

**DOCUMENTATION OF ENVIRONMENTAL INDICATOR DETERMINATION**

Interim Final 2/5/99

**RCRA Corrective Action Environmental Indicator (EI) RCRIS code (CA 725)  
Current Human Exposures Under Control**

Facility Name: E. I. du Pont de Nemours and Company (DuPont) Edge Moor Plant

Facility Address: 104 Hay Road, Edgemoor, Delaware

Facility EPA #: DED000800284

1. Has all available relevant/significant information on known and reasonably suspected releases to soil, groundwater, surface water, sediments, and air, 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?

If yes -check here and continue with #2 below. If no- re-evaluate existing data, or If data are not available skip to #6 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 EIs 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 "Current Human Exposures Under Control" EI**

A positive "Current Human Exposures Under Control" EI determination ("YE" status code) indicates that there are no "unacceptable" human exposures to "contamination" (i.e., contaminants in concentrations in excess of appropriate risk-based levels) that can be reasonably expected under current land- and groundwater-use conditions (for all "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 "Current Human Exposures Under Control" EI are for reasonably expected human exposures under current land- and groundwater-use conditions ONLY, and do not consider potential future land- or groundwater-use conditions or ecological receptors. The RCRA Corrective Action program's overall mission to protect human health and the environment requires that Final remedies address these issues (i.e., potential future human exposure scenarios, future land and groundwater uses, and ecological receptors).

**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).

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2. Are groundwater, soil, surface water, sediments, or air media known or reasonably suspected to be "contaminated" above appropriately protective risk-based "levels" (applicable promulgated standards, as well as other appropriate standards, guidelines, guidance, or criteria) from releases subject to RCRA Corrective Action (from SWMUs, RUs or AOCs)?

Media	Yes	No	?	Rationale/Key Contaminants
Ground water	√			The saturated zones are localized and discontinuous in areas where interior wells are installed. Some VOCs, SVOCs, PCBs, and metals were detected in interior groundwater (Section 5.2.1); however, no appropriate screening levels apply to the interior groundwater because (1) groundwater at the site is not used for drinking water, and (2) the interior groundwater is not hydraulically connected to the surface water. The screening was performed for comparison and information purposes. Only cobalt, iron, and manganese were detected in the recent sampling events at concentrations exceeding the drinking water screening criteria. No site-related contaminants were identified in the perimeter wells at concentrations above the applicable screening criteria for the ground water migration to surface water pathway.
Air (indoors) <sup>2</sup>		√		Although some VOCs have been detected in groundwater at isolated locations (MW-11D, MW-13S, and MWs-15S/15D) across the Site, the locations where VOCs have been detected do not extend under occupied on-site buildings or within 100 feet of an occupied building (Sec 5.2.3).
Surface Soil (e.g., <2 ft)	√			Five PAHs in SWMU 1&3 and PCB-126 in SWMU 5 exceeded screening levels in surface soil (Section 5.2.2 and Table 6).
Subsurface Soil (e.g., >2 ft)	√			Five PAHs, hexachlorobenzene, and lead in SWMU 5, total PCBs in SWMU 23, ORO >C28 - C35 in SWMU 20, and copper in SWMU 1&3 exceed screening levels in subsurface soil (Section 5.2.2 and

				Table 6).
Air (outdoors)		√		Although PAHs, PCBs and metals were detected at concentrations exceeding their respective screening levels, these locations are covered by asphalt, concrete or vegetation, which mitigates the potential for soil particles to become airborne (Section 5.2.3)

If no (for all media) -skip to #6, and enter "YE," status code after providing or citing appropriate "levels," and referencing sufficient supporting documentation demonstrating that these "levels" are not exceeded.

√ If yes (for any media) -continue after identifying key contaminants in each "contaminated" medium, citing appropriate "levels" (or provide an explanation for the determination that the medium could pose an unacceptable risk), and referencing supporting documentation.

