

Second Five-Year Review Report

**E. I. du Pont de Nemours & Co., Inc. (Newport Pigment
Plant Landfill) Superfund Site
(a.k.a. DuPont-Newport Site)**

Newport, Delaware



Prepared by:

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A handwritten signature in black ink, appearing to read "Abraham Ferdas".

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3/31/05
Date



Table of Contents

List of Acronyms	iv
Executive Summary	v
Five-Year Review Summary Form	vii
I. Introduction	1
II. Site Chronology	2
Table 1: Chronology of Site Events	2
III. Background	4
Physical Characteristics	4
Land and Resource Use	5
History of Contamination	5
Initial Response	7
Basis for Taking Action	8
IV. Remedial Actions	10
Remedy Selection	10
Remedy Implementation	11
Table 2: Operable Unit Description	12
Table 3: Site-specific Sediment Clean-up Criteria for the Christina River	16
Operations & Maintenance (O&M)	16
V. Progress Since the Last Five-Year Review	19
VI. Five-Year Review Process	19
Administrative Components	19
Community Involvement	19
Document Review	21
Data Review	22
North Wetlands	22
South Wetlands	23
Christina River	25
Ground Water Recovery System	26
Ground Water Pretreatment	27
Perimeter Ground Water Monitoring	27
Thorium Ground Water Monitoring	28
Christina River Biphenyl Monitoring	28
Site Inspection	28
VII. Technical Assessment	30
Question A: Is the remedy functioning as intended by the decision documents?	30
Question B: Are the exposure assumptions, toxicity data, cleanup levels and remedial action objectives (RAOs) used at the time of the remedy selection still valid?	32
Changes in Standards and To Be Considered	32
Table 4: Comparison of 1993 and Current Water Quality Criteria	33

	Table 5: South Landfill Permeable Reactive Barrier Wall Treatment Standards	34
	Changes in Exposure Pathways, Toxicity and Other Contaminant Characteristics	35
	Question C: Has any other information come to light that could call into question the protectiveness of the remedy?	35
	Technical Assessment Summary	36
VIII.	Issues	36
	Table 6: Issues	36
IX.	Recommendations and Follow-up Actions	38
	Table 7: Recommendations and Follow-up Actions	38
X.	Protectiveness Statement	40
XI.	Next Five-Year Review	42
	Appendix A - List of Documents Reviewed	43

List of Acronyms

ARAR	Applicable or Relevant and Appropriate Requirement
AWQC	Federal Ambient Water Quality Criteria
CCC	Criterion Continuous Concentration
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
CibaSC	Ciba Specialty Chemicals
CMC	Criterion Maximum Concentration
DelDOT	Delaware Department of Transportation
DNREC	Delaware Department of Natural Resources & Environmental Control
EPA	U.S. Environmental Protection Agency
ESD	Explanation of Significant Differences
HASP	Health and Safety Plan
ICs	Institutional Controls
MCLs	Maximum Contaminant Levels
MCLGs	Maximum Contaminant Level Goals
n/a	Not Applicable
NCP	National Contingency Plan
NPL	National Priorities List
O&M	Operations and Maintenance
OSHA	Occupational Safety and Health Administration
OU	Operable Unit
PCE	Perchloroethylene or Tetrachloroethene
PCOR	Preliminary Close Out Report
POTW	Publicly Owned Treatment Works
ppb	Parts per Billion
ppm	Parts Per Million
PRB	Permeable Reactive Barrier Wall
PRP	Potentially Responsible Party
QA/QC	Quality Assurance and Quality Control
RAO	Remedial Action Objective
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
RPM	Remedial Project Manager
SWQSS	State Water Quality Standards
TCE	Trichloroethene
UAO	Unilateral Administrative Order
VOC	Volatile Organic Compound
WQC	Water Quality Criteria

Executive Summary

The E. I. du Pont de Nemours & Co., Inc. (Newport Pigment Plant Landfill) Superfund Site (a.k.a. DuPont-Newport Site) is located in the Town of Newport, New Castle County, Delaware. It is an approximately 120-acre site that includes the location of a paint pigment production facility (Ciba Specialty Chemicals or CibaSC), a former chromium dioxide production facility (DuPont Holly Run), two industrial landfills separated by the Christina River and a baseball diamond owned by DuPont situated just northwest of the paint pigment plant across the Amtrak railroad. The Site includes portions of the Christina River in which site-related contamination has come to be located. Most of the waste at the Site is from operations and disposal practices of a Lithopone production facility that operated from approximately 1902 until 1952. Lithopone was a barium- and zinc-based paint pigment.

