

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: Shell Oil Company, Norco Chemical Plant
Facility Address: P.O. Box 10 Norco, LA 70079
Facility EPA ID #: LAD 980 622 104

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?

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 "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 EI 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)?

	Yes	No	?	Rationale / Key Contaminants
Groundwater	<u>X</u>	—	—	GW plume delineated during RFI. See Table 1 for key contaminants.
Air (indoors) ²	—	<u>X</u>	—	No buildings are located over SWMUs. Additionally, all buildings are maintained with positive pressure.
Surface Soil (e.g., <2 ft)	<u>X</u>	—	—	Impacted surficial soils identified during RFI. See Table 1 for key contaminants.
Surface Water	<u>X</u>	—	—	Impacts to surface water identified in RFI and current surface water monitoring. See Table 1 for key contaminants.
Sediment	<u>X</u>	—	—	Impacted sediments identified during RFI. See Table 1 for key contaminants.
Subsurf. Soil (e.g., >2 ft)	<u>X</u>	—	—	Impacted subsurface soils identified during RFI. See Table 1 for key contaminants.
Air (outdoors)	<u>X</u>	—	—	Potential for construction worker scenario only.

— 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):

In 1990, USEPA issued a hazardous waste permit to Shell requiring corrective action for Solid Waste Management Units (SWMUs) and other Areas of Concern (AOCs). Twelve SWMUs and 2 AOCs requiring investigation were identified by USEPA (see Figure 1 of Appendix C). The Closed Spent Raney Nickel Catalyst Impoundment (SWMU 5), the decommissioned VCM/EDC Manufacturing Unit (SWMU 82), the AN/AG Dowtherm area (Area of Concern B), and the Allyl Chloride area (additional area of groundwater contamination) also were identified by a Louisiana Department of Environmental Quality (LDEQ) order (G-E-90-017) dated June 6, 1991 (amended June 17, 1992) as requiring assessment of constituents in groundwater. Because of the overlapping requirements of the HSWA permit and the LDEQ order, the U.S. EPA, LDEQ, and Shell agreed to address these areas separately as the Phase II RFI.

The areas identified by the EPA were investigated in the RCRA Facility Investigation (RFI). Field activities for this investigation were conducted in 1992 and 1997 and the work was approved by LDEQ in May 1998. The results of these investigations are provided in the Phase I and Phase II RFI reports (Groundwater Technology, Inc., 1993; Woodward-Clyde, 1997a; Woodward-Clyde, 1997b). Impacts to groundwater, surficial soil, subsurface soil, surface water, and sediments were identified in the RFI. The sources of designation, RFI phase designation, and status of the SWMUs investigated in the RFI are summarized in Appendix D.

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Following the approval of the RFI, Shell initiated a Risk Evaluation/Corrective Action Program (RECAP) evaluation. This assessment consisted of several activities including:

- A screening assessment to establish the number of chemicals of concern (COCs) that will be assessed in the CMS. This evaluation concluded that less than 1/2 of the chemicals detected in soil and less than 2/3 of the chemicals detected in groundwater will need to be included in the CMS (i.e., exceeded protective risk-based levels).
- Risk-based cleanup levels for the remaining COCs in soils and groundwater were calculated following the methods provided in the LDEQ RECAP guidance. The measured concentrations on site were compared with the risk-based values to determine areas and chemicals that will require further action (Equilon Enterprises, 2001). A summary of these screening results is provided in Appendix C, Figures 2-4. These figures indicate the locations of the samples exceeding the screening risk-based concentrations.

Shell submitted a revised CMS Work Plan to LDEQ in September 2001 which included a Management Option 2 evaluation of the soil within the plant and for groundwater in Zone II and Zone IV. The preliminary results of the Management Option 2 analysis included in the CMS Work Plan indicate that only 5 of the SWMUs require further action. Soil analytical results exceeding the risk-based standards were reported for samples collected from SWMU 9 and SWMU 82. Groundwater analytical results exceeding risk-based standards were reported for samples collected from SWMU 9, SWMU 26, SWMU, 59, SWMU 82, and SWMU 97.

The COCs in soil, groundwater, surface water and sediments exceeding the RECAP standards are listed in the following table.