If unknown (for any media) -skip to #6 and enter "IN" status code.

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Rationale and Reference(s):

**Data Set for EI Evaluation**

Site data, including subsurface lithology, groundwater analytical data, and the interaction between surface water and groundwater, have previously been provided in the following three documents:

- Phase I RFI Data Summary Report (Parsons, April 2009)
- Phase II RFI Data Summary Report (Parsons, March 2011)
- Post-Closure Care Plan – Addendum 1, Revised Monitoring and Maintenance Plan, Closed Surface Impoundments (Parsons, March 2010)

**Screening levels used to evaluate site data**

Concentrations of constituents detected in the EI evaluation data set were compared to appropriate screening levels to evaluate potential concerns for human health and to identify COPCs. The following screening levels were used during the evaluation:

**Groundwater** – As presented in the Phase II RFI Data Summary Report that was approved by the Delaware Department of Natural Resources & Environmental Control (DNREC) on November 30, 2011, no continuous shallow groundwater was identified at the Site. Onsite groundwater is not used as either a potable or non-potable source; therefore, there are no appropriate risk-based levels for screening.

As presented in the Phase II RFI Data Summary Report that was approved by the Delaware Department of Natural Resources & Environmental Control (DNREC) on November 30, 2011, groundwater discharging to surface water (Delaware River) was identified as an exposure pathway with potential human receptors (by fish consumption) and aquatic receptors. The Site is located at river mile (R.M.) 72.7, within Zone 5 of the Delaware River that extends from R.M. 78.8 to R.M. 48.2 (Delaware River Basin Commission [DRBC] 2008). Zone 5 is not used as a drinking water supply, but may be used for fishing and contact recreation. As presented in the approved Phase II RFI Data Summary Report, the 2010 DRBC stream quality objectives for Zone 5 were used as screening values when available; otherwise, the following screening criteria were used, in order of preference:

- Delaware Department of Natural Resources and Environmental Control [DNREC] surface water quality standards (July 11, 2004)
- DNREC 1999 Uniform Risk-Based Remediation Standards
- 2009 EPA National Recommended Water Quality Criteria
- EPA Region 3 Biological Technical Advisory Group (BTAG) recommended criteria (July 2006)
- Site-specific criteria

**Soil** – VOCs, SVOCs, metals, PCBs, dioxins, furans, and total petroleum hydrocarbons were detected in surface and subsurface soil. As presented in the Phase II Data Summary report, the USEPA RSLs for industrial soil were used as the screening levels, with one exception. The Delaware Department of Natural Resources and Environmental Control (DNREC) default background remediation standard of 11 milligrams per kilogram (mg/kg) was used as screening criteria for arsenic in soil.

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- Per the 1998 USEPA Office of Solid Waste and Emergency Response (OSWER) Dioxin Directive (OSWER 1998), a preliminary remediation goal for dioxins, furans and coplanar PCBs of 20 micrograms per kilogram ( $\mu\text{g}/\text{kg}$ ) were used for the industrial setting, measured as a total toxic equivalence (TEQs) to 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD). The toxic equivalence for a sample is the sum of the concentration for each congener multiplied by its associated toxicity equivalent factor (TEF).
- The TEF factors developed by the World Health Organization (WHO) in 2005 (WHO 2005) were used. For nondetects (NDs), TEQs were calculated using ND equal to zero.
- Actions levels from the Delaware Risk-Based Corrective Action Program (DERBCAP) (DNREC 2000) were used for total petroleum hydrocarbon concentrations.

**Indoor Air** - Limited VOCs were detected in groundwater at the Site. The low concentration VOCs were only detected sporadically and were not located under or within 100 feet of a building. Therefore, no screening was performed. Limited VOCs were detected in soil at the Site. Soil data were excluded from the indoor air evaluation because the USEPA subsurface vapor intrusion guidance (USEPA 2002) does not recommend the use of soil concentrations based on the number of uncertainties associated with their use.