To facilitate management of the cleanup, the DuPont-Newport Site was divided into seven operable units as follows:

- Operable Unit 1: Ballpark, waterline, ground water monitoring (monitoring for thorium migration at north landfill and plume migration at the southern perimeter of Site), CibaSC Health & Safety Plan
- Operable Unit 3: North wetlands
- Operable Unit 4: North landfill, including north landfill vertical ground water barrier wall
- Operable Unit 5: South wetlands
- Operable Unit 6: South landfill
- Operable Unit 7: Christina River
- Operable Unit 8: Plant Area paving, CibaSC vertical ground water barrier wall, ground water recovery & treatment

Note that Operable Unit 2 no longer exists.

The cleanup included excavation of contaminated sediments and restoration of wetlands and areas of the Christina River, capping the two landfills, soil removal at the ballpark, installation of a water line along Old Airport Road and preventing contaminated ground water from entering the wetlands and the river. The cleanup is providing protection to Delaware's natural resources and wildlife habitat. Over 35 acres of wetlands and wildlife habitat have been restored as part of the Site's overall cleanup. The cleanup has also allowed an important local employer (Ciba Specialty Chemicals) to continue operations safely on the Site. Due to the cooperative relationship of EPA, the Delaware Department of Natural Resources & Environmental Control and DuPont, the cleanup is more comprehensive than what was originally required in the 1993 Record of Decision, was \$13 million below estimated costs and was completed one year ahead of schedule.

The trigger for this five-year review was the completion of the first five-year review on March 31, 2000. The assessment of this five-year review found that overall the components of the remedy required in the 1993 Record of Decision and the 2001 Explanation of Significant Differences have been completed. Most of the components are functioning as designed although further work may be necessary

to increase the effectiveness of the ground water barrier wall at the north landfill and the permeable reactive barrier wall at the south landfill. Further evaluation is also necessary to determine whether or not contaminated ground water is migrating at a slow rate from the Site.

Other contamination has been found on the Christina River watershed (at an adjacent Superfund site and a nearby potential wetland mitigation site) that may be from the DuPont-Newport Site. Evaluation of the sediment data is on-going. The potential for contamination from the ground water to enter buildings (vapor intrusion) at the CibaSC plant is also being discussed with CibaSC. These issues could affect the long-term protectiveness of the Site, but in the short-term, the remedy is protective of human health and the environment.

Five-Year Review Summary Form (cont'd)

Issues:

- Ground water appears to be seeping over the sheet pile wall in several areas of the north landfill
- Possible vapor intrusion into structures at the CibaSC plant above the contaminated ground water plume
- Are the quality control and quality assurance procedures for environmental samples up-to-date?
- The deed(s) for the Delaware Department of Transportation-owned portion of the south landfill may not have a notice regarding the presence of contamination
- Are the Record of Decision and the Unilateral Administrative Order still attached to the deeds for the DuPont and CibaSC properties? Has the May 2001 Explanation of Significant Differences been added?
- Do the metals levels in the south wetland surface water remain below the acute state water quality standards?
- Are the plants around the south wetlands to restrict access in good condition?
- There currently is one "interior" ground water monitoring well for heavy metals in the Columbia aquifer and none in the Potomac to help ensure that there is no continued migration of contamination to the Columbia and Potomac aquifers
- Other potentially site-related contamination has been found in the Christina River watershed The permeable reactive barrier wall is not meeting the manganese treatment standard
- Should the permeable reactive barrier wall treatment standards be reduced for barium, cadmium, copper, manganese and nickel because of changes to the state water quality standards or risk-based criteria?
- Do the two wells being monitored for thorium provide adequate coverage to detect a release?
- Are the increases of manganese at the perimeter of the Site related to contamination? There are signs of animals burrowing into the cover soil of the south landfill
- Are residents and businesses along Old Airport Road still only using well water for non-potable purposes?
- Could erosion of soil from underneath CibaSC building near James Street release contaminants to the river?
- Was contamination exposed when the Delaware Department of Natural Resources & Environmental Control (DNREC) cut a channel through a portion of the downgradient area of the river that was dredged?

