

**DOCUMENTATION OF ENVIRONMENTAL INDICATOR DETERMINATION**  
**RCRA Corrective Action**  
**Environmental Indicator (EI) RCRIS code (CA750)**

**Migration of Contaminated Groundwater Under Control**

**Facility Name:** DuPont Seaford Nylon Plant  
**Facility Address:** 400 Woodland Road Seaford, DE 19973  
**Facility EPA ID #:** DED002348845

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).

### Sediment and Eco-systems:

While the EI form continues to include sediment and eco-systems, it has been noted that EPA has decided it is appropriate to exclude sediments from the EI. While the sediment and surface water of Lewis Creek’s forested wetlands will not be addressed in this EI, it may be investigated further as part of a final remedy.

**Migration of Contaminated Groundwater Under Control (cont.)**  
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2. Is **groundwater** known or reasonably suspected to be “**contaminated**”<sup>1</sup> 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.

Footnotes:

<sup>1</sup> “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).

Rationale and Reference(s):

This documentation of Environmental Indicator determination is based on the sampling results from the Phase II RFI and from the DNREC Solid Waste Permit for the Ash Landfill area. Phase II RFI sampling was completed in November, 2002. The results were discussed at a meeting between EPA, DNREC and DuPont on May 9, 2003. Sampling under the DNREC Solid Waste Permit occurs twice per year, in April and October. This Permit required sampling program has been in place for over 20 years.

For this EI determination (per footnote 1 above), “contaminated” groundwater is defined as any groundwater containing constituents above the Federal Safe Drinking Water Act Maximum Contaminant Levels (MCLs). These MCLs are the appropriate levels for those SWMUs where groundwater is pulled into the drinking water system at the Seaford Plant. For groundwater flowing to the surface water bodies at the Site the appropriate levels are both MCLs (typically a dilution factor of 10 is used for the evaluation) and Delaware Ambient Water Quality Criteria for the protection of aquatic life.

Data collected to date indicate that carbon tetrachloride was detected in the groundwater above the MCL at well LD-6 at SWMU 1 and that arsenic was detected in the groundwater above the MCL at wells 12MW-14S, 12MW-15S, 12MW-16S, MW-6, and MW-8A in the SWMU 7/12/13 area.

The Draft Phase II RFI Report, submitted August 15, 2003, data summary tables (Tables 1 thru 12) are referenced during the discussion below. The contaminants highlighted in yellow on the Tables are present at levels above enforceable standards (MCLs and AWQC). As can be seen on Table 1, SWMU 1 has only one well (L-6D) with only one compound, carbon tetrachloride, at 6 ug/l which is above the MCL of 5 ug/l. There are no other organic or inorganic compounds in any of the other SWMU 1 wells (both shallow and deep) that are above the MCL.

In the SWMU 7/12/13 area, arsenic is the only analyte detected above the MCL. The Draft RFI Phase II Report and the Powerhouse Ash Landfill 2002 Fall Monitoring Data Summary Report present the arsenic levels in the wells in the SWMU 7/12/13 area. The arsenic levels, which exceed the MCL of 50 ug/l, in this area range from 52 ug/l to 1410 ug/l.

The following SWMU have no concentrations of constituents of concern in groundwater above the MCL's:

SWMU 6 (Table 2)

SWMU 17 (Table 5) – Includes new VOC characterization of the groundwater.

SWMU 19 (Table 9)

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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”<sup>2</sup> 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”<sup>2</sup>.

       If no (contaminated groundwater is observed or expected to migrate beyond the designated locations defining the “existing area of groundwater contamination”<sup>2</sup>) - skip to #8 and enter “NO” status code, after providing an explanation.

       If unknown - skip to #8 and enter “IN” status code.

Footnotes:

<sup>2</sup>“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.

Rationale and Reference(s):

SWMU 1 VOC Plume:

Data collected in 1988, 1989, 1994 and 2002 in shallow and deep wells indicate that the VOC plume in this area is naturally attenuating and is currently at non-detectable concentrations, with one exception at L-6D. VOC concentrations detected during 1988 and 1989, had decreased below MCLs within a five-year time period. Levels of VOCs for the 2002 sampling (14 years after the first sampling) have all decreased below the analytical detection limit (i.e. “non-detect”) with the exception of L-6D. The level of carbon tetrachloride in L-6D continues to remain stable at 6 ug/l.

