

**RCRA Corrective Action
Environmental Indicator (EI) RCRIS code (CA 750)**

Migration of Contaminated Groundwater Under Control

Facility Name: Akzo Nobel Chemicals Inc.

Facility Address: Delaware City, Delaware

Facility EP A ID#: DED 980 551 667

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 (RD), 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 is 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 groundwater and contaminants within groundwater (e.g., non-aqueous phase liquids or NAPLs). Achieving this EI does not substitute for achieving other

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

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).

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 References:

The Akzo Nobel Chemicals Inc. facility was built on green space in 1960 and was used solely for the manufacture of carbon disulfide and sodium hydrosulfide. The plant is no longer operating; all equipment has been removed, and only vacant buildings remain. Akzo Nobel owns 191 acres of land. Sixty-eight acres comprise the former plant area; 16 acres of this is undeveloped land and is referred to as the Undeveloped Parcel. The plant area and the undeveloped land are the focus of Akzo Nobel's RCRA Corrective Action project. The remainder of the property is a 123-acre parcel which is, and has historically been used exclusively for agricultural purposes. The Akzo Nobel property is bounded to the south by Formosa Plastics (listed on the National Priorities List as the Delaware City PVC Site), and American Mirrex (under State-led remediation), and to the east by the Valero Refinery (formerly known as the Motiva Enterprises Refinery), which is being investigated under both federal and state programs.

The Akzo Nobel property and adjoining area have been extensively investigated since the mid-1980s as part of the CERCLA-led investigation of the Delaware City PVC Site. Akzo Nobel started its RCRA VI/RFI investigations in the early 1990's, which focused on the former plant area and the undeveloped parcel of land, which includes a landfill that was used to dispose of off-specification sulfur (the landfill is not a Solid Waste Management Unit under RCRA), and an adjoining strip of land, known as the Barren Area. The only formerly RCRA-regulated unit on the property was a drum

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 (CA 750)**

storage area in the former plant area. Within the area used for chemical plant operations, the investigation focused on the following Areas of Concern (AOCs): transformer pads, drainage features and sumps, and ground water beneath the former plant area and the undeveloped parcel. Data used to complete this Environmental Indicator (EI) form can be found in the following documents:

- □ Dames & Moore report entitled, “Impact of Proposed Industrial Landfill on Possible Groundwater Remediation Projects”, October 18, 1991.
- □ Rous Associates report entitled, “Response to USEPA’s June 19, 1992 Letter Concerning Additional Work, ICI Americas Inc., Delaware City PVC Site, October 6, 1992.
- □ Technical Memorandum - Results of Phase I, RCRA Facility Investigation/Verification Sampling, ERM, August 1999.
 - RCRA Facility Investigation Phase II, ERM, April 2002.
 - Letter to Ms. Linda Holden (USEPA) from ERM dated 20 July 2003 transmitting the Results of Supplemental Tetrachloroethene Delineation.
 - Letter to Ms. Linda Holden (USEPA) from ERM dated 10 March 2005, transmitting the Results of Tetrachloroethene Delineation on Premcor and Akzo Nobel premises.
 - Letter to Ms. Linda Holden (USEPA) from Akzo Nobel, dated December 20, 2005, transmitting a Proposed Sampling Scope for Supplemental Tetrachloroethene Delineation.
 - Table entitled “Analytical Results for Ground Water Samples, Supplemental Tetrachloroethene Delineation, Akzo Nobel Chemicals, Inc., Delaware City, Delaware”. (Table contained raw data from the May 2006 sampling event and was passed out to participants of the July 19, 2006 meeting between Akzo, EPA, and DNREC.)

Akzo Nobel's investigation included the installation of eleven piezometers (P1 through P6 and TP-11 through TP-15), seven geoprobe holes (direct push, one-time sampling locations; identified as GP-1 through GP-7) and the installation of one additional monitoring well (P-7). Five ground water sampling events have been completed by Akzo Nobel for VOCs; and two, for inorganics and semivolatiles compounds. Akzo Nobel also had access to monitor wells identified as OW-8, OW-10, OW-50, OW-51, and the numerous Motiva wells that were installed as part of the investigations on adjoining properties. Also, data collected by others on-and off the Akzo Nobel property have been used for this evaluation. The locations of the above wells are shown on Figure 1.