Recommendations and Follow-up Actions:

- Continue monitoring the elevation of ground water table at the north landfill; possible water, soil and/or sediment sampling; evaluate the need for more recovery wells
- Evaluate vapor intrusion potential at the CibaSC plant and take appropriate steps, if any, to mitigate
- Review existing quality assurance and quality control documentation and compare to the Unilateral Administrative Order requirements
- Ensure that the Delaware Department of Transportation attaches a notice regarding the presence of contamination to the deed(s) for the portion of the south landfill that it owns
- Inspect the DuPont and Ciba Specialty Chemicals property deeds
- Collect surface water samples in the south wetlands
- Inspect the south wetlands perimeter plants
- Consider modification of the ground water monitoring program to include more "interior" wells

- Continue on-going evaluation of possible site-related contamination in the Christina River watershed
- Complete a detailed review of the South Landfill Status Report regarding the performance of the permeable reactive barrier wall
- Evaluate the necessity of reducing the permeable reactive barrier wall treatment standards for barium, cadmium, copper, manganese and nickel
- Review the adequacy of the thorium monitoring well coverage; install a new well, if necessary
- Further evaluate ground water data and the adequacy of the monitoring network
- Eliminate animal burrows and increase inspections at the south landfill
- Survey well owners along Old Airport Road
- Continue monitoring status of the concrete along the Christina River at a CibaSC building near James Street and consider further soil sampling
- Sample the downgradient area of the river that was dredged where DNREC cut a channel to allow water flow from an adjacent wetland

Protectiveness Statement:

The remedy for Operable Unit (OU) 1 (includes the ballpark, the waterline, ground water monitoring and CibaSC's Health & Safety Plan) currently protects human health and the environment because the adjacent ballpark was cleaned up and nearby residents and businesses are on public water because of the water line that was installed as part of the remedy.

Institutional controls are in place to prevent the installation of drinking water wells near the Site or production wells at the plant area. Subsurface soil work at CibaSC's plant is conducted using procedures to protect workers from contaminated soil. However, in order for the OU 1 remedy to be protective in the long-term, further evaluation of potential plume migration at the southern perimeter of the Site and evaluation of the ground water monitoring network for thorium must be conducted.

The remedy for OU 3 (the north wetlands) is protective of human health and the environment because the contaminated sediments have been removed and the wetlands have been successfully restored. On-going maintenance activities, mainly control of invasive plant species, will continue to ensure protectiveness.

The remedy for OU 4 (the north landfill and ground water barrier wall) currently protects human health and the environment because the combination of the cap and the ground water barrier wall are preventing (except as discussed under OU 8 below) the migration of contaminated ground water to the north wetlands and Christina River. The cap also successfully covered contamination that was present in a wetland that had formed on the landfill. Institutional controls (ICs) are in place to ensure that the owners of the landfill are capable of performing on-going O&M and a monument has been placed at the entrance of the landfill warning of the presence of thorium in the landfill. However, in order for the OU 4 remedy to be protective in the long-term, further evaluation and/or upgrades of the ground water recovery system in the north landfill (see OU 8 discussion below;) must be undertaken to address several areas of potential ground water seeps at the landfill.

The remedy for OU 5 (the south wetlands) currently protects human health and the environment because the contaminated sediments have been removed and the wetlands have been successfully restored. On-going maintenance activities, mainly control of invasive plant species, will continue to ensure protectiveness. However, in order for the OU 5 remedy to be protective in the long-term, surface

water sampling must be conducted in the wetlands to ensure that levels of contamination in the surface water remain below acute state water quality standards.

The remedy for OU 6 (the south landfill) currently protects human health and the environment because the landfill has been capped and impacts to the adjacent wetlands and river have been significantly reduced by a combination of a slurry wall, a permeable reactive barrier wall and the cap construction along the river bank. However, in order for the OU 6 remedy to be protective in the long-term, further evaluation of the effectiveness of the permeable reactive barrier wall in controlling the migration of manganese to the south wetlands must take place. In addition, EPA must ensure that the ICs for the DuPont-owned portion of the landfill remain in place and that a notice regarding contamination is placed on the deed(s) for the Delaware Department of Transportation-owned portion of the Site.

The remedy for OU 7 (the Christina River) currently protects human health and the environment because the three areas of the river that were found to have levels of contamination that warranted clean up have been dredged and restored. Approximately three miles of the river were sampled (both upstream and downstream from the landfills because of the tidal nature of the river) resulting in the delineation of these three areas (one along the north landfill, one upstream and one downstream). However, in order for the OU 7 remedy to be protective in the long-term, a determination must be made as to whether the sediment contamination found in the deeper sediments at the adjacent Koppers Superfund Site and a nearby potential wetlands mitigation site is from the DuPont-Newport Superfund Site and, if so, if it poses a risk to human health or the environment. Also, the area where DNREC cut a channel through the downgradient dredged area must be sampled to ensure that there is not contamination in the upper several feet of sediments.

