

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**

**Facility Name:** Former Phillips Refinery  
**Facility Address:** 2029 Fairfax Traffic Way, Kansas City, Kansas  
**Facility EPA ID #:** KSD007162100

1. Has all available relevant/significant information on known and reasonably suspected releases to the groundwater media, subject to Resource Conservation and Recovery Act (RCRA) Corrective Action (CA) (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 #8 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 CA 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 [e.g., Maximum Contaminant Levels (MCLs), the maximum permissible level of a contaminant in water delivered to any user of a public water system under the Safe Drinking Water Act]) 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):

1) Petroleum Based Hydrocarbons, light non-aqueous phase liquids (LNAPL), Benzene, Toluene, Ethylbenzene and Xylene (BTEX), Semi-Volatile Organic Compounds (SVOCs), Metals (see attached data tables)

2) Comprehensive Investigation (CI) Report, Draft Corrective Action Study (CAS) Report, Annual Ground Water and/or LNAPL Recovery Reports.

3) Ground Water Quality: The widespread extent of a LNAPL smear zone at the site results in an aqueous phase (dissolved) plume of LNAPL constituents (see attached data summary tables). Considering the composition of fuel hydrocarbons and the solubility and mobility of LNAPL constituents, the priority pollutants associated with LNAPL which are typically of greatest concern are BTEX parameters. The ground water investigation established that BTEX concentrations in ground water generally are elevated throughout the smear zone area. However, BTEX concentrations vary laterally within the smear zone because of differences in the composition of the hydrocarbon releases that accumulated in the LNAPL pool, and the inherent variability in the soil properties and associated distribution. Petroleum hydrocarbons are the primary ground water contaminants. Of the samples collected as part of the CI - SWMU investigation, approximately 1/2 contained benzene at concentrations exceeding the MCL. Of the samples collected during the direct push (Geoprobe™) ground water sampling, approximately 3/4 contained benzene at concentration exceeding the MCL.

4) Other constituents exceeded MCLs (parenthetically listed as number of MCL exceedances per number of samples collected) but in less than 1/4 of the samples collected. These include: Arsenic (3/21), Barium (2/21), Lead (2/21), 4-Methyl phenol (2/21), Naphthalene (2/21), Nickel (2/21), Antimony (1/21), chromium (1/21), 2,4-dimethylphenol (1/21), 2-Methyl phenol (1/21), Mercury (1/21), and Phenol (1/21).

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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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):

Phillips Petroleum Company in response to known ground water contamination and regulatory oversight, designed, installed and continues to operate a ground water/LNAPL recovery system. The system has been in operation since early 1982. Operations and Maintenance (O&M) documentation shows:

1) The pool of LNAPL has decreased from nearly 200 acres to approximately 10 acres;

2) Ground water flow is controlled by recovery system pumping (see attached figures).

3) Lowering of ground water levels at the site by pumping of the recovery system has created a capture zone that encompasses the aqueous phase plume beneath the site.

4) The Missouri River stage (elevation) is consistently higher than the pumping levels of the recovery wells, resulting in ground water capture on the river side of the site (annual reports document the consistent effectiveness of the recovery system with respect to hydraulic containment of the site.

5) Illustrative results can be found in the 1997 through 2001 annual reports (figures attached).

6) As described in file documentation (and EI support documentation sheets) BTEX constituents were detected in two of the perimeter monitoring wells along the eastern side of the site, adjacent to the Missouri River. These wells were immediately “re-sampled”. Analytical data report non-detects for selected parameters in subsequent sample (collected during semi annual sampling) data for these wells.

7) More than 1.68 million gallons of LNAPL have been recovered through operation of the ground water/LNAPL recovery system. The rate of recovery has significantly declined in recent years, simply because there is less product to recover. As recovery rates decline, continued system operation will recover less and less LNAPL. Depletion of mobile LNAPL pools is further documented by review of LNAPL thickness measured in ground water monitoring wells.

<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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4. Does "contaminated" groundwater **discharge** into **surface water** bodies?

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

  **X**   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):

1) Under current conditions (i.e. continued operation of the ground water/LNAPL recovery system) contaminated ground water is contained on site. (Refer to the various reports, which include the CI Report, the Draft CAS Report and the Annual Monitoring reports).

2) Surface Water sampling analytical (from 1996 through 2002) data are attached - these data demonstrates contaminated ground water is not impacting surface water

3) Please refer to the attached figures showing extent of LNAPL (December 1996 through October 2000)sample and surface water sampling locations.

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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):

Refer to CA 750, question 4, line item “no”.

<sup>3</sup> As measured in groundwater prior to entry to the groundwater-surface water/sediment interaction (e.g., hypothetical) 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 can not 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):

<sup>4</sup> Note, because areas of inflowing groundwater can be critical habitats (e.g., nurseries or thermal refuge) 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):

Even though the project is not yet to the point where selection of a corrective action alternative is appropriate, and since it appears that ground water contaminated with the referenced parameters will remain in place, according to KDHE policy and proper scientific judgement(s) ground water monitoring will be required as an element of the final corrective action remedy for the site.