### Constituents of Potential Concern

Based on Phase I and Phase II investigation results, the data evaluation indicates that exceedences of screening levels were limited and localized to specific areas in SWMUs 1 & 3 and 5. There are no continuous groundwater contaminant plumes either on-site or migrating off-site. Elevated concentrations of arsenic in soil are below the DNREC default background concentration except for one sample slightly exceeding the background level. Most of the concentrations of polynuclear aromatic hydrocarbons (PAHs) detected were comparable to default agricultural background levels (ATSDR, 1995) or may also be related to surface cover (i.e., asphalt) at these locations. These concentrations may be representative of natural soil conditions or result from surface cover at the Site (e.g., fill material).

**Groundwater:** For purposes of this evaluation, groundwater was evaluated by groundwater flow components (interior wells versus perimeter wells) rather than by SWMUs. Some VOCs, SVOCs, PCBs, and metals were detected in interior groundwater (Section 5.2.1); however, no appropriate screening levels apply to the interior groundwater because (1) groundwater at the site is not used for drinking water, and (2) the interior groundwater is not hydraulically connected to the surface water. The screening was performed for comparison and information purposes. Only cobalt, iron, and manganese were detected in the recent sampling events at concentrations exceeding the drinking water screening criteria. The VOCs, SVOCs, and metals detected in the perimeter wells were compared to the applicable surface water screening criteria and no COPCs were identified for the groundwater migration to surface water exposure pathway.

**Surface soil:** Five PAHs (benzo(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene) and PCBs were identified as COPCs in surface soil. The highest PAH exceedences were detected in samples collected from location S01SB11, which are in the berm area of SWMU 1 & 3 located southeast of Spill Diversion Pond. The PCB exceedance was detected in a sample collected from location S05SB06. Most of the locations where exceedences have been detected occur in areas that are covered by asphalt, gravel, concrete, or ground cover.

**Subsurface soil:** Six SVOCs (benzo(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, dibenz(a,h)anthracene, hexachlorobenzene, and indeno(1,2,3-cd)pyrene), and three metals (arsenic, copper, and lead) were identified as COPCs in subsurface soil. The SVOC exceedences were all detected in SWMU 5. The highest PAH concentrations were detected in samples collected from location S05SB15. The exceeded total PCB was detected in one sample (S23SB01) at depths between 3 to 5 feet bgs. The exceeded arsenic concentration was detected in one sample (from S23SB02) at depths between 5 to 7 feet bgs. The exceeded copper

concentration was detected in one sample (from S01SB09) at depths between 7 to 9 feet bgs. The exceeded lead concentration was detected in one sample (from S05SB17) at depths between 4 to 6 feet bgs. These COPCs would be accessible only during intrusive activities. PAHs were identified as COPCs in SWMU 5 since the concentrations detected exceed the applicable screening levels. However, the exceedances may not be indicative of a release from the former waste settling area (Section 5.2.2) since the PAH exceedances in SWMU 5 are sporadic and not consistent either spatially around the SWMU or at depth. The presence of PAHs and metals may also be attributable to the presence of railroad tracks in the immediate vicinity. Railroad ties are a common source of low-level PAHs, and some heavy metals can be associated with the preservatives used in railroad ties.

**Indoor Air:** The potential for vapor intrusion into on-site and off-site buildings is incomplete under current land use conditions. VOCs were only detected sporadically and at low concentrations in groundwater. The location of these groundwater detections did not extend under or within 100 feet of occupied buildings. Soil data were excluded from the indoor air evaluation per the USEPA subsurface vapor intrusion guidance.

**Outdoor Air:** Outdoor air was screened as part of the soil evaluation. No VOCs were identified as COPCs for outdoor air in surface and subsurface soil. Although limited COPCs were identified in surface soils, the potential for fugitive emissions is minimal since the majority of the site is paved or vegetated.

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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 appropriately protective risk-based "levels" (for the media, that identify risks within the acceptable risk range).