The remedy for OU 8 (includes the plant paving, the vertical ground water barrier wall at CibaSC and the complete ground water recovery and treatment system) currently protects human health and the environment because the combination of the increase in paved area and paving integrity, the ground water barrier wall and the ground water recovery and treatment system are greatly restricting the flow of contaminated ground water to the river. The treatment plant is successfully reducing the level of contaminants in the ground water before it is discharged to a local treatment plant. ICs are in place to ensure that the CibaSC facility owners are capable of performing on-going O&M. However, in order for the OU 8 remedy to be protective in the long-term, further evaluation of the ground water recovery system at the north landfill is necessary. The north landfill has several areas of potential seeps (based on comparing the water table elevation to the elevation of the top of the sheet pile wall) that may be allowing small amounts of contaminated ground water to enter the Christina River. This is likely caused by lower-than-expected recovery rates from several pumping wells.

In summary, the remedial actions implemented at this Site are protective of human health and the environment in the short-term. However, as described above, a number of issues require further evaluation and possible action in order for the Site to be protective in the long-term.

Other Comments:

None.

**E. I. du Pont de Nemours & Co., Inc. (Newport Pigment Plant Landfill)
Superfund Site
(a.k.a. DuPont-Newport Superfund Site)
Newport, Delaware
Second Five-Year Review Report**

I. Introduction

The purpose of the five-year review is to determine whether the remedy at a site is protective of human health and the environment. The methods, findings and conclusions of reviews are documented in Five-Year Review reports. In addition, Five-Year Review reports identify issues found during the review, if any, and identify recommendations to address them.

The Agency is preparing this Second Five-Year Review report pursuant to Section 121 of the Comprehensive Environmental Response, Compensation and Liability Act, as amended, (CERCLA) and the National Contingency Plan (NCP). CERCLA § 121 states:

If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgement of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.

The Agency interpreted this requirement further in the NCP; 40 CFR § 300.430(f)(4)(ii) states:

If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.

The United States Environmental Protection Agency (EPA), Region 3, conducted the five-year review of the remedy for the E. I. du Pont de Nemours & Co., Inc. (Newport Pigment Plant Landfill) Superfund Site (a.k.a. DuPont-Newport Superfund Site) in Newport, New Castle County, Delaware. This review was conducted by the Remedial Project Manager (RPM) for the Site from May 2004 through March 2005. This report documents the results of the review.

This is the second five-year review for the DuPont-Newport Site. The triggering action for this statutory review is the first five-year review date of March 31, 2000. The five-year review is required due to the fact that hazardous substances, pollutants, or contaminants remain at the Site above levels that allow for unlimited use and unrestricted exposure.

II. Site Chronology

Table 1 lists the chronology of events for the Site.

Table 1: Chronology of Site Events

Date	Event
1/22/87	EPA proposed Site to National Priorities List
8/12/88	EPA and DuPont entered into Administrative Order on Consent requiring DuPont to conduct a remedial investigation and feasibility study
2/21/90	Site added to National Priorities List
8/26/93	EPA issued Record of Decision (ROD)
4/17/94	EPA issued Unilateral Administrative Order to DuPont and Ciba-Geigy to implement ROD
3/31/00	EPA issued First Five-Year Review Report
9/19/02	EPA issued Preliminary Close Out Report (PCOR); Site attains "Construction Completion" milestone
<i>Operable Unit 1</i>	
Ballpark Excavation	
12/9/94	EPA approved 100% Design
6/13/95	Excavation activities started and completed
12/14/95	EPA Final Inspection
Ciba Specialty Chemicals Health and Safety Plan (HASP) for Subsurface Work	
12/5/94	HASP submitted
9/20/95	EPA approved HASP
Old Airport Road Public Water Supply Line	
4/6/95	Public meeting for potential users of public water
9/29/95	EPA approved 100% Design
12/8/95	Water turned on to homes and businesses
12/14/95	EPA Final Inspection
Ground Water Monitoring - Phase I	
12/29/95	EPA Approved Ground Water Monitoring Field Manual (except for radiological analyses procedures)

Date	Event
<i>Operable Unit 3 - North Wetlands</i>	
2/1/96	EPA approved the delineation of area to be excavated
9/25/96	<i>Phragmites</i> control began
5/14/97	100% Design approved
12/8/97	Sediment excavation completed
3/98	Restoration planting completed
5/1/98	EPA Final Inspection
<i>Operable Unit 4 - North Landfill</i>	
10/15- 11/30/98	"Concrete jungle" area excavated and moved to main area of north landfill
6/29/99	North landfill vertical ground water barrier wall design approved by EPA
11/12/99	EPA Final Inspection of sheet piles (ground water barrier wall)
5/31/00	EPA approved North Landfill Cap Design Plan
7/12/01	EPA Final Inspection of landfill
<i>Operable Unit 5 - South Wetlands</i>	
2/1/96	EPA approved the delineation of area to be excavated
9/25/96	<i>Phragmites</i> control began
5/14/97	100% Design approved
12/8/97	Sediment excavation completed
3/98	Restoration planting completed
5/1/98	EPA Final Inspection
<i>Operable Unit 6 - South Landfill</i>	
8/16/95	EPA issued Explanation of Significant Differences (ESD) to modify remedy for south landfill
5/18/01	EPA issued second ESD to modify remedy for south landfill
9/28/01	South landfill design approved by EPA
2/7/02	Slurry wall construction completed
3/15/02	Permeable reactive barrier wall construction completed
9/5/02	EPA Final Inspection