The ground water data collected to date indicate that the compounds present in ground water above the United States Environmental Protection Agency (USEPA) Region 3 Tap Water Risk Based Criteria (RBCs) dated 7 April 2005, include the volatile organic compounds (VOCs) 1,2-dichloroethane (1,2-DCA), 1,2-dichloropropane (1,2-DCP), chloroform, tetrachloroethene (PCE), trichloroethene (TCE) and vinyl chloride. The following inorganic compounds (total analysis) have been detected above the RBCs: manganese, arsenic, hexavalent chromium, and nickel. The locations of the maximum concentration and the range of detected concentrations compared to the RBCs for each parameter are summarized below.

Compound	Max. Conc. Location	Range of Concentration (ppb)	USEPA RBC (ppb)
1,2-DCP	OW-10	1U-17	0.16
1,2-DCA	TP-13	2U-130	0.12
Chloroform	TP -11	5U- 4J	0.15
PCE	P-5	1U- 2,300	0.10
TCE	P-5	1U- 31	0.026
Vinyl Chloride	TP-12	5U- 39	0.015

Manganese	TP-14	4.6- 17,100	730
Arsenic	TP -11	3.2U- 22.4	0.045
Hexavalent Chromium	TP-15	10U- 647	110
Nickel	TP-15	1.4U- 3,640	730

U-not detected at the quantitation limit indicated

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

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"

_____ If no - (contaminated groundwater is observed or expected to migrate beyond the designated locations defining the "existing area of groundwater contamination") 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 general, the wells with the highest non-PCE VOC concentrations are located hydraulically upgradient of the undeveloped parcel and include wells TP-12, TP-13, TP-14 and OW-I0. These wells are in the path of a ground water plume flowing from the Formosa Plastics property. This plume is captured by a pumping system to the west operated by Formosa Plastics under EPA's Superfund program. Wells downgradient of the undeveloped parcel have lower VOC concentrations, indicating that the plume is decreasing in concentration in the downgradient direction. Well P-5, located on the eastern side of the plant property historically contained the highest level of PCE of the wells on Akzo Nobel premises. The concentration measured in this well has varied seasonally between 140 and 2,300 ppb. Additionally, property boundary well P-7 has had PCE concentrations ranging from 110 to 1,600 ppb. There is no known source of PCE on the plant site, and various plume delineation studies and related soil sampling events performed under Corrective Action yielded no evidence of an existing PCE mass in site soil.

As noted in the March 10, 2005 letter to EPA, the extent of the PCE plume to the east of the plant is defined. Sampling completed since then, including the latest rounds in 2006, has further verified PCE plume trends beneath Valero's property. The 2006 sampling events included numerous wells on Valero's property that were chosen to comprehensively evaluate plume extent in multiple potential directions. Valero monitoring wells included MW-3S, MW-4S, MW-8S, MW-10S, 9MW-4, C-5 and C-32. Results continue to indicate that the PCE plume does not extend beyond well C-32. The plume extends beneath closed landfills on the Valero property, and it is unknown whether these units contribute to the plume. Since there is no additional source loading, and the extent of the plume is similar to, or smaller than, that observed in previous samplings conducted by others, it is believed that this plume is stable, and future monitoring will be done to verify the continued stability of this

PCE plume.

Manganese is detected in wells on the undeveloped parcel, with the highest concentration found in the upgradient well TP-14, which borders the Formosa property.

Wells TP-9, TP-11, and TP-15 contained arsenic, hexavalent chromium (except well TP-9), and nickel above the RBCs. These wells are in the undeveloped area of the property, and the limit of the RBC exceedences is above the closest downgradient wells (TP-1, TP-10, and P-1).

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 (CA 750)

Iron above the RBCs was detected in one well (P-1), and bis (2-ethylhexyl) phthalate was detected in one well (TP-9) above the RBC. Both results are considered anomalous, because they were detected one time and at only one location.