<sup>2</sup> Recent evidence (from the Colorado Dept. of Public Health and Environment, and others) suggest that unacceptable indoor air concentrations are more common in structures above groundwater with volatile contaminants than previously believed. This is a rapidly developing field and reviewers are encouraged to look to the latest guidance for the appropriate methods and scale of demonstration necessary to be reasonably certain that indoor air (in structures located above (and adjacent to) groundwater with volatile organic compounds) does not present unacceptable risks.

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3. Are there complete pathways between "contamination" and human receptors such that exposures can be reasonably expected under the current (land-and groundwater-use) conditions?

Summary Exposure Pathway Evaluation Table Potential Human Receptors (Under Current Conditions)

"Contaminated" Media	Resident	Worker	Construction	Recreational User	Food <sup>3</sup>
Groundwater	No	No	Yes	Yes	No
Surface Soil (e.g., <2 ft)	No	Yes	Yes	No	No
Subsurface Soil (e.g., >2 ft)	No	No	Yes	No	No
Indoor Air					
Outdoor Air					

Instructions for Summary Exposure Pathway Evaluation Table:

1. Strike-out specific Media including Human Receptors' spaces for Media which are not "contaminated" as identified in #2 above.
2. Enter "yes" or "no" for potential "completeness" under each "Contaminated" Media - Human Receptor combination (Pathway). N/L = Not Likely
3. Indirect Pathway/Receptor (e.g., vegetables, fruits, crops, meat and dairy products, fish, shellfish, etc.)

Note: In order to focus the evaluation to the most probable combinations some potential "Contaminated" Media- Human Receptor combinations (Pathways) do not have check spaces ("-"). While these combinations may not be probable in most situations they may be possible in some settings and should be added as necessary.

If no (pathways are not complete for any contaminated media-receptor combination) - skip to #6, and enter "YE" status code, after explaining and/or referencing condition(s) in-place, whether natural or man-made, preventing a complete exposure pathway from each contaminated medium (e.g., use optional Pathway Evaluation Work Sheet to analyze major pathways).

√ If yes (pathways are complete for any "Contaminated" Media - Human Receptor combination) -continue after providing supporting explanation.

If unknown (for any "Contaminated" Media - Human Receptor combination) -skip to #6 and enter "IN" status code Rationale and Reference(s):

**Three potential human receptors were identified (Section 6.1):**

(1) **On-site Industrial Workers:** A portion of the facility is in active industrial use, and current land use is expected to continue in the future (Figure 2). The industrial worker could potentially be exposed to site-related constituents in surface soil (0 to 2 feet bgs).

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(2) **On-site Construction/Excavation Workers:** The on-site construction/excavation worker could potentially be exposed to site-related constituents in surface and subsurface soil, and groundwater while repairing subsurface utility lines, performing remedial activities, or during short-term construction. Subsurface soil depths for direct contact exposures to this receptor are defined as deeper than 2 feet bgs. The shallow groundwater occurs at depths ranging from 2 to 15 feet bgs; therefore, direct contact with groundwater may also occur during intrusive activities.

(3) **Recreational users:** Recreational users were considered potential receptors because there is potential for impacted groundwater from perimeter wells to migrate to the Delaware River.

Other receptors were considered; however, groundwater is not used in the surrounding area for domestic water supply, including irrigation. Groundwater impacts at the Site are isolated on-site, and no plumes have been identified migrating off-site. Therefore, the off-site resident was not considered a potential receptor.

Sensitive receptors (e.g., daycare, school) are not located on or immediately adjacent to the Site. Therefore, no sensitive receptors were identified.

