

DOCUMENTATION OF ENVIRONMENTAL INDICATOR DETERMINATION
Interim Final 2/5/99
RCRA Corrective Action
Environmental Indicator (EI) RCRAInfo code (CA750)

Migration of Contaminated Groundwater Under Control

Facility Name:	DuPont Chambers Works
Facility Address:	Deepwater, NJ
Facility EPA ID #:	NJD 002385730

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 RCRAInfo national database ONLY as long as they remain true (i.e., RCRAInfo status codes must be changed when the regulatory authorities become aware of contrary information).

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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.

See the Human Exposure Checklist (CA725), approved by EPA on May 28, 2004, for a description of the facility, including the solid waste management units (SWMUs) at DuPont (Deepwater).

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2. Is **groundwater** known or reasonably suspected to be “**contaminated**”¹ above appropriately protective “levels” (i.e., applicable promulgated standards, as well as other appropriate standards, guidelines, guidance, or criteria) from releases subject to RCRA Corrective Action, anywhere at, or from, the facility?

- If yes - continue after identifying key contaminants, citing appropriate “levels,” and referencing supporting documentation.
- If no - skip to #8 and enter “YE” status code, after citing appropriate “levels,” and referencing supporting documentation to demonstrate that groundwater is not “contaminated.”
- If unknown – skip to #8 and enter “IN” status code.

Rationale and Reference(s):

Groundwater at the facility has been impacted by site operations. The constituents of concern in groundwater include, among others, aniline, benzene, chlorobenzene, trichloroethene, tetrachloroethene, and lead.

References: (1) Environmental Indicator Determination Report, CWK Migration of Contaminated Groundwater Under Control (CA750) dated August 2003; (2) NJPDES -DGW Second Semester 2003 Semiannual Report dated April 2004; and (3) Supplemental Evaluation for Potential Migration of Groundwater to Surface Water in Further Support of the Environmental Indicator (EI) CA750 Determination Chambers Works Complex, Deepwater, New Jersey dated April 6, 2004

¹ “Contamination” and “contaminated” describes media containing contaminants (in any form, NAPL and/or dissolved, vapors, or solids, that are subject to RCRA) in concentrations in excess of appropriate “levels” (appropriate for the protection of the groundwater resource and its beneficial uses).

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3. Has the **migration** of contaminated groundwater **stabilized** (such that contaminated groundwater is expected to remain within “existing area of contaminated groundwater”² as defined by the monitoring locations designated at the time of this determination)?

- If yes - continue, after presenting or referencing the physical evidence (e.g., groundwater sampling/measurement/migration barrier data) and rationale why contaminated groundwater is expected to remain within the (horizontal or vertical) dimensions of the “existing area of groundwater contamination”²).
- If no (contaminated groundwater is observed or expected to migrate beyond the designated locations defining the “existing area of groundwater contamination”²) – skip to #8 and enter “NO” status code, after providing an explanation.
- If unknown - skip to #8 and enter “IN” status code.

Rationale and Reference(s):

The primary engineering control of impacted groundwater is the interceptor well system (IWS), a pump-and-treat system (P&T) that maintains an inward gradient throughout most of the site and recovers more than 1.5 million gallons of groundwater each day. The IWS has been in operation since the 1970s. Including the other (production) pumping wells on-site, approximately 2.0 million gallons per day is pumped. In addition, DuPont has implemented stabilization measures on SWMUs 45-9, 56, and 5 & 43 to eliminate sources, to prevent existing sources from further impacting groundwater, and/or to prevent the migration of contaminated groundwater to the Delaware River.

DuPont has been monitoring the groundwater semi-annually around A, B, and C Basins, the Secure C Landfill, and the perimeter of the site. Groundwater elevation contour maps are generated semi-annually for the A zone (in the area of SWMU 5) and site-wide in aquifers B through E to interpret the groundwater flow directions. The monitoring shows that most groundwater constituent concentrations at the Chambers Works Complex are either constant or decreasing and that the IWS maintains groundwater containment in the B, C, D, and E aquifers, except in the B aquifer along the site perimeter in the areas of Fluoroproducts and Antiknock.

In addition, the Chambers Works facility has two approved groundwater Classification Exception Areas (CEAs) that cover the entire site. CEA 1 covers groundwater south of Henby Creek, and CEA 2 covers groundwater north of Henby Creek. A CEA has the effect of suspending the designated uses (potable for the Class IIA Quaternary Aquifer and Potomac Raritan Magothy Aquifer System beneath the site) and constituent standards in the indicated area until the Aquifers are restored to meet the standards.

References: (1) Environmental Indicator Determination Report, CWK Migration of Contaminated Groundwater Under Control (CA750) dated August 2003; (2) NJPDES -DGW Second Semester 2003 Semiannual Report dated April 2004; and (3) Supplemental Evaluation for Potential Migration of Groundwater to Surface Water in Further Support of the Environmental Indicator (EI) CA750 Determination Chambers Works Complex, Deepwater, New Jersey dated April 6, 2004

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 groundwater elevation contour map for the A zone shows groundwater flow generally toward the south, away from the Delaware River. The slurry and sheet-pile walls in the SWMU 5 area are effective in hydraulically containing groundwater on-site.