Date	Event
<i>Operable Unit 7 - Christina River</i>	
2/26/96	Final sediment contamination delineation report
8/5/96	EPA approved revised site-specific sediment clean-up criteria
9/23/98	100% Design approved
5/10/99	Sediment dredging start
9/8/99	Sediment dredging and backfill complete
11/9/99	EPA Final Inspection
<i>Operable Unit 8 - Ciba Specialty Chemicals and DuPont Holly Run Plant Areas</i>	
7/19/99	Began installing north landfill ground water recovery wells
8/20/99	North landfill ground water recovery well installation completed
6/29/00	Ground water extraction design approved by EPA
8/18/00	Ciba Specialty Chemicals ground water vertical barrier wall design approved
8/21/00	Extraction system installation started at north landfill
12/2/00	Began installation of vertical barrier wall
12/15/00	Completed installation of north landfill extraction system
1/10/01	Installation of vertical barrier complete
7/12/01	EPA Final Inspection of ground water treatment plant
7/23/01	Began installing ground water extraction trench
7/30/01	Began Plant Area paving
8/10/01	Installation of ground water extraction trench complete
8/24/01	Paving complete
9/21/01	Complete extraction trench well system
9/28/01	All extraction wells operating
10/9/01	EPA Final Inspection of extraction system, paving and barrier wall
Spring 2004	Collection trench rebuilt

III. Background

Physical Characteristics

The DuPont-Newport Site is located partially in Newport, New Castle County, Delaware and partially in unincorporated New Castle County, Delaware. It is an approximately 120-acre site located at James and Water Streets in Newport near the I-95, I-495 and Delaware State Highway 141 interchange (see attached Figure 1 from the August 26, 1993 Record of Decision [ROD]). The Site includes the location of a paint pigment production facility (Ciba Specialty Chemicals or CibaSC), a former chromium dioxide production facility (DuPont Holly Run), two industrial landfills separated by the Christina River and a baseball diamond (owned by DuPont and referred to as the ballpark) situated just northwest of the CibaSC plant across the Amtrak railroad (see attached Figure 2 from the ROD). The Site includes portions of the Christina River in which site-related contamination has come to be located.

The two uppermost aquifers underneath the Site are the Columbia aquifer and the Potomac aquifer. The Potomac has two water-bearing zones at the Site. Low-permeability soils restrict ground water from flowing between the different water-bearing zones and aquifers, but do not prevent flow. In addition, due to all of the filling at the Site to build the pigment plant, a localized aquifer has been created called the fill zone.

Tidal wetlands exist at the Site on both sides of the Christina River adjacent to the landfills. The northeast corridor of the Amtrak Railroad runs along the northern edge of the Site, and a junk yard exists immediately to the southwest of the Site.

Land and Resource Use

Currently, CibaSC operates a paint pigment plant at the Site and DuPont operates a ground water pretreatment plant. Two landfills serve as long-term containment of waste, and restored wetlands provide ecological habitat. Ground water at the Site is not used for drinking water or industrial purposes.

History of Contamination

The pigment plant, originally built during the period from 1900 to 1902, was owned and operated by Henrik J. Krebs and manufactured Lithopone, a white, zinc- and barium-based inorganic paint pigment. In 1929, DuPont purchased the plant and continued to produce Lithopone. Due to a decline in popularity, Lithopone production ceased in 1952. By this time, however, DuPont had begun to produce different organic and inorganic pigments, as well as other miscellaneous products at the Site. Some of these included purified titanium dioxide (the titanium dioxide was produced elsewhere), titanium metal, blue and green copper phthalocyanine pigments, red quinacridone pigment, high purity silicon, thoriated nickel and chromium dioxide. In order to expand the production of chromium dioxide, DuPont constructed the Holly Run plant during the 1970's. In 1984, DuPont sold the pigment manufacturing operations to Ciba-Geigy Corporation (now Ciba Specialty Chemicals [CibaSC]) but retained the chromium dioxide production operations. From 2000 to 2001, DuPont shut down the Holly Run plant and dismantled most of it.

