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: Valero Bill Greehey Refinery
Facility Address: 1147 Cantwell Lane, Corpus Christi, TX 78407
Facility EPA ID #: TXD008132268

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 #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"**[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?

☒ 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):

Rationale - Affected groundwater and a groundwater protective concentration level exceedance (PCLE) zone were delineated at the refinery. Key contaminants in groundwater are NAPL, volatile organic, and semi-volatile organic chemicals of concern (COCs). The COCs exceeding risk-based levels include LNAPL and benzene. The protective levels are the critical PCLs for groundwater from the Texas Risk Reduction Program (TRRP). The critical PCLs were develop to protect Class 3 groundwater and surface water. Site investigation reports have been submitted to the TCEQ that describe the extent of affected groundwater at the property (ENSR 1999, RMT/JN 1996, JDC 1999, H2A 2004, H2A 2005).

References - The list includes reports that were submitted to the TCEQ or predecessor agencies and describe the delineation of COCs in groundwater:

ENSR 1999, *Final Groundwater Contamination Delineation Report* (June 1999)

JDC 1999, *Revised Remedial Investigation, Baseline Risk Assessment and Corrective Measures Study, Petroleum Impacted Soils* (March 1999)

H2A 2004, *Affected Property Assessment Report, Groundwater AOC*, January 2004

H2A 2005, *Revised Affected Property Assessment Report, Groundwater AOC*, July 2005

RMT/JN 1996, *Remedial Investigation, Baseline Risk Assessment and Corrective Measures Study, Petroleum Impacted Soils* (October 1996)

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).

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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"[2] as defined by the monitoring locations designated at the time of this determination)?

☒ 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 and Reference(s):

Rationale –An interim corrective action (ICA) system is currently in operation at the facility to remove phase-separated hydrocarbon and to control the migration of LNAPL and dissolved phase COCs.

There are currently 70 recovery wells operating in the ICA system. The wells are routinely checked and readings are collected weekly to determine the recovered volumes. The recovered volumes are summarized and reported in the semiannual groundwater reports. From April 1998 through December 2006 an estimated 205,483 barrels (8,630, 299 gallons) of hydrocarbon and 3,241,498 barrels (136,142,935 gallons) of affected groundwater have been recovered.

Based on long term data trends, the thickness of the phase-separated hydrocarbon continues to decrease and the lateral extent of affected groundwater remains stable or is declining. The volume of hydrocarbon recovered over time is also decreasing per well as would be expected as the available volume of hydrocarbon in the formation is being reduced. Based on these observations the ICA system continues to effectively remove the LNAPL plume to the maximum extent practicable. Semiannual groundwater monitoring has shown the ICA system is protecting the point of exposure and is the appropriate system until a full assessment final remedy decision is made. The facility continues to review and collect data

Footnotes:

[2] "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.

to evaluate if the plume is stable, increasing in size or migrating. The facility and an adjacent operator have coordinated their activities to upgrade and enhance the monitoring program as well as the ICA system.

In addition, an extensive Groundwater Monitoring Program is in place which maintains the continuous collection of groundwater monitoring data as well as fluid measurement data. Groundwater monitoring/measurement data will continue to be collected in the future to verify that the affected groundwater/groundwater PCLE zone is stable. The current well system consists of 214 wells. Currently, there are a total of 78 recovery wells, 40 monitor wells and 96 observation wells.

Fluid level measurements are collected quarterly from the monitor wells and observation wells (136 wells total). The measurements are summarized in tables and presented in the semiannual reports. The measurements from the April and October measuring events are used to develop groundwater gradient maps and phase-separated hydrocarbon thickness maps. These maps are presented in the semiannual reports.

Groundwater samples are collected in April and October from monitor wells (40 total). The groundwater samples are analyzed for metals, volatile organic constituents and semi-volatile organic constituents. The analytical results are summarized in tables and presented in the semiannual reports. Copies of the laboratory analytical reports are also presented in the semiannual reports. The reported benzene concentrations are mapped. These maps are presented in the semiannual reports.

Annual well inspections are conducted during the October measuring event and the results are included in each March 15th semiannual report.