Chemical	CAS No.	RECAP Standard	Value (mg/L or mg/kg)
Soils:			
1,1,1-Trichloroethane	71-55-6	SO3NDW	1.04E+02
1,1,2,2-Tetrachloroethane	79-34-5	SO3NDW	2.16E-02
1,1,2-Trichloroethane	79-00-5	SO3NDW	8.06E-02
1,2,3-Trichloropropane	96-18-4	SO3NDW	8.70E+00
1,2-Dichloroethane	107-06-2	SO3NDW	4.83E-02
1,2-Dichloropropane	78-87-5	SO3NDW	4.16E-02
Arsenic	7440-38-2	SOI 1.65	3.63E+01
Biphenyl (Diphenyl)	92-52-4	SO SAT	2.32E+02
Chromium	7440-47-3	SO3NDW	1.00E+02
Lead	7439-92-1	SO3NDW	4.13E+02
Nickel	7440-02-0	SO3NDW	2.09E+03
sec-Butyl ether	6863-58-7	SO3NDW	2.23E+02
Sulfolane	126-33-0	SO3NDW	3.60E+01
Trichloroethene	79-01-6	SO3NDW	3.05E-01
Groundwater:			
1,1,2-Trichloroethane	79-00-5	GW3NDW	6.99E-03
1,1-Dichloroethene	75-35-4	GW3NDW	5.80E-04
1,2-Dichloroethane	107-06-2	GW3NDW	6.80E-03
1,2-Dichloropropane	78-87-5	GW3NDW	5.00E-03
2-Butanol (sec-Butanol)	78-92-2	SS GW	5.48E-01
2-Butanone (MEK)	78-93-3	GW3NDW	3.88E+02
Acetone	67-64-1	GW3NDW	7.20E+02
Benzene	71-43-2	GW3NDW	1.25E-02
Biphenyl (Diphenyl)	92-52-4	GW3NDW	2.65E-01

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Chemical	CAS No.	RECAP Standard	Value (mg/L, or mg/kg)
Biphenyl ether	101-84-8	GW3NDW	9.50E-01
Bis(2-chloroethyl)ether	111-44-4	GW3NDW	2.06E-04
Chloride	16887-00-6	GW3NDW	2.50E+02
Dichloromethane	75-09-02	GW3NDW	8.70E-02
N-Nitroso di-n-propylamine	621-64-7	GW3NDW	4.44E-05
sec-Butyl ether	6863-58-7	GW3NDW	4.05E+00
Sulfolane	126-33-0	GW3NDW	1.44E+01
Tetrachloroethene	127-18-4	GW3NDW	2.50E-03
Tetrahydrothiophene	110-01-0	GW3NDW	1.81E+00
Trichloroethene	79-01-6	GW3NDW	2.10E-03
Vinyl chloride	75-01-4	GW3NDW	3.58E-02
Surface Water:			
1,1,2-Trichloroethane	79-00-5	GW3NDW	6.99E-03
1,2-Dichloroethane	107-06-2	GW3NDW	6.80E-03
1,2-Dichloropropane	78-87-5	GW3NDW	5.00E-03
Benzene	71-43-2	GW3NDW	1.25E-02
Biphenyl ether (Diphenyl ether)	101-84-8	GW3NDW	9.50E-01
Sec-Butyl ether	6863-58-7	GW3NDW	4.05E+00
Sulfolane	126-33-0	GW3NDW	1.44E+01
Tetrachloroethene	127-18-4	GW3NDW	2.50E-03
Tetrahydrothiophene	110-01-0	GW3NDW	1.81E+00
Trichloroethene	79-01-6	GW3NDW	2.10E-03
Sediment:			
1,1,2-Trichloroethane	79-00-5	SO3NDW	8.06E-02
1,2-Dichloroethane	107-06-2	SO3NDW	4.83E-02
Acetone	67-64-1	SO3NDW	1.83E+02
Benzene	71-43-2	SO3NDW	1.28E-01
Biphenyl ether (Diphenyl ether)	101-84-8	SO SAT	2.32E+02
Sec-Butyl ether	6863-58-7	SO3NDW	2.23E+02
Sulfolane	126-33-0	SO3NDW	3.60E+01
Tetrahydrothiophene	110-01-0	SO3NDW	4.00E+00
Trichloroethene	79-01-6	SO3NDW	3.05E-01

Notes:

- RECAP Standards derived in the Management Option-2 report are used as risk-based levels for this assessment. Incorporation of a DAF for groundwater migration is not included in these values (although consistent with RECAP, a groundwater dilution factor DAF is included in the MO-2 report).
- The MO-2 report did not address Zone I Groundwater, Surface Water, or Sediments. However, the RECAP Standards for groundwater and soils are used as risk-based levels for these media.
- No MO-2 standard was calculated for 2-butanol. The Screening Option Standard for this chemical is used as the risk-based level (Shell Chemical Company, 1998).

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References:

- Equilon Enterprises, 2001. RCRA Corrective Measures Study Work Plan (Revision 2), Shell Chemical Company, Norco, Louisiana.
- Groundwater Technology, Inc., 1993. RCRA Facility Investigation, Phase I, Shell Norco, West Site.
- Shell Chemical Company, 1998. RECAP Screening Option Report: Risk-Based Assessment for the RCRA Corrective Measures Study.
- Shell Chemical Company, 2002. Progress Report – RCRA Corrective Measures Study, Interim Corrective Measures, Surface Water Monitoring Data, First Quarter 2002, Shell Chemical West Site, Norco, Louisiana.
- URS Greiner Woodward Clyde, 1999. Interim Measures Plan, Shell Chemical Company, Norco, Louisiana.
- Woodward-Clyde, 1997a. Phase II RFI/Groundwater Assessment Final Report, Shell Norco Chemical Plant-West Site.
- Woodward-Clyde, 1997b. Amended Phase I RFI Draft Report, Shell Norco Chemical Plant-West Site.

