, thallium, and iron), five SVOCs (naphthalene, 2-methylnaphthalene, benzo(a)anthracene, benzo(a)pyrene, and dibenzofuran), and one VOC (benzene) exceeded the groundwater screening levels at the perimeter of the Site. One VOC (benzene) exceeded the groundwater screening levels at the interior of the Site.

Light non-aqueous phase liquid (LNAPL) has been identified at CITGO-MW16-20 and at CITGO-MW13-20 and CITGO-MW15-20 during the three rounds of groundwater monitoring post-RFI. While there are no generic screening levels for LNAPL, the presence of LNAPL represents contamination.

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3. Has the **migration** of contaminated groundwater **stabilized** (such that contaminated groundwater is expected to remain within “existing area of contaminated groundwater”<sup>2</sup> as defined by the monitoring locations designated at the time of this determination)?

  X   If yes - continue, after presenting or referencing the physical evidence (e.g., groundwater sampling/measurement/migration barrier data) and rationale why contaminated groundwater is expected to remain within the (horizontal or vertical) dimensions of the “existing area of groundwater contamination”<sup>2</sup>).

       If no (contaminated groundwater is observed or expected to migrate beyond the designated locations defining the “existing area of groundwater contamination”<sup>2</sup>) - skip to #8 and enter “NO” status code, after providing an explanation.

       If unknown - skip to #8 and enter “IN” status code.

Rationale and Reference(s):

Groundwater data from perimeter and interior monitoring wells were evaluated to determine whether the area of contaminated groundwater at the facility has stabilized. Comparison of the RFI groundwater data from perimeter and interior monitoring wells to the criteria is shown in Table 5.2a and Table 5.2b of the RFI Report, respectively. Groundwater concentrations that exceed the screening levels and therefore meet the definition of contamination are shown in the tables.

As discussed in the previous question, four metals (arsenic, manganese, thallium, and iron), five SVOCs (naphthalene, 2-methylnaphthalene, benzo(a)anthracene, benzo(a)pyrene, and dibenzofuran), and one VOC (benzene) exceeded the groundwater screening levels at the perimeter of the Site. One VOC (benzene) exceeded the groundwater screening levels at the interior of the Site.

There was one exceedance of IDEM-Industrial Vapor value for benzene at one interior well CITGO-MW16-20 during the first quarterly event. This exceedance is likely attributed to the presence of LNAPL, which was measured in the well in all three of the subsequent quarterly monitoring events. This exceedance was delineated to the MCLs at downgradient monitoring locations CITGO-MW18-20 and CITGO-MW17-20. Therefore, there are no exceedances of IDEM-Industrial Vapor values at the property boundary. The remaining exceedances of metals and SVOCs at the property boundary were generally stable or decreasing. Consistent with the CAF, the Site and surrounding area are mostly zoned industrial, the planned future use is to remain industrial, there are no drinking water wells within 1 mile of the site, and there are four other properties within a mile that are undergoing corrective action. Thus, it is unlikely that groundwater would be used for drinking water at or near the Site, and migration of contaminated groundwater to off-site residents is not occurring or expected.

Additional samples collected post-RFI (between October 2021 and June 2022) were consistent with the RFI data.

<sup>2</sup> “existing area of contaminated groundwater” is an area (with horizontal and vertical dimensions) that has been verifiably demonstrated to contain all relevant groundwater contamination for this determination, and is defined by designated (monitoring) locations proximate to the outer perimeter of “contamination” that can and will be sampled/tested in the future to physically verify that all “contaminated” groundwater remains within this area, and that the further migration of “contaminated” groundwater is not occurring. Reasonable allowances in the proximity of the monitoring locations are permissible to incorporate formal remedy decisions (i.e., including public participation) allowing a limited area for natural attenuation.

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LNAPL was detected during three different sampling events at CITGO-MW16-20 during the RFI and in three groundwater monitoring events post-RFI. Transmissivity testing was completed in January 2022 and the results were indicative of 'de minimus' conditions (extremely low LNAPL transmissivity). In addition, this well is in the interior of the site, and LNAPL was not detected in the downgradient wells. Thus, migration of LNAPL is stabilized. During the three groundwater monitoring events post-RFI, trace amounts were also identified at CITGO-MW15-20 and CITGO-MW13-20. The viscosity of LNAPL in CITGO-MW16-20 is similar to that of LNAPL in CITGO-MW15-20 and CITGO-MW13-20, and the in-well thicknesses of LNAPL in CITGO-MW15-20 and CITGO-MW13-20 are well below recommended minimum thicknesses for evaluating LNAPL transmissivity, therefore, transmissivity at CITGO-MW15-20 and CITGO-MW13-20 are also 'de minimus.' Additionally, LNAPL has not been observed in several wells to the east of the Site immediately across Cline Avenue.