Reference(s) – The list includes reports that were submitted to the TCEQ or predecessor agencies and describe the corrective action system and the semiannual groundwater monitoring events.

Interim Corrective Action System Efficiency Study Report (HLA, May 1999)

Final Groundwater Contamination Delineation Report (ENSR, June 1999)

Interim Corrective Action System Modifications Report – Pipeline Gallery Area (HLA, September 1999)

Interim Corrective Action Modification Report (JDC, September 2001)

Nixon Tract Aquifer Test Report (JDC, October 2002)

Barrier System Evaluation (RETEC, November 2002)

Interim Corrective Action Modification Evaluation Report (JDC, May 2003)

Recovery Well Installation Report Groundwater Migration Project Phase 1 – Complex 8 (JDC, September 2005)

Groundwater Monitoring Program – Semiannual Report – September 15, 1998

Groundwater Monitoring Program – Semiannual Report – March 15, 1999

Groundwater Monitoring Program – Semiannual Report – September 15, 1999

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Groundwater Monitoring Program – Semiannual Report – September 15, 2007

Groundwater Monitoring Program – Semiannual Report – March 15, 2007

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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):

Rationale – The potentially affected surface water body is the Corpus Christi Inner Harbor. The groundwater ICA system (i.e., coffer dam and perimeter recovery wells) controls the migration of COCs at the refinery property boundary and at the groundwater-to-surface water interface. Semiannual groundwater monitoring reports have shown that surface water is protected.

Reference(s) - The list includes reports that were submitted to the TCEQ or predecessor agencies.

Groundwater Monitoring Program – Semiannual Report – September 15, 1998

Groundwater Monitoring Program – Semiannual Report – March 15, 1999

Groundwater Monitoring Program – Semiannual Report – September 15, 1999

Groundwater Monitoring Program – Semiannual Report – March 15, 2000

Groundwater Monitoring Program – Semiannual Report – September 15, 2000

Groundwater Monitoring Program – Semiannual Report – March 15, 2001

Groundwater Monitoring Program – Semiannual Report – September 15, 2001

Groundwater Monitoring Program – Semiannual Report – March 15, 2002

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Groundwater Monitoring Program – Semiannual Report – March 15, 2005

Groundwater Monitoring Program – Semiannual Report – September 15, 2005

Groundwater Monitoring Program – Semiannual Report – March 15, 2006

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5. Is the **discharge** of "contaminated" groundwater into surface water likely to be **"insignificant"** (i.e., the maximum concentration[3] 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[3] 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.

☐ If no - (the discharge of "contaminated" groundwater into surface water is potentially significant) - continue after documenting: 1) the maximum known or reasonably suspected concentration[3] 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[3] 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):

Rationale – The discharge of contaminated groundwater is insignificant. The protective concentrations developed for COCs that could affect surface water are TRRP Tier 1 ^{SW}RBELs, which are the marine water quality standards without the use of a groundwater-to-surface water dilution factor. The protective levels consider protection of human health and the environment. Any discharge of groundwater contaminants is not expected to have unacceptable impacts to the receiving water, sediments or ecosystem.

Reference(s) – The list includes reports that were submitted to the TCEQ or predecessor agencies.

Groundwater Monitoring Program – Semiannual Report – September 15, 1998

Groundwater Monitoring Program – Semiannual Report – March 15, 1999

Groundwater Monitoring Program – Semiannual Report – September 15, 1999

Footnotes:

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

Groundwater Monitoring Program – Semiannual Report – March 15, 2000

Groundwater Monitoring Program – Semiannual Report – September 15, 2000

Groundwater Monitoring Program – Semiannual Report – March 15, 2001

Groundwater Monitoring Program – Semiannual Report – September 15, 2001

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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[4])?

☒ 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,[5] 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):

Rationale - An ICA system is currently in operation at the facility to remove LNAPL and to control the migration of phase-separated hydrocarbon and dissolved phase COCs.

There are currently 70 recovery wells operating in the ICA system. The wells are routinely checked and readings are collected weekly to determine the recovered volumes. The recovered volumes are summarized and reported in the semiannual groundwater reports. From April 1998 through December 2006 an estimated

[4] 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.