#### Arsenic Plume in SWMU 7/12/13 area:

Evidence collected to date and knowledge of the geochemical behavior of arsenic indicates that the arsenic plume detected on site is stable. Shallow groundwater beneath SWMU 7 (the ash settling ponds), SWMU 12 (the retention ponds) and SWMU 13 (the old landfill), contains iron (0.01 to 73 mg/l), has a near-neutral pH, and is generally aerobic (dissolved oxygen levels up to 11.1 mg/l). Arsenic released to the subsurface soil should precipitate out with the iron or adsorb onto iron-oxyhydroxide coatings on aquifer sediments limiting its mobility. Groundwater data for the site provides strong evidence that this attenuation is occurring. The highest arsenic concentrations occur in groundwater located immediately adjacent to the ash settling ponds (SWMU 7), retention ponds (SWMU 12) and old landfill (SWMU 13). The arsenic concentrations, ranging from 52 ug/l to 1410 ug/l, diminish with travel distance from the units. Additional evidence is provided by the description of "brown gravel" and "yellow sand" in the well logs. Under existing conditions in the aquifer, iron is not mobile and within the layers of aquifer (sediment), particles are coated with ferric oxyhydroxides. Phase II RFI and Solid Waste Permit sampling in wells MW-9S, 12MW-13S/13D, MW-4, MW-8S, MW-14D, MW-3S/3D, which are all wells down-gradient or cross-gradient to the contaminated wells, show no or very low arsenic levels; confirming that attenuation of arsenic is occurring.

There is no evidence of arsenic contaminated groundwater discharging to the Nanticoke River. The groundwater flow pathway from the area of SWMU 12 and wells MW-14S and MW-15S to the Nanticoke is monitored by well PZ-1. PZ-1 was specifically sampled in the Phase II RFI at EPA's request to assess the flow path to the Nanticoke. As can be seen in the Draft RFI Phase II Report, arsenic was not detected in well PZ-1.

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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):

Drainage Ditch:

Although the Drainage Ditch is not a Surface Water of the State of Delaware, the Ditch serves as a conveyance for some Site groundwater to discharges into the Nanticoke River. The Nanticoke River is a Surface Water of the State. Water level data collected as part of the 2002 Phase II RFI at SWMU 6 indicate that in the portion of the Drainage Ditch above the Outfall 011 weir structure, water in Drainage Ditch recharges groundwater. Below that weir, groundwater is discharging into the drainage ditch. It is the groundwater from the SWMU 7/12/13 area which discharges to the Drainage Ditch below the weir. As seen in Table 4 of the Draft RFI Phase II Report, groundwater in the area of SWMU 7/12/13 is contaminated with arsenic.

Lewes Creek:

Based on water levels in wells around the southern portion of the ash landfill (particularly well 17MW-17S) and the existence of several Springs feeding into Lewes Creek, groundwater is discharging into Lewes Creek and the forested wetlands at the toe of the ash landfill. As seen in Table 5 of the Draft RFI Phase II Report, there is no RCRA VOC, Semi-VOC or Metal contamination in the groundwater in the area of well 17MW-17S above the MCLs. However, Iron was found at 4,570 µg/l at Phase II sample location SWLC-1 (Table 7). Although iron is a RCRA metal, it will need to be addressed in order to reach a final remedy.

**Migration of Contaminated Groundwater Under Control (cont.)**  
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5. Is the **discharge** of “contaminated” groundwater into surface water likely to be **“insignificant”** (i.e., the maximum concentration<sup>3</sup> 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 concentration<sup>3</sup> of key contaminants discharged above their groundwater “level,” the value of the appropriate “level(s),” and if there is evidence that the concentrations are increasing; and 2) provide a statement of professional judgment/explanation (or reference documentation) supporting that the discharge of groundwater contaminants into the surface water is not anticipated to have unacceptable impacts to the receiving surface water, sediments, or eco-system.

       If no - (the discharge of “contaminated” groundwater into surface water is potentially significant) - continue after documenting: 1) the maximum known or reasonably suspected concentration<sup>3</sup> of each contaminant discharged above its groundwater “level,” the value of the appropriate “level(s),” and if there is evidence that the concentrations are increasing; and 2) for any contaminants discharging into surface water in concentrations<sup>3</sup> 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.

Footnotes:

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

Rationale and Reference(s):

As mentioned under “if no” in Question 5 above, the appropriate level to define groundwater “contamination” for arsenic is the MCL of 50 ug/l. Ten times this level is 500 ug/l. Another comparison that can be done (based on the risk to aquatic life) uses the AWQC for arsenic, which is 190 ug/l. Ten times that level is 1,900 ug/l.