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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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)

<u>"Contaminated" Media</u>	Residents	Workers	Day-Care	Construction	Trespassers	Recreation	Food ¹
Groundwater	No	No	No	Yes	No	No	No
Air (indoors)							
Soil (surface, <3 ft)	No	Yes	No	Yes	Yes	No	No
Surface Water	No	No	No	No	Yes	Yes	No
Sediment	No	No	No	No	Yes	Yes	No
Soil (subsurface, >3 ft)	No	No	No	Yes	No	No	No
Air (outdoors)	No	No	No	Yes	No	No	No

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):

An evaluation of the complete exposure pathways was made in the RECAP Management Option-2 Report included in the CMS Work plan. To establish a conceptual exposure model for the Norco facility, available information has been analyzed to identify potential pathways of human and ecological exposure to constituents released from on-site SWMUs or AOCs. The exposure assessment flowchart provided in Appendix C, Figure 5 illustrates the potential sources, transport mechanisms, and exposure pathways associated with potentially affected soil, groundwater, sediment, or surface water at the site. For each exposure pathway, relevant on-site and off-site receptors have been identified. Based on available site information, this flowchart provides a site wide conceptual model of complete human exposure pathways at the Shell facility.

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Groundwater: There is no current use of the impacted groundwater in the area. Evaluation of groundwater use is included in the Management Option-2 Report of the CMS Work Plan (2001). Consequently, groundwater exposure to Residents, Workers, Day-Care Facilities, Trespassers, Recreational Individuals, or Food is not expected. Since first encountered groundwater occurs between 2 and 8 feet below ground surface, it is possible that direct exposure may be possible during construction activities.

Surficial Soils: Impacted surficial soils above risk-based limits are found only in SWMU 9 (inactive landfill). This is illustrated in Appendix C, Figure 2. Consequently, exposure to Residents, Day-Care Facilities, Recreational Individuals, or Food is not expected. Potential exposure to Workers, Construction Workers, and Trespassers is possible.

Surface Water: The impacted surface water is a shallow drainage ditch that is situated at the north end of the property. Since, this is not a drinking water source nor is it a likely water body for fishing, exposure to Residents, Workers, Day Care Facilities, Construction Workers, or Food is not expected. Potential exposure to Trespassers and Recreational Individuals is possible.

Sediment: The impacted sediments are in the shallow drainage ditch that is situated at the north end of the property. Limited activity at this location and exposure to sediments may occur. Exposure of Residents, Workers, Day Care Facilities, Construction Workers, and Food is not expected. Potential exposure to Trespassers and Recreational Individuals is possible.

Subsurface Soils: Impacted subsurface soils above risk-based limits are found only in SWMU 9 (inactive landfill) and SWMU 82. This is illustrated in Figure 2 of Appendix C. The subsurface soil impacts are greater than 3 feet in depth (most often greater than 10 feet below ground surface). Consequently, exposure to Residents, Workers, Day-Care Facilities, Trespassers, Recreational Individuals, or Food is not expected. Potential exposure to Construction Workers is possible.

Air (outdoors): Excavation activities may result in brief exposure to construction workers to vapors from soil or groundwater. Outdoor air exposure to Residents, Workers, Day-Care Facilities, Trespassers, Recreational Individuals, or Food is not expected.

Note that although the exposure pathways listed above are potentially complete, institutional and engineering controls are in place to prevent significant exposure (see question 4). Current OSHA health and safety protocols are in place to manage potential exposure during construction activities. The work permit process at the plant prevents the initiation of construction work without proper safety measures. Additionally, access has been restricted to the SWMU 9 area to prevent worker exposure to surficial soils at this location. Fencing has been installed around the site and south of the RR tracks to prevent trespasser access.

References:

- Equilon Enterprises, 2001. RCRA Corrective Measures Study Work Plan (Revision 2), Shell Chemical Company, Norco, Louisiana.
- Groundwater Technology, Inc., 1993. RCRA Facility Investigation, Phase I, Shell Norco, West Site.
- Shell Chemical Company, 1998. RECAP Screening Option Report: Risk-Based Assessment for the RCRA Corrective Measures Study.
- URS Greiner Woodward Clyde, 1999. Interim Measures Plan, Shell Chemical Company, Norco, Louisiana.
- Woodward-Clyde, 1997a. Phase II RFI/Groundwater Assessment Final Report, Shell Norco Chemical Plant-West Site.
- Woodward-Clyde, 1997b. Amended Phase I RFI Draft Report, Shell Norco Chemical Plant-West Site.