**Complete Exposure Pathways by Media (Sections 6.2.2) include:**

(1) **Groundwater:** The potential for exposure to groundwater is low because it is not used on-site for potable or industrial purposes. In addition, residential users have not been identified within a one-mile radius of the Site. However, due to the shallow depth of groundwater in some portions of the Site, exposure may occur during construction/excavation activities. Potentially complete exposure pathways for a construction/excavation worker may include incidental ingestion of and dermal contact with groundwater. However, these pathways are insignificant because institutional controls are strictly enforced. The groundwater migration to surface water pathway is insignificant because the groundwater concentrations detected in the perimeter wells are below the applicable surface water screening levels.

(2) **Surface Soil:** The potential for exposure to contaminants in surface soils is limited to on-site receptors because impacted soils are contained within the facility boundaries. Even on-site, the potential for exposure is low for most receptors under current conditions because there is limited access to the principal areas of surface soil contamination or these areas are covered by asphalt, gravel, concrete, buildings, or grass. The receptor with the greatest potential for exposure is the current/future on-site construction/excavation worker, where intrusive activities may provide a greater likelihood of direct contact with impacted soil. Potentially complete exposure pathways for the on-site industrial worker may include: incidental ingestion of and dermal contact with surface soil and inhalation of soil-derived particulates.

(3) **Subsurface Soil:** Because subsurface soil contamination is only present on-site and exposure to subsurface soil is only achieved during excavation and construction activities, the only potential receptor is the on-site construction/excavation worker. Potentially complete exposure pathways may include incidental ingestion of and dermal contact with subsurface soil and inhalation of soil-derived particulates. The inhalation of soil-derived vapor in outdoor air exposure pathway is not complete because no VOCs were identified as COPCs in soil.

**Incomplete Exposure Pathways by Media (Section 6.2.1) include:**

(1) **Groundwater:** Groundwater is not used on-site for potable or industrial uses. Therefore, direct contact (ingestion or dermal contact) with groundwater for on-site industrial workers is incomplete. The groundwater to indoor air pathway is incomplete because no VOCs were detected in shallow groundwater underneath or within 100 feet of occupied buildings at the Site.

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(2) **Soil:** Since the day-to-day operations involving the on-site industrial worker do not include intrusive activities, direct contact (ingestion or dermal contact) with subsurface soil is not anticipated and is incomplete. The presence of either asphalt or pavement limits the potential for exposure to the underlying surface soils. Exposure pathways associated with food are incomplete because neither gardening nor hunting is allowed on the facility.

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Can the exposures from any of the complete pathways identified in #3 be reasonably expected to be "significant" (i.e., potentially "unacceptable" because exposures can be reasonably expected to be: 1 ) greater in magnitude (intensity, frequency and/or duration) than assumed in the derivation of the acceptable "levels" (used to identify the "contamination"); or 2) the combination of exposure magnitude (perhaps even though low) and contaminant concentrations (which may be substantially above the acceptable "levels") could result in greater than acceptable risks)?

√ \_\_\_\_\_ If no (exposures cannot be reasonably expected to be significant (i.e., potentially "unacceptable") for any complete exposure pathway) -skip to #6 and enter "YE" status code after explaining and/or referencing documentation justifying why the exposures (from each of the complete pathways) to "contamination" (identified in #3) are not expected to be "significant."

If yes (exposures could be reasonably expected to be "significant" (i.e., potentially "unacceptable") for any complete exposure pathway) -continue after providing a description (of each potentially "unacceptable" exposure pathway) and explaining and/or referencing documentation justifying why the exposures (from each of the remaining complete pathways) to "contamination" (identified in #3) are not expected to be "significant."

