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: DuPont Spruance
Facility Address: 5401 Jefferson Davis Highway, Richmond, VA, 23234
Facility EPA ID #: VAD 00 930 5137

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).

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

__X__ If yes - continue after identifying key contaminants, citing appropriate "levels," and referencing supporting documentation.

_____ If no - skip to #8 and enter "YE" status code, after citing appropriate "levels," and referencing supporting documentation to demonstrate that groundwater is not "contaminated."

_____ If unknown - skip to #8 and enter "IN" status code.

Rationale and Reference(s):

The previous environmental investigations at the Spruance facility have identified hexamethylphosphoramide (HMPA), trichlorofluoromethane (TCFM), and chloroform as the primary contaminants. All of these contaminants are located beneath the western half of the facility with plumes extending offsite to the south and northeast. Carbon disulfide has been detected at a small number of locations, but is not present as a widespread plume. Carbon disulfide and possibly TCFM may be present as non-aqueous phase material at the base of the aquifer in a localized area of the main plant.

Groundwater onsite and downgradient of the Spruance Plant is not currently used as a drinking water source or for any human contact. Although groundwater is not used as a potable water supply onsite or downgradient of the DuPont Spruance facility, as a conservative measure (since currently all groundwater in VA is considered potentially drinking water), groundwater data were screened against MCLs or EPA Region III Tapwater RBCs for compounds with no MCL or SMCL. For HMPA, which has no regulatory-derived risk criteria, best professional judgment was used to identify HMPA as a potential key contaminant in groundwater.

Additional supporting information and references are provided in "Environmental Indicator Determination Report, Migration of Contaminated Groundwater Under Control (CA 750)", CH2M HILL, September 2002. Details of the groundwater contamination are provided in Section 4 of that report.

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).

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):

The report summarizing the results of the Spring 2001 long-term monitoring sampling event (CH2M HILL, December 2001) evaluates the stability of the various contaminant plumes on and around the Spruance facility. Figures 1, 2, and 3 present plume contour maps for HMPA, TCFM, and chloroform, respectively, based on the results of the April 2001 sampling event. As discussed in the Spring 2001 long-term monitoring report (CH2M HILL, December 2001), the overall extents, shapes and concentrations of the HMPA, TCFM, and chloroform plumes have not significantly changed since the 1993 sampling event. The comparison of both hydrodynamic and chemical data from the most recent monitoring event in April 2001 to earlier monitoring events supports the conclusion that the various plumes of groundwater contamination originating from the Spruance facility are generally stable and not migrating beyond their historical extents.

Additional supporting information is provided in Section 5 of "Environmental Indicator Determination Report, Migration of Contaminated Groundwater Under Control (CA 750)", CH2M HILL, August 2002.

[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.

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 hydrogeology of the area in and around the DuPont Spruance facility was evaluated during the four phases of Groundwater Assessment conducted between 1987 and 1994. Based on the evaluation of chemical and hydrodynamic data, the Groundwater Assessments concluded that groundwater at the Spruance facility discharges to the James River east of the facility as well as into smaller surface water bodies within and south of the facility. All surface water eventually discharges to the James River.

The potentially affected water bodies include:

- James River
- Grindall Creek
- Falling Creek

Additional supporting information is provided in Section 6 of "Environmental Indicator Determination Report, Migration of Contaminated Groundwater Under Control (CA 750)", CH2M HILL, August 2002.

5. Is the **discharge** of "contaminated" groundwater into surface water likely to be **"insignificant"** (i.e., the maximum concentration[3] 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)?

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__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[3] 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 concentration[3] 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[3] 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):

DuPont started conducting surface water investigations in 1987 and has continued monitoring of surface water (on and offsite) to the present (CH2M HILL 1991, 1992, 1993, 1997, 1999, 2001). During these investigations, surface water, sediment and fish tissues were sampled for HMPA and surface water has been sampled for HMPA, zinc, carbon disulfide, trichlorofluoromethane (TCFM), and chloroform. The general conclusions from these investigations are that groundwater contaminants at the Spruance facility that have plumes discharging to surface water bodies are HMPA, TCFM, and chloroform but these are not present at levels that are of concern for both human and ecological receptors. Also, there are no other conditions which would significantly increase the potential for unacceptable impacts to surface water, sediments, or eco-systems at these concentrations. Further, TCFM and chloroform have only been detected at trace levels and the levels of HMPA have been declining over time. The rationale for these conclusions is summarized below. See also Sections 3.1.4 and 7 of the EI Determination report (CH2M HILL, September 2002).

Although drinking water criteria were used to identify the contaminants of concern, neither the James River nor Grindall and Falling Creeks are used for drinking water at the point of groundwater discharge or for a considerable distance downstream. At the confluence of the Appomattox River with the James, there is a drinking water intake at Hopewell (approximately 18 miles down river). Also, the James River is used for recreational boating. None of these constituents are expected to accumulate in sediments or bioaccumulate in aquatic organisms (Schneider, et al, 1979, TNRCC, 2001). HMPA has not been detected in onsite or offsite natural sediments or in fish tissue (CH2M HILL, 1991).