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

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4. Can the exposures from any of the complete pathways identified in #3 be reasonably expected to be "significant" (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 can not 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):

Several controls have been implemented at the facility to limit exposure from any of the complete pathways identified in question #3. These controls include standard operating procedures for the Shell Norco Plant (work permit procedures) and implementation of interim corrective measures. The interim corrective measures include hydraulic containment of groundwater and restriction of access to the inactive landfill area. The interim measures work plan was submitted to LDEQ in August 1999 and the interim measures certification report was submitted to LDEQ in April 2002. Additionally, natural conditions such as shallow surface water in the ditches and heavy foliage south of the rail road further limit exposure through the potentially complete pathways.

Soil concentrations exceeding risk-based limits were found only in samples collected on-site in SWMU 9 and SWMU 82. Security fences around the facility will prevent potential exposure to trespassers and access to SWMU 9 is restricted to plant personnel with a safety barricade. Additionally, current OSHA health and safety protocols are in place to manage potential exposure during construction activities.

The work permit process at the plant prevents the initiation of construction work without proper safety measures. Compliance with these procedures will prevent any significant exposures to construction workers (surficial soil, subsurface soil, shallow groundwater, and outdoor air).

Surface water and sediment impacts are predominantly between the north boundary of the facility and the Illinois Central Railroad. Access to this area is limited due to the steep railroad embankment, heavy foliage, and fences located between the facility property and railroad embankment. Sediment samples collected in the East-West Ditch do not have any chemicals exceeding the Soil RECAP Standards. Surface water in the East-West Ditch is shallow with depths generally between 6 and 12 inches (Huner, 2000). Incidental surface water ingestion and fish/shellfish ingestion from this area is highly unlikely, although dermal contact with surface water is possible. Average surface water concentrations in the East-West Ditch are very low and below GW3NDW RECAP Standards. Additional discussion of the East-West Ditch is included in Question 6, CA750.

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References:

- Equilon Enterprises, 2001. RCRA Corrective Measures Study Work Plan (Revision 2), Shell Chemical Company, Norco, Louisiana.
- Groundwater Technology, Inc., 1993. RCRA Facility Investigation, Phase I, Shell Norco, West Site.
- Huner, J.V., 2000. Crawfish Site Report, Shell Chemical Company, Norco Chemical Plant, Louisiana Ecrevisse.
- Shell Chemical Company, 1998. RECAP Screening Option Report: Risk-Based Assessment for the RCRA Corrective Measures Study.
- Shell Chemical Company, 2002. Progress Report – RCRA Corrective Measures Study, Interim Corrective Measures, Surface Water Monitoring Data, First Quarter 2002, Shell Chemical West Site, Norco, Louisiana.
- URS Greiner Woodward Clyde, 1999. Interim Measures Plan, Shell Chemical Company, Norco, Louisiana.
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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 - 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 Shell Oil Company, Norco Chemical Plant facility, EPA ID # LAD 980 622 104, located at 16122 River Road, Norco, LA 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) Jeffrey T. Jones Date 6/26/02
(print) Jeffrey T. Jones
(title) Geologist III, Environmental Technology Division

Supervisor (signature) Narendra M. Dave Date 6/26/02
(print) Narendra M. Dave
(title) Geologist Manager, Environmental Technology Division
Louisiana Department of Environmental Quality

Wfr 6/14/04 EPA

Locations where References may be found:

Louisiana Department of Environmental Quality, Baton Rouge, LA
Shell Oil Company, Norco Chemical Plant, 16122 River Road, Norco, LA

Contact telephone and e-mail numbers

(name) Jeffrey Jones, LDEQ, Office of Environmental Assessment, Environmental Technology Division
(phone #) (225)-765-0489
(e-mail) jeffreyj@deg.state.la.us

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.

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: Shell Oil Company, Norco Chemical Plant
Facility Address: P.O. Box 10, Norco, LA 70079
Facility EPA ID #: LAD 980 622 104

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 (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?

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):

RCRA Facility Investigation

In 1990, USEPA issued a hazardous waste permit to Shell requiring corrective action for Solid Waste Management Units (SWMUs) and other Areas of Concern (AOCs). Twelve SWMUs and 2 AOCs requiring investigation were identified by USEPA (see Figure 1 of Appendix C). The Closed Spent Raney Nickel Catalyst Impoundment (SWMU 5), the decommissioned VCM/EDC Manufacturing Unit (SWMU 82), the AN/AG Dowtherm area (Area of Concern B), and the Allyl Chloride area (additional area of groundwater contamination) also were identified by a Louisiana Department of Environmental Quality (LDEQ) order (G-E-90-017) dated June 6, 1991 (amended June 17, 1992) as requiring assessment of constituents in groundwater. Because of the overlapping requirements of the HSWA permit and the LDEQ order, the U.S. EPA, LDEQ, and Shell agreed to address these areas separately as the Phase II RFI.