[5] 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.

205,483 barrels (8,630, 299 gallons) of hydrocarbon and 3,241,498 barrels (136,142,935 gallons) of affected groundwater have been recovered.

Based on long term data trends, the thickness of the LNAPL continues to decrease and the lateral extent remains stable or declining. The volume of hydrocarbon recovered over time is also decreasing per well as would be expected as the available volume of hydrocarbon in the formation is being reduced. Based on these observations the ICA system continues to effectively remove the LNAPL plume to the maximum extent practicable. Semiannual groundwater monitoring has shown the ICA system is protected at the point of exposure and is the appropriate system until a full assessment final remedy decision is made.

The facility continues to review and collect data to observe if the plume is increasing in size or migrating. The facility and an adjacent operator have coordinated their activities to upgrade and enhance the monitoring program as well as the ICA system.

In addition, an extensive Groundwater Monitoring Program is in place which maintains the continuous collection of groundwater monitoring data as well as fluid measurement data. Groundwater monitoring/measurement data will continue to be collected in the future to verify that the affected groundwater/groundwater PCLE zone is stable. The current well system consists of 214 wells. Currently, there are a total of 78 recovery wells, 40 monitor wells and 96 observation wells.

Fluid level measurements are collected quarterly from the monitor wells and observation wells (136 wells total). The measurements are summarized in tables and presented in the semiannual reports. The measurements from the April and October measuring events are used to develop groundwater gradient maps and phase-separated hydrocarbon thickness maps. These maps are presented in the semiannual reports.

Groundwater samples are collected in April and October from 40 monitor wells. The groundwater samples are analyzed for metals, volatile organic constituents and semi-volatile organic constituents. The analytical results are summarized in tables and presented in the semiannual reports. Copies of the laboratory analytical reports are also presented in the semiannual reports. The reported benzene concentrations are mapped. These maps are presented in the semiannual reports.

Annual well inspections are conducted during the October measuring event and the results are included in each March 15th semiannual report.

Reference(s) – The list includes reports that were submitted to the TCEQ or predecessor agencies and describe the installation and operation of the ICA system.

Interim Corrective Action System Efficiency Study Report (HLA, May 1999)

Final Groundwater Contamination Delineation Report (ENSR, June 1999)

Interim Corrective Action System Modifications Report – Pipeline Gallery Area (HLA, September 1999)

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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?"

   ☒ 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):

Rationale - An extensive Groundwater Monitoring Program is in place which maintains the continuous collection of groundwater monitoring data as well as fluid measurement data. Groundwater monitoring/measurement data will continue to be collected in the future to verify that the affected groundwater/groundwater PCLE zone is stable. The current well system consists of 214 wells. Currently, there are a total of 78 recovery wells, 40 monitor wells and 96 observation wells.

Fluid level measurements are collected quarterly from the monitor wells and observation wells (136 wells total). The measurements are summarized in tables and presented in the semiannual reports.

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References - The list includes monitoring reports that were submitted to the TCEQ or predecessor agencies.

Groundwater Monitoring Program – Semiannual Report – September 15, 1998

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Groundwater Monitoring Program – Semiannual Report – March 15, 2006

Groundwater Monitoring Program – Semiannual Report – September 15, 2007

Groundwater Monitoring Program – Semiannual Report – March 15, 2007

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).

__X__ 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 Valero Bill Greehey Refinery facility , EPA ID # TXD008132268 , located at 1147 Cantwell Lane, Corpus Christi, Texas 78407. 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) Todd Counter Date 1/22/09
(print) Todd Counter
(title) Project Manager

Supervisor (signature) Jason Wang Date 1/22/09
(print) Jason Wang
(title) Team Leader
Texas Commission on Environmental Quality

Locations where References may be found:

TCEQ Central Records, Austin, TX

Contact telephone and e-mail numbers:

Project Manager listed above
(512) 239-2200
ccounter@tceq.state.tx.us

Final Note: The purpose of the Migration of Contaminated Groundwater EI is to verify that the groundwater plume is stable. A "YE" determination does not constitute a screening tool to end the corrective action process. The "YE" determination may be changed at any time as new information becomes available.