If unknown (for any complete pathway) -skip to #6 and enter "IN" status code

**Rationale and Reference(s):**

The following potentially complete exposure pathways were evaluated in Step Four of the EI determination process:

**Groundwater:**

**On-Site Construction/Excavation Worker** - incidental ingestion of and dermal contact with groundwater

**Surface Soil:**

**On-Site Industrial Worker** - incidental ingestion of and dermal contact with surface soil in limited areas without any ground covers

**On-Site Construction/Excavation Worker** - incidental ingestion of and dermal contact with surface soil and inhalation of soil-derived particulates

**Subsurface Soil:**

**On-Site Construction/Excavation Worker** - incidental ingestion of and dermal contact with subsurface soil and inhalation of soil-derived particulates)

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Although potentially complete exposure pathways are evaluated and illustrated on the conceptual site model, no significant exposure pathways were identified for the Site. The direct contact to surface and subsurface soil exposure pathways for an industrial worker and a construction worker are not significant because the entire site is covered by asphalt, concrete, gravel, building foundation, or grass, all of which mitigate exposure. In addition to these covers, institutional controls (i.e., excavation limitations, permit requirements) are in place to ensure the appropriate personal protective equipment (PPE) is used if soil is disturbed, thereby mitigating the potential for exposure. The groundwater exposure pathways are not significant because of implementation of health and safety procedures and use of PPE to prevent direct contact with groundwater during construction activities. The groundwater migration to surface water is complete; however, the pathway is not significant because the groundwater concentrations detected in the perimeter wells are below the applicable screening levels (Section 5.1.1).

Additional information regarding the exposure pathway analysis is provided in Section 7 of this report.

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<sup>4</sup> If there is any question on whether the identified exposures are "significant" (i.e., potentially "unacceptable") consult a human health Risk Assessment specialist with appropriate education, training and experience.

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5. Can the "significant" exposures (identified in #4) be shown to be within acceptable limits?

\_\_\_\_\_ If yes (all "significant" exposures have been shown to be within acceptable limits) –continue and enter "YE" after summarizing and referencing documentation justifying why all "significant" exposures to "contamination" are within acceptable limits (e.g., a site-specific Human Health Risk Assessment).

\_\_\_\_\_ If no (there are current exposures that can be reasonably expected to be "unacceptable")- continue and enter "NO" status code after providing a description of each potentially "unacceptable" exposure.

\_\_\_\_\_ If unknown (for any potentially "unacceptable" exposure) - continue and enter "IN" status code

Rationale and Reference(s):

This section is not applicable because no significant exposure pathways are identified for the Site.

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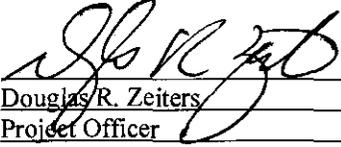
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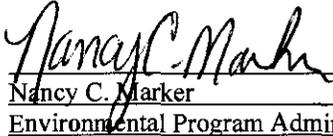
6. Check the appropriate RCRIS status codes for the Current Human Exposures Under Control EI event code (CA725), and obtain Supervisor (or appropriate Manager) signature and date on the EI determination below (and attach appropriate supporting documentation as well as a map of the facility):

**YE** -Yes, "Current Human Exposures Under Control" has been verified. Based on a review of the information contained in this EI Determination, "Current Human Exposures" are expected to be "Under Control" at the **DuPont Edge Moor White Pigment Facility**, EPA ID # **DED000800284**, located at **104 Hay Road, Edgemoor, Delaware**, under current and reasonably expected conditions. This determination will be reevaluated when the Agency/State becomes aware of significant changes at the facility.

NO -"Current Human Exposures" are NOT "Under Control."

IN -More information is needed to make a determination.

Completed by:  Date 9/28/12  
Douglas R. Zeiters  
Project Officer

Approved by:  Date 9/28/12  
Nancy C. Marker  
Environmental Program Administrator

Locations where References may be found:

DNREC. 2006. Corrective Action Permit # HW-03A16, March 24, 2006.  
DuPont. April 2009a. Phase I RFI Data Summary Report for DuPont Edge Moor Plant, Edgemoor, DE  
Parsons. March 2011. Phase II RFI Data Summary Report for DuPont Edge Moor Site, Edgemoor, DE

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**FINAL NOTE: The human exposures EI is a qualitative screening of exposures and the determinations within this document should not be used as the sole basis for restricting the scope of more detailed (e.g., site-specific) assessments of risk.**