

DOCUMENTATION OF ENVIRONMENTAL INDICATOR DETERMINATION

RCRA Corrective Action Environmental Indicator (EI) RCRIS code (CA750)

Migration of Contaminated Groundwater Under Control

Facility Name: Giant Yorktown Refinery
Facility Address: 2201 Goodwin Neck Road, Grafton, Virginia, 23692
Facility EPA ID #: VAD050990357

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?

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 (EIs) 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 "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 EIs are near-term objectives that 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”¹ 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: Groundwater in the shallow Columbia Aquifer and the upper portion of the Yorktown Confining System (YCS) Aquifer is known to be contaminated above the Maximum Contaminant Levels (MCLs) and USEPA Region III Risk-based Concentrations (RBCs). Table 1 identifies the 15 contaminants of concern (COCs) and 24 secondary constituents found to be present in the groundwater at the site at concentrations greater than the appropriately protective levels. This table was prepared using groundwater data collected at the site from 2000 to 2007 as a part of routine monitoring events associated with multiple regulatory programs implemented at the site.

References: *Supplemental Investigation Report, Giant Yorktown Refinery*, July 2007; *2006 Annual Groundwater Assessment Report - CAMU*, February 28, 2007; *Interim Measures Report-Well CW3 NAPL Area, Giant Yorktown Refinery*, June 21, 2006; *Acetone Source Investigation Report, Giant Yorktown Refinery*, June 3, 2004; *Phase II RFI Report* (ThermoRetec, 2001); *Phase II RFI Report Addendum* (ThermoRetec, 2001).

Table 1. Maximum Detected Concentration of Contaminants of Concern and Secondary Constituents Detected Above Protective Levels in Groundwater

Contaminants of Concern	Clean-Up Level ² (µg/L)	Maximum Detected Concentration (µg/L)	Secondary Constituents	MCL/RBC ³ (µg/L)	Maximum Detected Concentration (µg/L)
Acetone	1920	2,600 J	1,2-Dibromoethane	0.05	NA
Benzene	5	6,500	1,3-Dichlorobenzene	1.83	NA
Ethylbenzene	700	4,300	1-Methylnaphthalene	2.43	560
MTBE	28.6	25,000	2,4-Dimethylphenol	73	380 J
Pentachlorophenol	1	0.6 J	2-Methylnaphthalene	2.43	990
Toluene	1,000	20,000	4-Methylphenol	18.25	1,500
Xylene, total	10,000	25,000	Acenaphthene	36.5	49
Antimony	6	16.5	Aluminum	3,650	124,000
Arsenic	10	140	Benzenethiol	0.006	79 J
Beryllium	4	10.3 B	Benzo(a)anthracene	0.03	230
Chromium	100	280	Benzo(a)pyrene	0.2	180
Lead	15	142	Benzo(b)fluoranthene	0.03	110
Nickel	384	1,710	Bis(2-ethylhexyl)phthalate	6	100 B
Molybdenum	96	71.5 J	Boron	730	3,480 J
Thallium	2	25.3 J	Chrysene	3	260
			Dibenz(a,h)anthracene	0.003	57
			Fluorene	24.3	57
			Indeno(1,2,3-cd)pyrene	0.03	39
			Iron	2,555	162,000
			Manganese	73	6,640
			Methylene Chloride	5	9.8 B
			Naphthalene	0.65	3,400
			Pyrene	18.25	250
			Vanadium	3.65	487 J

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 appropriate “levels” (appropriate for the protection of the groundwater resource and its beneficial uses).

² Groundwater Media Clean-up Levels were established for 15 COCs in Table 2b of the Final Decision and Response to Comments, March 31, 2004.

³ Region III Risk-based Concentrations (RBCs) are used when Maximum Contaminant Levels (MCLs) are not available.

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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”⁴ 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”²).