The areas identified by the EPA were investigated by Shell in the RCRA Facility Investigation (RFI). Field activities for this investigation were conducted in 1992 and 1997 and the work was approved by LDEQ in May 1998. The results of these investigations are provided in the Phase I and Phase II RFI reports (Groundwater Technology, Inc., 1993; Woodward-Clyde, 1997a; Woodward-Clyde, 1997b). Impacts to groundwater, surficial soil, subsurface soil, surface water, and sediments were identified in the RFI. The sources of designation, RFI phase designation, and status of the SWMUs that were investigated in the RFI are summarized in Appendix D.

Site Hydrogeology

The RFI identified six lithologic zones of sediments, of which three contain affected water bearing zones. Groundwater in the affected water-bearing zones at the site has been determined to be of Groundwater Classification 3 (Equilon Enterprises, 2001).

RECAP Evaluation

Following the approval of the RFI, Shell initiated a Risk Evaluation/Corrective Action Program (RECAP) evaluation. This assessment consisted of several activities including:

- A screening assessment to establish the number of chemicals of concern (COCs) that will be assessed in the CMS. This evaluation concluded that less than 2/3 of the chemicals detected in groundwater needed to be included in the CMS (i.e., exceeded protective risk-based levels).
- Risk-based cleanup levels for the remaining COCs in groundwater were calculated following the methods provided in the LDEQ RECAP guidance. The measured concentrations on site were compared with the risk-based values to determine areas and chemicals that will require further action. A summary of these screening results is provided in Appendix C, Figures 3 and 4. These figures indicate the locations of the samples exceeding the screening risk-based concentrations.

Because Shell has determined that Zone I groundwater discharges to surface water, applicable standards will be developed under an MO-3 RECAP evaluation as proposed in the CMS Work Plan. Therefore, to date, Zone I groundwater constituent concentrations have been compared to GWNDW3 screening standards

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only. MO-2 RECAP Standards have been developed for Zone II and IV groundwater. The following table summarizes groundwater constituents, applicable RECAP standards and the groundwater zone(s) in which the standards have been exceeded.

Chemical	CAS No.	RECAP Standard	RS x Min DAF	Groundwater Zone		
				I	II	IV
1,1,2-Trichloroethane	79-00-5	GW3NDW	9.09E-03	X	X	X
1,1-Dichloroethene	75-35-4	GW3NDW	4.03E-02		X	
1,2-Dichloroethane	107-06-2	GW3NDW	8.84E-03	X	X	X
1,2-Dichloropropane	78-87-5	GW3NDW	7.50E-03		X	
2-Butanol (sec-Butanol)	78-92-2	GW3NDW	5.48E-01	X		
2-Butanone (MEK)	78-93-3	GW3NDW	3.88E+02	X		
Acetone	67-64-1	GW3NDW	7.20E+02	X		
Benzene	71-43-2	GW3NDW	1.88E-02	X	X	
Biphenyl (Diphenyl)	92-52-4	GW3NDW	2.65E-01	X	X	
Biphenyl ether	101-84-8	GW3NDW	9.50E-01	X	X	
Bis(2-chloroethyl)ether	111-44-4	GW3NDW	4.12E-04		X	
Chloride	16887-00-6	GW3NDW	5.00E+02		X	X
Dichloromethane	75-09-02	GW3NDW	8.70E-02		X	
N-Nitroso di-n-propylamine	621-64-7	GW3NDW	5.43E-03		X	
sec-Butyl ether	6863-58-7	GW3NDW	4.05E+00	X		
Sulfolane	126-33-0	GW3NDW	2.16E+01	X	X	
Tetrachloroethene	127-18-4	GW3NDW	3.75E-03		X	X
Tetrahydrothiophene	110-01-0	GW3NDW	2.72E+00	X	X	
Trichloroethene	79-01-6	GW3NDW	3.25E-03	X	X	
Vinyl chloride	75-01-4	GW3NDW	1.18E-01		X	

Preliminary results of the MO-2 (Zone II and IV groundwater) analysis included in the CMS Work Plan indicate that only 5 of the SWMUs require additional evaluation in the CMS.