The groundwater elevation contour map for the B aquifer shows inward hydraulic gradients along the plant boundaries indicating groundwater flow toward the interior of the plant, with the exception of two areas: Fluoroproducts (near wells E16-M01B and D14-M01B) and Antiknocks (near wells C11-M02B and C07-M01B) in which groundwater flow is not towards the interior of the plant. These areas have historically exhibited higher elevations in the B aquifer relative to the calculated Delaware River mean elevation.

In addition, during the drought in August 2002, a groundwater seep was observed discharging towards the Salem Canal along the southern perimeter of the Chambers Works facility. The results of subsequent investigations support that the release was primarily confined to an area immediately adjacent to the seep and there are no adverse impacts on surface water in the area. DuPont is currently conducting additional investigations to confirm that the release poses no adverse impacts and to implement appropriate remedial measures, if deemed necessary, to prevent any similar releases in the future. Under normal climatic conditions, groundwater is contained within the facility along the Salem Canal because it flows towards the site from the Canal. Dense non-aqueous phase liquid (DNAPL) was also observed in the vicinity of the seep. DNAPL has been removed from well G05-M03B at approximately a half gallon per day.

The groundwater elevation contour map shows hydraulic gradients toward the plant interior along all Chambers Works facility boundaries in the C, D and E aquifers, indicating site-wide groundwater control in these aquifers.

References: (1) Environmental Indicator Determination Report, CWK Migration of Contaminated Groundwater Under Control (CA750) dated August 2003; (2) NJPDES -DGW Second Semester 2003 Semiannual Report dated April 2004; and (3) Supplemental Evaluation for Potential Migration of Groundwater to Surface Water in Further Support of the Environmental Indicator (EI) CA750 Determination Chambers Works Complex, Deepwater, New Jersey dated April 6, 2004

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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):

The discharge of contaminated groundwater into the Delaware River is potentially significant. The contaminants detected at the perimeter monitoring wells higher than 10 times of the respective New Jersey groundwater Class IIA criteria include, among others, benzene, chlorobenzene, tetrachloroethylene, trichloroethylene, 2,4-dinitrotoluene, 2,6-dinitrotoluene, & 1,2,4-trichlorobenzene. Aniline and 4-chloroaniline which currently have no respective New Jersey groundwater cleanup criteria were also detected at some perimeter monitoring wells higher than 10 times of their respective screening values.

References: (1) Environmental Indicator Determination Report, CWK Migration of Contaminated Groundwater Under Control (CA750) dated August 2003; (2) NJPDES -DGW Second Semester 2003 Semianual Report dated April 2004; and (3) Supplemental Evaluation for Potential Migration of Groundwater to Surface Water in Further Support of the Environmental Indicator (EI) CA750 Determination Chambers Works Complex, Deepwater, New Jersey dated April 6, 2004

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 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):

DuPont will likely continue the IWS as the primary component of the final remedy for contaminated groundwater until it is remediated and restored to meet the applicable standards.

The average annual flow rate of surface water in the Delaware River near Trenton, New Jersey (United State Geological Survey (USGS) stream gage 01463500 for 88 years of record) is about 330 cubic meters per second. The flow rate of groundwater discharging to the Delaware River through the B aquifer along the perimeter in the areas of Fluoroproducts and Antiknock is estimated to be about 0.00194 cubic meter per second. The ratio is approximately 170,000 to 1. Most of the maximum groundwater concentrations at the perimeter monitoring wells are less than 700 times of their respective AWQC, except for tetrachloroethylene detected approximately 4000 times of its AWQC at E15-M01B and for aniline and 4-chloroaniline detected approximately 19,000 and 110,000 times of their respective screening criteria at C10-M01B.

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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Assuming the conservative flow rate in the Delaware River of about 80 cubic meters per second (7Q10, 7 days 10-year low flow) and also only 10% of the surface water mixing with groundwater when discharged, the concentrations of discharged constituents in the Delaware River surface water were derived and compared to the respective Ambient Water Quality Criteria (AWQC) for aquatic life, except for aniline and 4-chloroaniline whose criteria have not yet been promulgated but whose screening criteria were developed and utilized instead. The results showed that none of the constituents have surface water concentrations higher than the respective AWQC, except aniline and 4-chloroaniline. Aniline is in a range of below to 4.5 times and 4-chloroaniline is in a range of 4 to 21 times of their respective screening criteria.

Elevated levels of aniline and 4-chloroaniline were detected at monitoring well C10-M01B but much lower levels were detected at the adjacent monitoring wells, C08-M01B, C09-M01B, and C11-M01B. However, the estimation above was based on the conservative assumption that contaminated groundwater is discharged into the River at elevated levels throughout the entire designated area of Antiknock. Therefore, actual impacts of aniline and 4-chloroaniline on the surface water would be much lower than the estimation.