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

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

Rationale: Based on information presented in the July 2007 SI Report, the June 2007 CMI Work Plan and the RFI documents, it appears that the lateral and vertical extent of groundwater contamination has been delineated sufficiently to determine that contaminated groundwater is not migrating offsite. The potential for groundwater contaminants to migrate substantially beyond their current location over the next several years is considered very low. Hydrogeologic data from the Phase II RFI (ThermoRetec, 2001) indicate horizontal groundwater flow velocities are extremely low. The representative horizontal linear flow velocity for the Columbia aquifer is 2.19 feet per year, and that of the underlying YCS aquifer is less than one foot per year (RETEC, October 15, 2001). Based on a review of groundwater data collected at the site over several years, very few changes have been observed which supports the finding that the migration of contaminated groundwater has stabilized. Therefore, contaminated groundwater plumes are expected to remain stable and within the dimensions of the existing areas of groundwater contamination that have been delineated to date. See Figures 3-2 and 3-3 in the June 2007 CMI Work Plan and Plates 1, 2 and 3 in the Supplemental Investigation Report for a description of the monitoring locations used to support this determination.

The implementation of corrective measures described in the June 2007 CMI Work Plan includes several activities that will help to ensure that contaminants in groundwater remain stable and will not migrate offsite. Source removal work, groundwater assessment activities, CAMU monitoring, and groundwater remediation activities for delineated plumes will ensure contaminants in groundwater will remain stable and not migrate offsite. In addition, routine groundwater monitoring activities completed for several regulatory programs will continue for several years. See Figure 3-4 in the June 2007 CMI Work Plan.

References:

Supplemental Investigation Report, Giant Yorktown Refinery, July 2007; Corrective Measures Implementation Work Plan, June 22, 2007; 2006 Annual Groundwater Assessment Report - CAMU, February 28, 2007; Interim Measures Report-Well CW3 NAPL Area, Giant Yorktown Refinery, June 21, 2006; Acetone Source Investigation Report, Giant Yorktown Refinery, June 3, 2004; Phase II RFI Report (ThermoRetec, 2001); Phase II RFI Report Addendum (ThermoRetec, 2001).

Footnotes:

⁴ “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:

Based on our understanding of the conceptual site model, overall groundwater flow across the refinery is generally west to east, and then it diverges radially to the surface water bodies surrounding the peninsula. Groundwater flow in the eastern part of the facility is especially complex due to the relatively flat gradient and shallow depth to water influenced by surface and subsurface features (i.e., ditch system, utility corridors, fill areas, surface impoundments). Although groundwater may discharge to surface water bodies adjacent to the facility, contaminants above levels of concern have not been found in surface water. The Risk Assessment portion of the *Risk Assessment/Corrective Measures Study* (RETEC, October 2001) concluded that surface water is not impacted at unacceptable levels. Minor contaminant impacts were identified within the tidal salt marsh, but are associated with a facility discharge point under the Virginia Pollutant Discharge Elimination System (VPDES) program, and will be addressed as part of the Corrective Measures Implementation process and facility operations. A limited area of impacted sediment was identified in the northwestern portion of Bull Creek Pond, but these impacts are likely associated with surface runoff from east end solid waste management units (SWMUs) including SWMU 6 (inactive industrial waste landfill). These SWMUs (as well as the impacted sediment) will undergo excavation to the corrective action management unit (CAMU) as part of the remedy selected by EPA in the March 31, 2004 Final Decision and Response to Comments.

References: *Supplemental Investigation Report, Giant Yorktown Refinery*, July 2007; *Corrective Measures Implementation Work Plan*, June 22, 2007; *SWMU 6 Investigation Work Plan*, June 4, 2007; *2006 Annual Groundwater Assessment Report - CAMU*, February 28, 2007; *Interim Measures Report-Well CW3 NAPL Area, Giant Yorktown Refinery*, June 21, 2006; *Acetone Source Investigation Report, Giant Yorktown Refinery*, June 3, 2004; *Final Decision and Response to Comments for Giant Yorktown Refinery*, EPA, March 31, 2004; *Risk Assessment and Corrective Measures Study Report*, (RETEC, 2001); *Phase II RFI Report* (ThermoRetec, 2001); *Phase II RFI Report Addendum* (ThermoRetec, 2001).

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5. Is the discharge of “contaminated” groundwater into surface water likely to be “insignificant” (i.e., the maximum concentration⁵ 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)?

NA If yes - skip to #7 (and enter “YE” status code in #8 if #7 = yes) after documenting: 1) the maximum known or reasonably suspected concentration³ 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 judgment/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.