SWMU	Area	Groundwater Zone
SWMU 9	Inactive Landfill	II and IV
SWMU 26	pH Basin	II
SWMU 59	Inactive Backwash Pit	II
SWMU 82	Decommissioned VCM/EDC Manufacturing Unit	II and IV
SWMU 97	New SWMU at T Unit	II and IV

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References:

- Equilon Enterprises, 2001. RCRA Corrective Measures Study Work Plan (Revision 2), Shell Chemical Company, Norco, Louisiana.
- Groundwater Technology, Inc., 1993. RCRA Facility Investigation, Phase I, Shell Norco, West Site.
- Shell Chemical Company, 1998. RECAP Screening Option Report: Risk-Based Assessment for the RCRA Corrective Measures Study.
- Shell Chemical Company, 2002. Progress Report – RCRA Corrective Measures Study, Interim Corrective Measures, Surface Water Monitoring Data, First Quarter 2002, Shell Chemical West Site, Norco, Louisiana.
- URS Greiner Woodward Clyde, 1999. Interim Measures Plan, Shell Chemical Company, Norco, Louisiana.
- Woodward-Clyde, 1997a. Phase II RFI/Groundwater Assessment Final Report, Shell Norco Chemical Plant-West Site.
- Woodward-Clyde, 1997b. Amended Phase I RFI Draft Report, Shell Norco Chemical Plant-West Site.

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"¹² 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"¹².
- If no (contaminated groundwater is observed or expected to migrate beyond the designated locations defining the "existing area of groundwater contamination"¹²) - 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):

In preparation of RECAP Management Option-2 Report, Shell examined concentration trends for 1,2-dichloroethane, sulfolane and sec-butyl ether in downgradient monitor wells for the EDC, Sulfolane and Allyl Chloride Areas, respectively (Table 2; from 1992-1998 Remediation Systems Status Reports). Data summarized in the Management Option-2 Report clearly demonstrate declining conditions for 1,2-dichloroethane. Sulfolane concentrations have decreased since 1994. Finally, sec-butyl ether concentrations appear to be relatively stable. Historical releases are not continuing sources of COCs and groundwater seepage velocities are known to be very low at the plant.

Shell submitted an Interim Measures Plan to LDEQ in December 1999 as a basis for implementing interim/stabilization measures for SWMUs in advance of completion of the CMS. Shell anticipated that the interim measures would be consistent with, and may constitute major components of, the recommended final comprehensive corrective measures for the site. Shell plans to utilize all findings from implementation of the interim measures in preparation of the CMS. Activities associated with implementation of the Interim Measures Plan are reported to LDEQ on semi-annual basis in *Status Report - Remediation Systems and Corrective Measures*, beginning with the reporting period July - December 2000.

A pair of interceptor trenches was constructed downgradient of SWMU 26 and 97, both located in the northeast corner of the plant, and parallel to the ICRR. The trench system became fully operational in June 2001. The objective of this system is to control Zone I and Zone II groundwater flow and intercept groundwater discharge to the shallow ditches (Ditch 5, Ditch 6 and the Parallel Ditch) in the area between the plant north fence line and the ICRR. A network of piezometers is monitored periodically to evaluate the operation of the interceptor trench. Figure 6 shows the location of the interceptor trench and monitored piezometer and ditch locations. Shell submitted *Interim Measures Certification Report* to LDEQ in April 2002 documenting details of interim measures implemented at SWMUs 26 and 97. Ongoing operation of the interceptor trench system is reported in the semi-annual report, *Status Report - Remediation Systems and Corrective Measures*.

Proposed Interim Measures for SWMU 9 include evaluation of natural attenuation and phytoremediation processes in reducing groundwater constituent concentrations and stabilization of the affected groundwater, potentially minimizing or even preventing off-site constituent migration in the SWMU 9 area.

The groundwater quality monitoring system consists of a series of paired piezometers (Zone I and Zone II) that are aligned along a roughly north-south transect through SWMU 9. Additional piezometers in the area are also used for potentiometric measurements of Zone I and Zone II groundwater. The SWMU 9 groundwater monitoring system is shown in Figure 7. The sampling program for SWMU 9 includes the natural attenuation parameters (dissolved oxygen, oxidation-reduction potential, pH, specific conductance, temperature, ferrous iron, ferric iron, total iron, nitrate and sulfate) and selected COCs. Semi-annual sampling began in January 2001. Shell is currently presenting data for SWMU 9, including water level data, natural attenuation parameters and constituent concentrations for the monitoring network in the semi-

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annual report, *Progress Report, Second Quarter 2001 – RCRA Corrective Measures Study, Interim Corrective Measures*. These data further demonstrate the stability of the affected groundwater at the plant.

In Zone IV, EDC, 1,1,2-trichloroethane, trichloroethene, tetrachloroethene and tetrahydrothiophene were detected in only the plant area. Groundwater samples from Zone IV north of the plant fence line have shown no detected constituents. Therefore, the Interim Measures Plan does not address the occurrence of constituents in Zone IV in the northwest corner of the plant.