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

Based on these observations, relevant exposure scenarios are direct contact of ecological receptor in the James River, Grindall and Falling Creeks, and possible human exposures during recreational activities in the James River. In addition, human consumption of drinking water at Hopewell was considered. Therefore, to assess "significance", the following were considered:

- For HMPA, which does not have regulatory criteria, a risk evaluation was performed (James River Assessment and associated documents, DuPont, 1998, 2000, 2001). The following routes of exposure were considered in this focused assessment:

  - Ingestion of drinking water from the City of Hopewell intake;
  - Dermal contact while showering, using City of Hopewell municipal water;
  - Incidental ingestion of James River water while swimming;
  - Dermal contact with James River water while swimming; and,
  - Direct contact of aquatic organisms inhabiting the James River downstream of the facility.

  These evaluations have been accepted by EPA Region III as being protective of human and ecological receptors (Region III EPA, 08/08/01). In addition, the site has already achieved a positive EI 725 (09/01) where these issues were taken into account. Therefore, HMPA discharges to the surface water are deemed to be insignificant.

- Chloroform and TCFM have never been detected above trace levels in the surface waters adjacent to the plant. Since surface water is not consumed, ecological species are proposed as the most relevant receptors at the point of discharge.

  However, no federal or state ambient water quality criteria are available for either of these materials. Therefore, benchmark values were obtained from the Texas Natural Resource Conservation Commission's Ecological Risk Assessment Guidance document (TNRCC, 2001). The TNRCC values were developed using a similar process as that used for deriving the acceptable level for HMPA. (Note that the VA human health ambient water quality standard for non-potable surface waters for chloroform is 4,700 ppb, which is well above the ecological benchmark).

  Based on chemical data from the most recent surface water and groundwater sampling events, the following comparisons confirm that groundwater discharge to surface water is not significant:

	Derived Chronic Benchmark Value (Aquatic Life)	**Surface water concentration directly downgradient**	**Max. Concentration in groundwater wells adjacent to James River**	**10 x Benchmark Value**
HMPA	5,000[a]	0.17	480	50,000
TCFM	1,740[b]	0.9	12,000	17,400
Chloroform	890[c]	0.7	59	8,900

Note all concentrations are in micrograms/liter.

[a]DuPont, 2001.

[b]TNRCC, 2001.

[c]TNRCC, 2001.

In addition, there are no known conditions (e.g., the nature and number of discharging contaminants, or environmental setting) that significantly increase the potential for unacceptable impacts to surface water, sediments, or ecosystems at the concentrations discharging from groundwater to surface water.

Additional evidence of the insignificance of the concentrations of groundwater contaminants discharging to surface water can be found in the data collected during the numerous surface water studies that have been conducted at the Spruance facility since 1987. These results of these investigations indicate that:

1. HMPA is the primary surface water contaminant. TCFM and chloroform have never been detected in the James River above trace levels (3-4 orders of magnitude lower than the derived criteria).
2. Levels of HMPA in the James River have been generally 3-4 orders of magnitude below the derived criterion at all sampling stations below the Spruance facility up to 40 miles downstream (the furthest sampling location downgradient).
3. HMPA was not present in sediment or fish tissue samples collected in the James River at concentrations above the quantitation limit.

6. Can the **discharge** of "contaminated" groundwater into surface water be shown to be **"currently acceptabl**e" (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[4])?

_____ 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):_____
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[4]Note, because areas of inflowing groundwater can be critical habitats (e.g., nurseries or thermal refugia) for many species, appropriate specialist (e.g., ecologist) should be included in management decisions that could eliminate these areas by significantly altering or reversing groundwater flow pathways near surface water bodies.

[5]The understanding of the impacts of contaminated groundwater discharges into surface water bodies is a rapidly developing field and reviewers are encouraged to look to the latest guidance for the appropriate methods and scale of demonstration to be reasonably certain that discharges are not causing currently unacceptable impacts to the surface waters, sediments or eco-systems.

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):

DuPont will continue to collect groundwater and surface water monitoring data in the future to verify that contaminated groundwater has remained within the existing area of contamination.

Groundwater Monitoring

DuPont conducts annual groundwater monitoring at the Spruance facility in accordance with the plant's Virginia Pollution Discharge Elimination System (VPDES) permit. The annual groundwater monitoring program is outlined in the plan entitled "Performance Monitoring and Sampling Plan for the Onsite Groundwater Extraction System: (CH2M HILL, April, 1999). The major elements of the annual monitoring program are:

- Water-level measurements from approximately 100 monitoring wells
- Water quality sampling from 31 monitoring wells (all samples analyzed for HMPA and VOCs)

The analytical results of the groundwater monitoring program are summarized in an annual report prepared each year.

Surface Water Monitoring

Spruance wastewater outfalls discharging to the James River are sampled on a regular basis as part of the VPDES permit described above. In addition, DuPont conducts voluntary surface water monitoring on a regular basis.

DuPont's voluntary surface water monitoring program consists of:

- Quarterly collection of 24-hour composite samples for HMPA analysis from: (1) the James River adjacent to American Tobacco Co., and (2) the Appomattox River at the intake to the City of Hopewell water treatment plant.
- Collection of supplemental samples every other year for HMPA, chloroform, TCFM, carbon disulfide, and total zinc analysis from 5 locations in the James River, 2 locations in Grindall Creek, and 2 locations in Falling Creek.

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 Spruance facility, EPA ID # VAD 00 930 5137, located at 5401 Jefferson Davis Highway, Richmond, VA, 23234. 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)_____
(title)_____

Supervisor (signature)_____ Date _____
(print)_____
(title)_____

(EPA Region or State)_____

Locations where References may be found:

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Contact telephone and e-mail numbers

(name)_____
(phone #)_____
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