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4. Does “contaminated” groundwater **discharge** into **surface water** bodies?

\_\_\_\_\_ If yes - continue after identifying potentially affected surface water bodies.

\_\_\_\_\_ If no - skip to #7 (and enter a “YE” status code in #8, if #7 = yes) after providing an explanation and/or referencing documentation supporting that groundwater “contamination” does not enter surface water bodies.

\_\_\_\_\_ If unknown - skip to #8 and enter “IN” status code.

Rationale and Reference(s):

There are limited surface water bodies in the area surrounding the Site and contaminated groundwater does not extend to surface water bodies. Therefore, contaminated groundwater does not discharge to surface water bodies.

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5. Is the **discharge** of “contaminated” groundwater into surface water likely to be “**insignificant**” (i.e., the maximum concentration<sup>3</sup> of each contaminant discharging into surface water is less than 10 times their appropriate groundwater “level,” and there are no other conditions (e.g., the nature, and number, of discharging contaminants, or environmental setting), which significantly increase the potential for unacceptable impacts to surface water, sediments, or eco-systems at these concentrations)?

\_\_\_\_\_ If yes - skip to #7 (and enter “YE” status code in #8 if #7 = yes), after documenting: 1) the maximum known or reasonably suspected concentration<sup>3</sup> of key contaminants discharged above their groundwater “level,” the value of the appropriate “level(s),” and if there is evidence that the concentrations are increasing; and 2) provide a statement of professional judgement/explanation (or reference documentation) supporting that the discharge of groundwater contaminants into the surface water is not anticipated to have unacceptable impacts to the receiving surface water, sediments, or eco-system.

\_\_\_\_\_ If no - (the discharge of “contaminated” groundwater into surface water is potentially significant) - continue after documenting: 1) the maximum known or reasonably suspected concentration<sup>3</sup> of each contaminant discharged above its groundwater “level,” the value of the appropriate “level(s),” and if there is evidence that the concentrations are increasing; and 2) for any contaminants discharging into surface water in concentrations<sup>3</sup> greater than 100 times their appropriate groundwater “levels,” the estimated total amount (mass in kg/yr) of each of these contaminants that are being discharged (loaded) into the surface water body (at the time of the determination), and identify if there is evidence that the amount of discharging contaminants is increasing.

\_\_\_\_\_ If unknown - enter “IN” status code in #8.

Rationale and Reference(s):

Skipped because of answer to Question 4

<sup>3</sup> As measured in groundwater prior to entry to the groundwater-surface water/sediment interaction (e.g., hyporheic) zone.

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6. Can the **discharge** of “contaminated” groundwater into surface water be shown to be “**currently acceptable**” (i.e., not cause impacts to surface water, sediments or eco-systems that should not be allowed to continue until a final remedy decision can be made and implemented<sup>4</sup>)?

\_\_\_\_\_ If yes - continue after either: 1) identifying the Final Remedy decision incorporating these conditions, or other site-specific criteria (developed for the protection of the site’s surface water, sediments, and eco-systems), and referencing supporting documentation demonstrating that these criteria are not exceeded by the discharging groundwater; OR 2) providing or referencing an interim-assessment,<sup>5</sup> appropriate to the potential for impact, that shows the discharge of groundwater contaminants into the surface water is (in the opinion of a trained specialists, including ecologist) adequately protective of receiving surface water, sediments, and eco-systems, until such time when a full assessment and final remedy decision can be made. Factors which should be considered in the interim-assessment (where appropriate to help identify the impact associated with discharging groundwater) include: surface water body size, flow, use/classification/habitats and contaminant loading limits, other sources of surface water/sediment contamination, surface water and sediment sample results and comparisons to available and appropriate surface water and sediment “levels,” as well as any other factors, such as effects on ecological receptors (e.g., via bio-assays/benthic surveys or site-specific ecological Risk Assessments), that the overseeing regulatory agency would deem appropriate for making the EI determination.

\_\_\_\_\_ If no - (the discharge of “contaminated” groundwater cannot be shown to be “**currently acceptable**”) - skip to #8 and enter “NO” status code, after documenting the currently unacceptable impacts to the surface water body, sediments, and/or eco-systems.