Based on ground water monitoring data collected over a time span of over 15 years, a reasonable conclusion can be made that the lateral migration of contaminated ground water has stabilized. The ground water analytical data indicate that the location of compounds exceeding the RBCs has been generally consistent, and the downgradient extent of these exceedences is identified. The identified contaminant plumes appear stable and do not appear to be extending beyond the boundaries identified by the existing groundwater monitoring system. The inorganic compounds have a low mobility in the shallow aquifer at the site and were not observed to have migrated any great distance from their presumed source areas on the Formosa property or undeveloped parcel. It is reasonable to expect that the VOC plume will not expand, but rather will decrease in extent over time, based on the ground water analytical results collected to date, the lack of additional source loading, and the natural attenuation processes of dilution and adsorption. For the inorganics, EPA has concurred that the manganese exceedences are from the adjoining properties. With regard to the other inorganics, the landfill and Barren Area on the undeveloped parcel (the presumed sources of these other inorganics) will undergo interim measures in the near future that will serve as the final corrective action. Finally, there are no other known or suspected source area(s) on the Akzo Nobel property that require corrective action.

Vertical ground water migration is considered an unlikely significant factor at the site, because a thick, continuous clay layer has been identified immediately below the shallow, unconfined aquifer. Furthermore, no DNAPL source is believed to exist beneath the site that would indicate potential free-product pooling at the base of the unconfined aquifer (and, therefore, potential downward penetration/migration into lower lithologic/water-bearing units).

**Migration of Contaminated Groundwater Under Control
Environmental Indicator (EI) RCRIS code (CA 750)**

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

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

X If no - skip #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):

Ground water from the Akzo Nobel facility that contains compounds above the RBCs does not discharge into adjoining surface water bodies. The two closest surface water bodies are Dragon Run (approximately 4,000 feet south of the property) and Red Lion Creek (approximately 4,500 feet north of the property). Both surface water bodies are sidegradient to the primary direction of shallow ground water flow from the property, which is to the east. Ground water flow in the shallow aquifer ultimately shifts to the north in the vicinity of the Land Treatment Unit (LTU) at the Valero facility. This unit is roughly 6000 feet to the east of Akzo. The LTU, in turn, is roughly 2000 feet south of Red Lion Creek. Trends indicating plume stabilization/shrinkage well to the west of the LTU suggest that contaminated ground water beneath the Akzo site is unlikely to travel the 8000-foot distance to impact Red Lion Creek.

Migration of Contaminated Groundwater Under Control
Environmental Indicator (EI) RCRIS code (CA 750)

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 #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.

_____ 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): N/A

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 (CA 750)**

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 ecosystems, 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): N/A

⁴Note, because areas of in flowing 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 ecosystems.

Migration of Contaminated Groundwater Under Control
Environmental Indicator (EI) RCRIS code (CA 750)

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 vertical, 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):

Akzo Nobel has performed several rounds of groundwater sampling at the facility. The data collected from these events were used as the bases for the statements made in item #3 of this EI. These data will be used as the baseline for future monitoring. In the future, monitoring will be performed to evaluate the performance of the corrective action to be performed for the landfill and Barren Area. This future monitoring will be performed for arsenic, hexavalent chromium and/or nickel at wells TP-9, TP-11, TP-14, and TP-15. This monitoring program for the landfill and Barren Area will be submitted to EPA as part of the long-term maintenance plan for these capped areas. It is expected that the long-term groundwater monitoring system will make use of the existing piezometer/well network in place at the property.

In addition, on December 20, 2005, Akzo Nobel submitted a work plan to the EPA that will entail quarterly monitoring of wells for four (4) consecutive quarters to continue evaluation of the aforementioned PCE plume. Twelve (12) wells comprise the monitoring network, nine (9) of which track the plume beneath the Valero property. Should results of these four rounds of sampling verify continuation of a stable or shrinking plume, Akzo will likely scale back frequency of sampling (subject to EPA approval) as part of their long term monitoring efforts.

**Migration of Contaminated Groundwater Under Control
Environmental Indicator (EI) RCRIS code (CA 750)**

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 **Akzo Nobel Chemicals Inc.** facility, EPA ID# **DED 980 551 667**, located at **Delaware City, Delaware.** 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 reevaluated 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 _____

Eric J. Trinkle
(print)

Hydrologist IV
(title)

Supervisor _____
(signature)

Date _____

Karen G. J'Anthony
(print)

Program Manager I
(title)

State of Delaware, EPA Region III
(EPA Region or State)

**Migration of Contaminated Groundwater Under Control
Environmental Indicator (EI) RCRIS code (CA 750)**

Locations where References may be found:

Delaware Department of Natural Resources and Environmental Control
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