The former Holly Run plant and the CibaSC plant were built on fill material placed over low-lying farmland. Most of the fill material underneath the CibaSC plant, and a small portion at the former DuPont plant, is contaminated with heavy metals such as cadmium, lead, barium and zinc. This is a result of past disposal operations and poor raw material storage and handling practices. As part of the CibaSC pigment plant operations (although prior to CibaSC's ownership), waste and off-specification products were disposed of in the north and south landfills.

The north landfill was constructed by disposing miscellaneous fill behind a man-made berm along the Christina River. Wastes, including Lithopone, other organic pigments, chromium and miscellaneous materials such as thoriated nickel were disposed of in the north landfill from 1902 to 1974. The maximum waste depth in the landfill was approximately 20 to 25 feet. There was no bottom liner system constructed prior to fill placement. Plant records indicate that drums containing thorium-232/nickel alloy and processing materials were disposed of from 1961 to 1966 and are buried about 10 feet below the top surface of waste fill.¹ Fill included trash (glass, wood, paper and cardboard), steel drums, concrete rubble, steelwork and artificial marble. Because of how the landfill was constructed, waste migrated into the adjacent wetlands and the Christina River.

The south landfill was used for the disposal of large quantities of Lithopone wastes, which were pumped through a pipe on the river bottom and discharged to a diked area in a wetland. There was no bottom liner, and some of the waste is currently in the water table. The south landfill operated from approximately 1902 to 1953. A small portion of the ballpark appeared to have become contaminated when soil from the pigment plant was used to groom the field (the ballpark was cleaned up in 1995).

Data collected during the remedial investigation and feasibility study (RI/FS) determined that the Site had extensive contamination in soils, sediments, ground water, surface water and plant tissue. High concentrations of certain metals were found in soils in the north landfill, in the south landfill and underneath the CibaSC and DuPont Holly Run plants. Barium, zinc, cadmium, arsenic, lead, mercury, silver, antimony, cobalt, copper, selenium and vanadium were all detected above background levels. Of these metals barium, zinc, cadmium and lead were the most prevalent. Contaminant levels underneath the CibaSC plant are as high as 0.6% arsenic, 13% lead, 9% barium and 6% zinc. The north landfill has levels as high as 4% barium, 5% zinc and 5% lead. The south landfill has levels as high as 7% barium, 1.6% lead and 1% zinc. In the wetland areas, contaminant levels were as high as 117 parts per million (ppm) arsenic; 21,500 ppm barium; 77 ppm cadmium; 3,070 ppm copper; 27,000 ppm lead; 8.6 ppm mercury and 15,300 ppm zinc (1%= 10,000 ppm).

Elevated levels of metals in the ballpark were primarily in the area adjacent to Awe Street and the ballpark. It is believed that the only source of these metals was from fill for the baseball field (as opposed to transport of airborne particulate). A review of aerial photography dating back to 1937 for this area of the Site suggests that the current location of the ballpark coincides with the recreational area that existed during much of the historical Lithopone operation era. Conversion of the ballpark into a parking lot coincided approximately with the termination of Lithopone operations in the early 1950's. By 1968, the area was returned to use as a ballpark. Fill material from the Site was reportedly used to manicure the baseball diamond over the history of its use (from pre-1940's). Lead was the only metal elevated to a level of concern in the ballpark.

¹ Note, however, that during installation of the ground water recovery system in the north landfill, several thorium drums were found much closer to the surface. These were relocated within the landfill.

Data collected during the RI/FS showed that two major aquifers are present beneath the Site: the Columbia (the upper aquifer) and the Potomac (the lower aquifer). The Potomac aquifer is subdivided into two water-bearing zones, the upper Potomac aquifer and the lower Potomac aquifer. All of the past filling operations (for plant construction and waste disposal) created another localized aquifer referred to as the fill zone. Low-permeability soils restrict ground water from flowing between the different water-bearing zones and aquifers, but do not prevent flow. This provides a pathway for contamination to migrate between the water-bearing zones and/or aquifers.

The chemicals that were found in ground water at concentrations which exceed maximum contaminant levels (MCLs) or non-zero maximum contaminant level goals (MCLGs) include cadmium, tetrachloroethene (PCE), trichloroethene (TCE), lead, barium, beryllium, carbon tetrachloride, 1,2-dichlorobenzene, 1,4-dichlorobenzene, chlorobenzene, vinyl chloride, benzene and antimony. Also, zinc, arsenic and cobalt have been detected at levels at the Site that are considered unsafe to drink.