\_\_\_\_\_ If unknown - skip to 8 and enter “IN” status code.

Rationale and Reference(s):

Skipped because of answer to Question 4

<sup>4</sup> Note, because areas of inflowing groundwater can be critical habitats (e.g., nurseries or thermal refugia) for many species, appropriate specialist (e.g., ecologist) should be included in management decisions that could eliminate these areas by significantly altering or reversing groundwater flow pathways near surface water bodies.

<sup>5</sup> The understanding of the impacts of contaminated groundwater discharges into surface water bodies is a rapidly developing field and reviewers are encouraged to look to the latest guidance for the appropriate methods and scale of demonstration to be reasonably certain that discharges are not causing currently unacceptable impacts to the surface waters, sediments or eco-systems.



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7. Will groundwater **monitoring**/measurement data (and surface water/sediment/ecological data, as necessary) be collected in the future to verify that contaminated groundwater has remained within the horizontal (or vertical, as necessary) dimensions of the “existing area of contaminated groundwater?”

  X   If yes - continue after providing or citing documentation for planned activities or future sampling/measurement events. Specifically identify the well/measurement locations which will be tested in the future to verify the expectation (identified in #3) that groundwater contamination will not be migrating horizontally (or vertically, as necessary) beyond the “existing area of groundwater contamination.”

       If no - enter “NO” status code in #8

       If unknown - enter “IN” status code in #8.

Rationale and Reference(s):

Monitoring for groundwater and LNAPL is as follows<sup>6</sup>:

Groundwater

All monitoring wells at the Site will be sampled annually for the full suite of constituents (TCL VOCs, TCL SVOCs, and TAL inorganics) analyzed as part of the RFI Work Plan. Perimeter monitoring wells will be sampled quarterly for constituents that exceeded screening levels during the first four rounds of quarterly groundwater monitoring. This includes metals (arsenic, iron, manganese, and thallium), SVOCs (benzo(a)anthracene, benzo(a)pyrene, dibenzofuran, 2-methylnaphthalene, and naphthalene), and one VOC (benzene). Thus, future sampling at the Site will include:

- Q4 (2022), Q1 (2023): perimeter wells sampled for constituents that exceeded screening levels during the first four rounds of quarterly groundwater monitoring
- Q2 (2023): all wells sampled for full suite of constituents analyzed as part of the RFI Work Plan

The groundwater sampling program will be re-evaluated after two years of quarterly sampling (after the Q2 sampling event in 2023). Monitoring wells will not be abandoned without EPA concurrence.

LNAPL

As part of the ongoing quarterly groundwater monitoring program, groundwater elevations and LNAPL thickness, if present, have been measured during each event. Measurable LNAPL has been present in monitoring well CITGO-MW16-20 in nine of the ten gauging events but not in downgradient locations CITGO-MW18-20 and CITGO-MW17-20. A trace of LNAPL has been present at CITGO-MW13-20 and CITGO-MW-15-20 since the fifth quarterly groundwater monitoring event. The need for quarterly gauging for LNAPL at the above-mentioned monitoring wells will be re-evaluated following the completion of the Q2-(2023) event.

<sup>6</sup> GHD. January 21, 2022. Responses to EPA’s January 19, 2022, Comments on the October 2021 RFI Reports, CITGO Terminal and Former Cities Refinery, East Chicago, Indiana.

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8. Check the appropriate RCRIS status codes for the Migration of Contaminated Groundwater Under Control EI (event code CA750) and obtain Supervisor (or appropriate Manager) signature and date on the EI determination below (attach appropriate supporting documentation as well as a map of the facility).

  YE   YE - Yes, "Migration of Contaminated Groundwater Under Control" has been verified. Based on a review of the information contained in this EI determination, it has been determined that the "Migration of Contaminated Groundwater" is "Under Control" at the **CITGO Terminal** facility, EPA ID # **IND 095 267 381**, located at **2500 East Chicago Avenue, East Chicago, Indiana**. Specifically, this determination indicates that the migration of "contaminated" groundwater is under control, and that monitoring will be conducted to confirm that contaminated groundwater remains within the "existing area of contaminated groundwater" This determination will be re-evaluated when the Agency becomes aware of significant changes at the facility.

       NO - Unacceptable migration of contaminated groundwater is observed or expected.

       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:  
RFI Report

Contact telephone and e-mail numbers

(name) \_\_\_\_\_  
(phone #) \_\_\_\_\_  
(e-mail) \_\_\_\_\_