#### Nanticoke River:

Well PZ-1 characterizes the component of groundwater flow from the SWMU 7/12 area that discharge to the Nanticoke River. The Phase II sampling results for groundwater in Well PZ-1 document that no Arsenic (i.e. 0.21 ug/l) or other inorganics above the MCL (and certainly nothing ten times above the MCL or the AWQC exists in the groundwater in that area), hence it is an “insignificant” discharge to that surface water body. Any contaminants released from these SWMUs, migrating along this component of flow are diluted, dispersed, biodegraded and otherwise naturally attenuated below detection limits prior to reaching the Nanticoke given the distance from these units to the Nanticoke, the low levels of contaminants present and the fate and transport properties of the contaminants. Any contaminants reaching the Nanticoke directly (or thru the Drainage Ditch) would be diluted beyond detection by the high volume of flow in the Nanticoke.

#### Drainage Ditch:

Any discharge of Arsenic contaminated groundwater from the SWMU 7/12/13 area to the ditch is insignificant. The groundwater (just prior to discharge to the Ditch) is characterized by well MW-3S(R) and MW-3D. As can be seen in Table 5 of the Draft RFI Phase II Report, the arsenic concentration in MW-3S(R) is 4.9 ug/l. This concentration is far below 500 ug/l or 1,900 ug/l. Well MW-3D was not sampled for the Phase II RFI, but was sampled for the Solid Waste Permit program on October 23, 2002. The arsenic concentration in MW-3D was 2.9 ug/l, which clearly is a concentration far below 500 ug/l or 1,900 ug/l.

In addition to the above comparison, there were actual surface water samples taken in the Drainage Ditch during the Phase II RFI and analyzed for arsenic. This surface water sampling of the Ditch document that only very, very low levels of Arsenic are detected; far below the DNREC Water Quality Criteria for Protection of Aquatic Life, Freshwater Chronic value of 190 ug/l. The two surface water samples (SW-9 and SW-10) which are “down stream” of where the arsenic plume would discharge to the Ditch had arsenic values of 1.1 ug/l and 2.1 ug/l respectively. There are some high values of copper and zinc detected in the surface water samples but they appear unrelated to groundwater.

#### Lewes Creek:

The arsenic concentration in the groundwater next to Lewes Creek is best characterized by well 17MW-17S. The regular sampling of 17MW-17S under the Solid Waste Permit has always shown arsenic concentrations below the MCL, i.e. there is no “contaminated” groundwater in this area of the Site. However since there are detectable levels of arsenic in the groundwater a comparison will be done here. The Phase II RFI results (see Table 5), shows arsenic at 28 ug/l. This is below the DNREC Water Quality Criteria for Protection of Aquatic Life, Freshwater Chronic value of 190 ug/l or 1,900 ug/l. Hence any discharge of groundwater containing arsenic from SWMU 17 to Lewes Creek is insignificant. In addition, the three surface water samples in Lewes Creek (see Table 7 for samples SWLC-1, 3 and 3) had very, very low levels of detectable Arsenic at 1.1 ug/l, 0.65 ug/l and 0.65 respectively.

**Migration of Contaminated Groundwater Under Control (cont.)**  
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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 <sup>4</sup>)?

\_\_\_\_\_ 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, <sup>5</sup> 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.

Footnotes:

<sup>4</sup> 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.

<sup>5</sup> 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.

Rationale and Reference(s): [not applicable since answer to Question 5 was “yes”]

**Migration of Contaminated Groundwater Under Control (cont.)**  
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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):

In the SWMU 12/7/13/17 area, groundwater data is collected on a regular basis as required by the site's Solid Waste Permit for the fly ash landfill.

The non-detect concentrations of VOCs at SWMU 1 indicate that additional monitoring may not be necessary. Production wells PW-2A and PW-8 have been isolated from the Plant’s drinking water distribution system. The single exceedence of carbon tetrachloride approximates the MCL and is expected to follow the downward trend of the historical VOCs concentrations.

While the EI form continues to include sediment and eco-systems, it has been noted that EPA has decided it is appropriate to exclude sediments from the EI. While the sediment and surface water of Lewis Creek’s forested wetlands will not be addressed in this EI, it may be investigated further as part of a final remedy.

**Migration of Contaminated Groundwater Under Control (cont.)  
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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).

  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 DuPont Seaford Nylon Plant facility, EPA ID # DED002348845, located at 400 Woodland Road, Seaford, DE 19973. 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       /s/       Date       9/29/03        
Jenefer Russum  
Environmental Scientist

Supervisor       /s/       Date       9/29/03        
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Locations where References may be found:

EPA Region III project files, DNREC project files and DuPont CRG project files.

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## REFERENCES

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