References:

- Equilon Enterprises, 2001. RCRA Corrective Measures Study Work Plan (Revision 2), Shell Chemical Company, Norco, Louisiana.
- Groundwater Technology, Inc., 1993. RCRA Facility Investigation, Phase I, Shell Norco, West Site.
- Shell Chemical Company, 1998. RECAP Screening Option Report: Risk-Based Assessment for the RCRA Corrective Measures Study.
- Shell Chemical Company, 2001. Progress Report, Second Quarter 2001, RCRA Corrective Measures Study, Interim Corrective Measures, Shell Chemical West Site, Norco, Louisiana.
- Shell Chemical Company, 2002. Status Report, Remediation Systems and Interim Corrective Measures, July 2001 – December 2001, Norco Chemical Plant – West Site, Shell Chemicals LP.
- URS Greiner Woodward Clyde, 1999. Interim Measures Plan, Shell Chemical Company, Norco, Louisiana.
- URS, 2002. Interim Measures Certification Report, Shell Chemical Company, Norco, Louisiana.
- Woodward-Clyde, 1997a. Phase II RFI/Groundwater Assessment Final Report, Shell Norco Chemical Plant-West Site.
- Woodward-Clyde, 1997b. Amended Phase I RFI Draft Report, Shell Norco Chemical Plant-West Site.

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.

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

X 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):

The hydrogeologic conditions were defined during the RFI and are described in detail in the RFI reports. Existing groundwater flow data suggests that shallow groundwater from a discontinuous sandy/silty permeable portion of Zone I has potential to discharge to stormwater ditches along the north plant property boundary. A south-north cross section illustrating potential groundwater-surface water interaction is shown in Figure 8.

As a conservative measure, interim corrective measures have been implemented (previously described in #2) to manage potential discharge of affected groundwater to surface water. The interim measures are consistent with *Interim Measures Plan* submitted to LDEQ in December 1999.

References:

- Equilon Enterprises, 2001. RCRA Corrective Measures Study Work Plan (Revision 2), Shell Chemical Company, Norco, Louisiana.
- Groundwater Technology, Inc., 1993. RCRA Facility Investigation, Phase I, Shell Norco, West Site.
- URS Greiner Woodward Clyde, 1999. Interim Measures Plan, Shell Chemical Company, Norco, Louisiana.
- Woodward-Clyde, 1997a. Phase II RFI/Groundwater Assessment Final Report, Shell Norco Chemical Plant-West Site.
- Woodward-Clyde, 1997b. Amended Phase I RFI Draft Report, Shell Norco Chemical Plant-West Site.

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5. Is the discharge of "contaminated" groundwater into surface water likely to be "insignificant" (i.e., the maximum concentration³ 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 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 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.

X 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.

_____ If unknown - enter "IN" status code in #8.

Rationale and Reference(s):

Surface water samples have been collected and analyzed for site constituents at this location since 1993 and this activity continues as part of the interim measures. A complete listing of the surface water analytical results for samples collected from the ditches north of the plant is included in Appendix C, Table 1 and the locations are shown on Figure 9. These data indicate discharge of groundwater into surface water may not be insignificant. The table below lists the chemicals detected in surface water, the appropriate risk-based level, and the range of concentrations detected.

To evaluate whether the groundwater concentrations are increasing, the table below lists the range of concentrations detected throughout the surface water sampling program (1993 to present) and the range of results over approximately the past 3 years (1999 - present). The maximum surface water concentrations for many of the constituents were detected early in the sampling program and the concentration ranges for samples collected since 1999 are smaller than the historical ranges. However, no clear trend is evident based on the surface water data collected over the past three years.

No calculations for the mass of contaminants being discharged to surface water have been made. However, the groundwater recovery trench near the north property boundary will limit the discharge of the contaminants to surface water.

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Chemical	CAS No.	RECAP Standard	Value (mg/L)	Conc. Range 1993 – present (mg/L)	Conc. Range 1999 – present (mg/L)
Surface Water:					
1,1,2-Trichloroethane	79-00-5	GW3NDW	6.99E-03	ND – 0.623	ND – 0.623
1,2-Dichloroethane	107-06-2	GW3NDW	6.80E-03	ND – 12.3	ND – 1.97
1,2-Dichloropropane	78-87-5	GW3NDW	5.00E-03	ND – 0.035	ND – 0.035
Benzene	71-43-2	GW3NDW	1.25E-02	ND – 1.4	ND – 0.04
Biphenyl ether (Diphenyl ether)	101-84-8	GW3NDW	9.50E-01	ND – 0.165	ND – 0.014
Sec-Butyl ether	6863-58-7	GW3NDW	4.05E+00	ND – 0.42	ND – 0.233
Sulfolane	126-33-0	GW3NDW	1.44E+01	ND – 126	ND – 8.6
Tetrachloroethene	127-18-4	GW3NDW	2.50E-03	ND – 0.013	ND – ND
Tetrahydrothiophene	110-01-0	GW3NDW	1.81E+00	ND – 8.1	ND – 3.4
Trichloroethene	79-01-6	GW3NDW	2.10E-03	ND – 0.058	ND – 0.028

