

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: The Dow Chemical Company, Texas Operations
Facility Address: 2301 N. Brazosport Blvd. Freeport, TX
Facility EPA ID #: TXD008092793

1. Has **all** available relevant/significant information on known and reasonably suspected releases to the groundwater media, subject to RCRA Corrective Action (e.g., from Solid Waste Management Units (SWMU), Regulated Units (RU), and Areas of Concern (AOC)), been **considered** in this EI determination?
- X If yes - check here and continue with #2 below.
- If no - re-evaluate existing data, or
- if data are not available, skip to #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).

**Migration of Contaminated Groundwater Under Control
Environmental Indicator (EI) RCRIS code (CA750)**

Page 2

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): - Documentation of contamination in the groundwater has been submitted to the TCEQ in many corrective action investigation reports (RFI/CMS) since 1989. This information was summarized in the TCEQ Permit/Compliance Plan application initially submitted in May 2000 and amended in submittals dated April 5, 2001; April 19, 2001; August 30, 2001; and September 29, 2001. This application included requests for approval of Facility Operations Areas (FOAs) for the Plant A and Plant B Sites. The Facility Operations Areas consolidate corrective action for the solid waste management units and all other areas of concern. This request was approved with issuance of a revised permit/compliance plan on March 29, 2004. Additional documentation regarding contamination levels in groundwater has been submitted to the TCEQ in the semi-annual reports as required by Permit/Compliance Plan No. CP-50161001 and in a recent report, *Dow Plant A and B Investigation: Outside FOA Boundary*, submitted September 30, 2004.

A specific list of hazardous constituents detected in groundwater at the facility can be found in Table II. 5 of the Compliance plan application form submitted in the April 5, 2001 revision to the May 2000 compliance plan modification application. The indicator parameter constituents include Benzene, Dichloroethane, 1,2-, Dichloropropane, 1,2-, Tetrachloroethene, Trichloroethane, 1,1,1-, Trichloroethene, Trichloropropane, 1,2,3-, and Vinyl chloride.

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).

**Migration of Contaminated Groundwater Under Control
Environmental Indicator (EI) RCRIS code (CA750)**

Page 3

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)?

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 and Reference(s):

As indicated previously, documentation of contamination in the groundwater was submitted to the TCEQ in many corrective action investigation reports. This information was summarized in the TCEQ Compliance Plan application initially submitted in May 2000 and amended in submittals dated April 5, 2001; April 19, 2001; August 30, 2001; and September 29, 2001. This application included proposed corrective action including requests for approval of Facility Operations Areas (FOAs) for the Plant A and Plant B Sites. These requests were approved with issuance of a revised compliance plan on March 29, 2004.

A more recent assessment report, *Dow Plant A and B Investigation: Outside FOA Boundary*, was submitted to TCEQ on September 30, 2004. This report indicates plume growth is not occurring outside the FOA boundaries. Semi-annual reports required by the compliance plan demonstrate the Oyster Creek Site groundwater plumes are stabilized. The supplemental submittal to the semi-annual report submitted on December 10, 2004, contains data indicating the plume in the Slaughter Road Area is stabilized.

An additional assessment of surface water bodies, *Dow Plant A and Plant B Tier 2 SLERA*, includes information demonstrating that no significant impact is occurring to surface water bodies.

Dow has completed assessments of all potential groundwater-to surface-water migration pathways. Where assessments indicated potentially significant impact, barrier walls or hydraulic control systems have been installed to limit the potential impact to surface water. Based on the assessment submitted in September 2004 and the planned submittal in the first quarter 2005, Dow believes that any discharge of contaminated groundwater is stabilized and that unacceptable impacts to surface water, sediments, or eco-systems are not occurring.

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.

**Migration of Contaminated Groundwater Under Control
Environmental Indicator (EI) RCRIS code (CA750)**

Page 4

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)

Documentation of the geology and hydrogeology was provided in Sections 5.4 – 5.6 of Volume 3 of the compliance plan modification application referenced on Page 2 and figures (i.e., cross-sections and other maps) were provided in Volumes 6 and 7 of the application. Potentially affected surface water bodies are the Brazos River, the Freeport Harbor, the East Union Bayou Marsh, the Dow Barge Canal, and the Clute-Lake Jackson Drainage Canal. At the Oyster Creek Site, there is no discharge into surface water.