The B Aquifer along the facility perimeter in the areas of Fluoroproducts and Antiknock is under tidal influence. Although, based on the monitored groundwater and surface water levels, the overall net flow in the areas is towards the Delaware River, what would actually happen in the zone of interface between the groundwater and the surface water is continued tidal mixing/washing back and forth of surface water and groundwater in the interfacial zone. Contaminated groundwater would be mixed/washed and diluted with surface water in the interfacial zone before discharged and, therefore, contaminants when discharged to the surface water would already be well mixed, diluted, and dispersed. Therefore, actual concentrations of contaminants in the surface water would likely be much lower than the estimation based on the 10% mixing through dispersion only. The groundwater discharge modeling assessment by Environ, DuPont's consultant, shows that tidal influences on the B aquifer in these areas reduce constituent concentrations below Ambient Water Quality Criteria (AWQC) before discharging to the Delaware River.

The physical and chemical characteristics of aniline and 4-chloroaniline - highly soluble in water, readily degradable biologically, microbially, and/or through photooxidation, and less tendency to be bioaccumulated – would tend to cause less risks to eco-species.

DuPont is also discharging chemical contaminants to the Delaware River through a point source permitted under the New Jersey Pollutant Discharge Elimination System (NJPDES)-Discharge to Surface Water (DSW) program. Most of the chemical contaminants discharging to the Delaware River via groundwater migration are also being monitored for the discharge stream under the NJDEP-DSW permit. Mass loadings of these contaminants to the Delaware River with the discharge of contaminated groundwater through the areas of Fluoroproducts and Antiknock are insignificant compared to the discharge by the facility allowed under the NJPDES-DSW permit. Aniline and 4-chloroaniline are significant contaminants among those discharging via groundwater migration but not monitored for the discharge stream under the NJPDES-DSW. These two contaminants will be monitored for the discharge stream either under the NJPDES-DSW permit or voluntarily.

References: (1) Environmental Indicator Determination Report, CWK Migration of Contaminated Groundwater Under Control (CA750) dated August 2003; (2) NJPDES -DGW Second Semester 2003 Semiannual Report dated April 2004; and (3) Supplemental Evaluation for Potential Migration of Groundwater to Surface Water in Further Support of the Environmental Indicator (EI) CA750 Determination Chambers Works Complex, Deepwater, New Jersey dated April 6, 2004

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7. Will groundwater **monitoring** / measurement data (and surface water/sediment/ecological data, as necessary) be collected in the future to verify that contaminated groundwater has remained within the horizontal (or vertical, as necessary) dimensions of the “existing area of contaminated groundwater?”

If yes - continue after providing or citing documentation for planned activities or future sampling/measurement events. Specifically identify the well/measurement locations which will be tested in the future to verify the expectation (identified in #3) that groundwater contamination will not be migrating horizontally (or vertically, as necessary) beyond the “existing area of groundwater contamination.”

If no – enter “NO” status code in #8.

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

Rationale and Reference(s):

DuPont will continue the monitoring activities in accordance with the NJPDES -DGW program, including:

- Development of semi-annual groundwater contour maps for the B, C, D and E aquifers, and the A zone at SWMU5.
- Semi-annual groundwater monitoring of 16 wells and annual groundwater monitoring of 40 wells.
- Semi-annual sampling of two additional wells (wells S24-M01B and T22-M01B) to characterize background groundwater quality for both corrective action and detection monitoring programs at the Secure C Landfill.

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8. Check the appropriate RCRAINFO 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 **DuPont Chambers Works**, EPA ID # **NJD 002385730**, located at **Deepwater, New Jersey**. Specifically, this determination indicates that the migration of "contaminated" groundwater is under control, and that monitoring will be conducted to confirm that contaminated groundwater remains within the "existing area of contaminated groundwater". This determination will be re-evaluated when the Agency becomes aware of significant changes at the facility.

NO - Unacceptable migration of contaminated groundwater is observed or expected.

IN - More information is needed to make a determination.

Completed by	(signature)	Date
	(print) Andrew Park	
	(title) Project Manager	
Reviewed by	(signature)	Date
	(print) Barry Tornick	
	(title) Chief, New Jersey Section	
Approved by	Original signed by:	Date: 9/2/2004
	(print) Adolph Everett	
	(title) Chief, RCRA Programs Branch	
	EPA Region 2	

Locations where References may be found:

EPA Region 2, RCRA Record Center, 15th Floor, 290 Broadway, NY, NY 10007-1866
NJDEP, 401 East State Street, Trenton, New Jersey 08625

Contact telephone and e-mail numbers

EPA	Andrew Park, 212-637-4184, park.andy@epa.gov
NJDEP	Frank Faranca, 609-984-4071, frank.faranca@dep.state.nj.us
DuPont	Albert Boettler, 302-892-0647, albert.j.boettler@usa.dupont.com