References:

- Equilon Enterprises, 2001. RCRA Corrective Measures Study Work Plan (Revision 2), Shell Chemical Company, Norco, Louisiana.
- Groundwater Technology, Inc., 1993. RCRA Facility Investigation, Phase I, Shell Norco, West Site.
- Shell Chemical Company, 2002. Progress Report – RCRA Corrective Measures Study, Interim Corrective Measures, Surface Water Monitoring Data, First Quarter 2002, Shell Chemical West Site, Norco, Louisiana.
- URS Greiner Woodward Clyde, 1999. Interim Measures Plan, Shell Chemical Company, Norco, Louisiana.
- Woodward-Clyde, 1997a. Phase II RFI/Groundwater Assessment Final Report, Shell Norco Chemical Plant-West Site.
- Woodward-Clyde, 1997b. Amended Phase I RFI Draft Report, Shell Norco Chemical Plant-West Site.

³ 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*)?

 X 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,* 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):

An interim assessment was conducted by wildlife biologists to determine whether the surface water impacts are "currently acceptable". The interim assessment report and site description report are included in Appendix E. This evaluation concluded that the potential discharge of groundwater into the East-West ditch is not causing impacts to surface water, sediments, or ecosystems that require an interim remedy. This conclusion is derived from the following observations:

- The East-West ditch is a shallow, eutrophic drainage system that is unlikely to serve as quality wildlife habitat.
- The COPECs found in the ditch have a low frequency of detection (range 2 - 28%) and recent concentrations (1999 - present) are lower than the historical maximum concentrations (1993 - present);
- There is not an immediate risk to aquatic life from direct contact with surface water. The 95% UCL concentrations for chemicals of potential ecological concern (COPEC) and maximum concentrations measured since 1999 are below the acute and chronic screening levels for aquatic life protection standards.
- For all COPECs, tissue concentrations are orders of magnitude lower than those in the sediment or the surface water. These data suggest that the constituents in East-West Ditch are not concentrating in crawfish and will most likely not accumulate in higher trophic levels.

References:

- Humer, J.V., 2000. Crawfish Site Report, Shell Chemical Company, Norco Chemical Plant, Louisiana Ecrevisse.
- Shell Global Solutions, 2002. Norco East-West Ditch RCRA Corrective Action Environmental Indicators Checklist (CA750) - Question 6.

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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.

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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):

The Interim Measures Plan (URS Greiner Woodward Clyde, 1999) includes the groundwater and surface water sampling plan to verify that groundwater contamination will not migrate beyond the existing impacted area. Additionally, the data collected during surface water monitoring will be used to evaluate the trend of chemical concentrations detected in surface water. The monitoring plan includes:

- Groundwater monitoring in Zone I and Zone II groundwater piezometers to assess the hydraulic effectiveness of the groundwater recovery trench. Potentiometric data and groundwater concentration data are collected on a quarterly basis from a network of piezometers identified in Figure 6.
- Additional groundwater samples are collected north of SWMU 9 to evaluate the potential roles of natural attenuation and phytoremediation process in this area. Groundwater samples are collected on a quarterly basis from a network of wells screened in Zone I and Zone II groundwater. In addition to potentiometric data and chemical analysis, these samples are monitored for natural attenuation parameters. The locations of these wells are illustrated in Figure 7.
- Surface water samples are collected on a quarterly basis and analyzed for the surface water constituents of concern. The locations of these sample points are identified in Figure 9.

Shell currently prepares Remediation Systems Status Reports for submittal to LDEQ on a semiannual basis. These reports summarize the operations of the groundwater remediation systems and groundwater monitoring data. Additional, potentiometric data and groundwater concentration data to evaluate on-site remediation systems are collected on a quarterly basis for these reports.

References:

- URS Greiner Woodward Clyde, 1999. Interim Measures Plan, Shell Chemical Company, Norco, Louisiana.
 - Shell Chemical Company, 2002. Status Report, Remediation Systems and Interim Corrective Measures, July 2001 - December 2001, Norco Chemical Plant - West Site, Shell Chemicals LP.
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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 Shell Oil Company, Norco Chemical Plant facility, EPA ID # LAD 980 622 104, located at 16122 River Road, Norco, Louisiana. 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) Jeffrey T. Jones Date 6/26/02
(print) Jeffrey T. Jones
(title) Geologist III, Environmental Technology Division

Supervisor (signature) Narendra M. Dave Date 6/26/02
(print) Narendra M. Dave
(title) Geologist Manager, Environmental Technology Division
Louisiana Department of Environmental Quality

4/6/09 EPA

Locations where References may be found:

Louisiana Department of Environmental Quality, Baton Rouge, LA
Shell Oil Company, Environmental Department, 16122 River Road, Norco, LA

Contact telephone and e-mail numbers

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Attachments
Available
Upon Request