Based on a review of groundwater data collected in historical investigations, contamination levels are not expected to exceed the GWPS established by the compliance plan in areas where open groundwater-to surface-water migration pathways exist. As described on response to Question 5, corrective action has been taken at several locations to stabilize groundwater movement into surface water. However, groundwater outside the barrier/hydraulic control system with COC concentrations potentially exceeding GWPS may be discharging into surface water in those areas.

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

**Migration of Contaminated Groundwater Under Control
Environmental Indicator (EI) RCRIS code (CA750)**

Page 5A

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)?

X If yes - skip to #7 (and enter “YE” status code in #8 if #7 = yes), after documenting: 1) the maximum known or reasonably suspected concentrations³ 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 concentrations³ 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)

As indicated in response to Question 3, groundwater outside barrier/hydraulic controls systems with COCs potentially above PCLs may be migrating into surface water. The Barrier/hydraulic control systems are described below:

Plant A Site

A-16-22 – A barrier wall has been installed along the Freeport Harbor Channel/hydraulic control wells have been installed. Constituents potentially discharged include 1,1 dichloroethene (6.2 mg/L), and tetrachlorethene (85 mg/L). These concentrations are isolated and not widespread.

A-27 – No evidence of discharge to surface water/horizontal wells have been installed (not currently operational) to recover contaminated groundwater. Constituents potentially discharged include 1,2-dichloroethane (9 mg/L), and 1,1,2,2-tetrachlorethene (8.1 mg/L). These concentrations are not widespread and within the concentrations determined to be insignificant.

A-41/42 - barrier walls have been installed or extended along the Plant A Barge Canal and the Clute-Lake Jackson Drainage Canal/hydraulic control wells have been installed.

Plant B Site

B-10 – enhanced biological treatment has been instituted. Constituents potentially discharged include 1,1 dichloroethene (6.2 mg/L), and tetrachlorethene (85 mg/L). These concentrations are isolated and not widespread.

B-47 – a barrier wall has been installed around the block and hydraulic control wells have been installed. Constituents potentially discharged include 1,2 dichloroethene (290 mg/L), and 1,2-dichloropropane (610 mg/L). These concentrations are located where the barrier wall was installed and have been declining since corrective action was implemented.

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

**Migration of Contaminated Groundwater Under Control
Environmental Indicator (EI) RCRIS code (CA750)**

Page 5B

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)?

Rationale and Reference(s) continued:

Additional assessment information concerning potential surface water pathways was included in the *Plant A and B Investigation: Outside the FOA Boundary* report submitted to TCRQ on September 30, 2004. An additional assessment of surface water bodies, *Dow Plant A and Plant B Tier 2 SLERA*, is being completed and includes information that no significant impact is occurring to surface water bodies or to ecological systems. The report verifying this information is due by April 2005. Based on this information, it appears that any discharge of contaminated groundwater outside the barrier/hydraulic control systems is “insignificant” and that unacceptable impacts to surface water, sediments, or eco-systems are not occurring.

**Migration of Contaminated Groundwater Under Control
Environmental Indicator (EI) RCRIS code (CA750)**

- 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 implemented⁴)?

_____ 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): _____

⁴Note, 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.

⁵The 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.

Migration of Contaminated Groundwater Under Control
Environmental Indicator (EI) RCRIS code (CA750)

Page 7

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 Compliance Plan issued March 29, 2004 has a detailed, specific monitoring program for both ground water and surface water that is required to be reported to the TCEQ semi-annually. The monitoring program specified in the compliance plan appears to be capable of documenting that area of existing ground water contamination are not expanding and should also document the positive results that implemented corrective action has on ground water quality and plume size and concentration.

**Migration of Contaminated Groundwater Under Control
Environmental Indicator (EI) RCRIS code (CA750)**

Page 8

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 Dow Chemical Company, Texas Operations facility, EPA ID # TXD008092793, located at Freeport, Texas. 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 3/22/05
(print) Mark E. Erwin
(title) Project Manager

Supervisor (signature) _____ Date 3/22/05
(print) Cathy Remmert
(title) Team Leader
Texas Commission on Environmental Quality

Locations where References may be found:

TCEQ Central Records, Austin, Texas

Contact telephone and e-mail numbers

**Project Manager listed above
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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.