NA If no - (the discharge of “contaminated” groundwater into surface water is potentially significant) - continue after documenting: 1) the maximum known or reasonably suspected concentration³ 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 concentrations³ 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.

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

Rationale and Reference(s):

NA - Not Applicable, see #4

⁵ 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 ⁶)?

NA 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, ⁷ 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.

NA 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.

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

Rationale and Reference(s):

NA - Not Applicable, see #4

⁶ 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.

⁷ 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 be collected in the future to verify that contaminated groundwater has remained within the horizontal or vertical 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 to 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:

The Corrective Measures Implementation Work Plan (CMIWP) issued June 2007 states that the groundwater remedy will be conducted in a phased approach and address both NAPL and dissolved-phase plumes site-wide. Phase 1 of the groundwater remedy was initiated in June 2006 and consists of activities to address the Short-Term Protection Goals and includes:

- Soil source removal to the CAMU and site restoration;
- Non-aqueous phase liquid and groundwater plume delineation;
- Cleaning and inspection of the below grade oily water sewer (OWS);
- Establishment of institutional controls; and
- Routine groundwater monitoring.

Phase 2 of the groundwater remedy will overlap with Phase 1 and address the Intermediate Performance Goals for continued source and migration control following SWMU remediation. Phase II activities include:

- Complete contaminant plume delineation and identify potential areas of impacts resulting from the below grade OWS inspection;
- Reassess groundwater flow and plume stability in areas of limited soil source removal;
- Implement short-term source zone and migration control measures (i.e., AS/SVE, hydraulic containment, product recovery); and
- Establish monitoring well networks at various plume locations and initiate collection of groundwater quality data (COCs) and monitored natural attenuation (MNA) parameters to evaluate natural attenuation processes.

Final Cleanup Goals will be achieved during Phase 3 of the groundwater remedy which incorporates the following activities, in conjunction with Phase 1 and 2.

- CAMU monitoring in accordance with the GWMP to ensure no releases from the CAMU;
- Continue NAPL and leak detection monitoring under the AST Program in coordination with the USEPA;
- Implement active corrective measures for groundwater migration control and source zone removal, where appropriate, with system performance monitoring; and
- Long-term monitoring for groundwater restoration.

The three groundwater remedy phases are interdependent and their timing will overlap with one another. For example, as source removal occurs in Phase 1, plume delineation will be completed and reassessment of groundwater conditions will begin for Phase 2; and the long-term goal of groundwater restoration, identified as Phase 3, will be underway.

In addition to the corrective action project, future groundwater monitoring is planned for the site as part of several routine monitoring programs including continuation of the VDEQ semiannual monitoring at the permitted Industrial Waste Landfill (SWMU 4) and the annual and monthly AST leak detection monitoring program.

References: *Supplemental Investigation Report, Giant Yorktown Refinery*, July 2007; *Corrective Measures Implementation Work Plan*, June 22, 2007; *SWMU 6 Investigation Work Plan*, June 4, 2007; *2006 Annual Groundwater Assessment Report - CAMU*, February 28, 2007; *Final Decision and Response to Comments for Giant Yorktown Refinery*, EPA, March 31, 2004.

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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 - 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 **Giant Yorktown Refinery** facility, EPA ID # **VAD050990357**, located at **2201 Goodwin Neck Road, Grafton, Virginia, 23692**. 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) Donna McCartney
(title) USEPA Project Coordinator

Supervisor: (signature) _____ Date _____
(print) Robert E. Greaves
(title) Chief, General Operations Branch, Region III EPA

EPA Region: _____

Locations where References may be found:

<u>Yorktown Refinery</u>	<u>EPA Region III</u>	<u>VDEQ</u>
<u>2201 Goodwin Neck Road</u>	<u>1650 Arch Street</u>	<u>629 East Main Street</u>
<u>Grafton, VA 23692</u>	<u>Philadelphia, PA 19103</u>	<u>P.O. Box 10009</u>
		<u>Richmond, VA 23219</u>

Contact telephone and e-mail numbers

(name) Donna McCartney
(phone #) (215) 814-3427
(e-mail) Mccartney.donna@epa.gov