Initial Response

In the late 1970's and early 1980's, the Delaware Department of Natural Resources & Environmental Control (DNREC) and DuPont sampled and analyzed ground water from on-site monitoring wells. The results indicated elevated levels of heavy metals (especially barium, cadmium and zinc) and volatile organic compounds (mainly tetrachloroethene and trichloroethene) in ground water. During the mid 1980's, EPA and DNREC gathered and reviewed information to determine whether or not the Site was eligible for the National Priorities List (NPL). The Site was proposed for inclusion on the NPL in January 1987 and was promulgated in February 1990.

On August 22, 1988, DuPont entered into an Administrative Order by Consent with EPA whereby DuPont agreed to perform a RI/FS for the Site. This study included collection of ground water, soil, sediment and surface water (both river and wetlands) samples. Although the Site was originally included on the NPL because of ground water contamination caused by the north landfill, the RI/FS found that the river and the adjacent wetlands were contaminated as well. Some areas showed significant impacts to the ecosystem, although other areas had only-minor impacts. The RI/FS also determined that the south landfill and the soil underneath the production plants are sources of ground-water contamination. The RI/FS was completed with the issuance of a Record of Decision (ROD) on August 26, 1993.

On June 10, 1993, EPA and DuPont entered into a removal consent order to address seepage of a heat transfer fluid (similar in composition to Dowtherm) into the Christina River. The seeps, along the north bank of the Christina River, were causing an oil sheen on the Christina River. Ciba-Geigy had been reporting the releases to the National Response Center beginning in October 1992. Oil sorbing booms were placed in the river to control the spread of the fluid. EPA determined that the levels of Dowtherm were potentially hazardous to aquatic life and that the booms were not an adequate measure of control until such a time as the permanent remedy for the Site could be implemented. Actions taken in this removal project (sheet piling installed along the river bank) provided an interim remedy for the seeps.

Basis for Taking Action

Contaminants

Hazardous substances that have been released at the Site in each media include:

Soils

Arsenic
 Barium
 Cadmium
 Cobalt
 Copper
 Lead
 Manganese
 Mercury
 Thorium Oxide
 Zinc

Sediment

Arsenic
 Barium
 Cadmium
 Chromium
 Copper
 Lead
 Mercury
 Zinc

Ground Water

Antimony
 Arsenic
 Barium
 Beryllium
 Cadmium
 Cobalt
 Lead
 Manganese
 Zinc

Surface Water (and seeps)

Aluminum
 Cadmium
 Chromium
 Copper
 Iron
 Lead
 Mercury
 Zinc

Benzene
 Carbon tetrachloride
 Chlorobenzene
 1,2-Dichlorobenzene
 1,4-Dichlorobenzene
 PCE
 TCE
 Vinyl chloride

1,2-Dichloroethene
 Chlorobenzene
 PCE

As part of the RI/FS, EPA conducted a human health risk assessment and an environmental risk assessment. Most of risks at the Site were to environmental receptors, especially aquatic life.

In regard to the human health risk assessment, receptors for which risks were unacceptable included a future construction worker and an adolescent trespasser at the south landfill area; a maintenance worker for the north landfill area and the Holly Run plant; a maintenance and future construction worker at the CibaSC plant; a resident undertaking recreational activities in a ballpark just

north of the CibaSC plant across the Amtrak rail line; and a resident, in the future, drinking contaminated ground water just off the south landfill property. The contaminants which contributed most to the human health risk at the Site were lead, vinyl chloride, arsenic, tetrachloroethene, trichloroethene, cobalt, zinc, cadmium and manganese.

In regard to the environmental risk assessment, EPA determined that several areas of the north and south wetlands and the Christina River warranted remediation based on the review of all available data, especially that of the sediment toxicity tests, the benthic studies and the sediment chemistry tests.

In summary, based on the potential impacts to human health and the environment, EPA determined in the August 26, 1993, ROD that the following areas of the Site warranted remediation:

1. **Ballpark:** The east entrance to the ballpark near the end of Ayre Street had surface soils above EPA's clean-up criteria of 500 ppm that created an unacceptable risk to human health.
2. **North landfill including the drainage way:** This area continually releases contaminants to the ground water in the fill and/or Columbia aquifers which affects shallow ground water in the direction of migration and ground-water discharge areas. One of the areas affected by the discharge was the Christina River which had ambient water quality criteria (AWQC) or state water quality standard (SWQS) exceedances and some sediments which exhibited unacceptable environmental impacts. Another area affected by the discharge was the north drainage way, parts of which exhibited extreme impacts to ecological receptors.
3. **South landfill:** This area continually releases contaminants to the ground water in the fill zone and/or Columbia aquifers which affected shallow ground water in the direction of migration and ground water discharge areas. The two discharge points were the river and the south wetlands which had AWQC or SWQS exceedances and some sediments which exhibited unacceptable environmental impacts. Future subsurface maintenance or construction activities would have resulted in unacceptable risks to humans.
4. **South wetlands:** Part of this area exhibited unacceptable environmental impacts including low benthic density and poor benthic diversity (i.e., a high percentage of pollution tolerant species).
5. **Christina River:** Some of the sediments in the river exhibited unacceptable environmental impacts. AWQC or SWQSs for several site-related contaminants, including cadmium, lead and zinc, were exceeded in the vicinity of the Site.
6. **CibaSC plant and a small portion of the DuPont Holly Run plant:** Exposure to surface and subsurface soils cause unacceptable risks to humans. This area continually releases contaminants to the ground water in the fill zone and/or Columbia aquifers which affects shallow ground water in the direction of migration, ground water in the Potomac aquifer where the hydraulic gradient is downward and ground water discharge areas. One of the discharge points that was affected is the river which had AWQC or SWQS exceedances and some sediments which exhibited unacceptable environmental impacts.

7. Ground water: The ground water in the fill zone and both the Columbia and the Potomac aquifers at the Site is not safe to drink. Levels of contaminants such as tetrachloroethene, trichloroethene, cadmium, barium and lead exceed their MCLs or non-zero MCLGs in the Columbia aquifer. Arsenic, cobalt, manganese and zinc also contribute to unacceptable human health risks in the Columbia aquifer. Levels of contaminants such as tetrachloroethene, cadmium, lead and trichloroethene exceed their MCLs or non-zero MCLGs in the Potomac aquifers. Cobalt also contributes to unacceptable risks to humans. No one is currently consuming any ground water that has MCL or non-zero MCLG exceedances caused by the Site.

IV. Remedial Actions

Remedy Selection

On August 26, 1993, EPA issued a ROD, which addressed the complete Site. Below is a summary of the selected remedy.²

Ballpark: Excavation of soils above 500 ppm lead with disposal in the north landfill.

Purpose: Prevent human exposure to elevated levels of lead.

North Landfill: Capping; wetland remediation, restoration and monitoring; vertical barrier wall down to base of the Columbia aquifer; and ground water recovery and treatment.

Purpose: Prevent continued releases of contaminants to the ground water which discharges to the river and the north wetlands; clean up areas of unacceptable environmental impact in the north wetlands; prevent exposure of plant and terrestrial life to contaminated soils.

South Landfill: Excavation and consolidation of contaminated soil underneath and to the east of Basin Road or South James Street onto the south landfill; in-situ soil stabilization of the combined soil; capping of the south landfill.

Purpose: Prevent continued releases of contaminants to the ground water which discharges to the river and the south wetlands; prevent unacceptable human exposure to contaminated soils from the landfill.

South Wetlands: Excavation, restoration and monitoring.

Purpose: Prevent unacceptable impacts to environmental receptors.

Christina River: Dredging and monitoring.

Purpose: Prevent unacceptable impacts to environmental receptors.

² See the remedy implementation section below to see how some portions of the remedy (particularly the south landfill cleanup technology and the sediment cleanup criteria) changed during the implementation of the remedy.

CibaSC and DuPont Holly Run plants: Vertical ground water barrier wall along the Christina River at the CibaSC plant; pave the rest of the ground within the contaminated plant areas; recover and treat the ground water up-gradient of the barrier wall; institute special health and safety plans for intrusive work.

Purpose: Prevent continued releases of contaminants to the ground water which discharges to the river; prevent unacceptable human exposure to contaminated soils.

Ground water: Monitoring, provide public water supply along Old Airport Road and establish a ground water management zone.

Purpose: Prevent human exposure to Site-related contaminated ground water; prevent further contamination of the Columbia and the Potomac aquifers; protect the south wetlands.

The remedy for the ground water also included invoking the "greater risk to human health and the environment" applicable or relevant and appropriate requirement (ARAR) waiver. This waiver applies to both the Columbia and Potomac aquifers. Attempts to remediate the Potomac aquifer would have caused more contamination to migrate into the Potomac aquifer directly underneath the Site from the more highly contaminated Columbia aquifer. Attempts to remediate the Columbia aquifer would have adversely affected the wetlands around the south landfill. These adverse effects outweighed the benefits of installing pump-and-treat systems in these aquifers. The ROD included a long-term monitoring program to make sure that this waiver continues to be justified.

State of Delaware SWQSS were waived in the north wetlands and the river using the "technical impracticability" ARAR waiver because of off-site sources. Federal AWQC were waived in the river for the same reason. SWQSS were also waived in the south wetlands using the "greater risk to human health and the environment" waiver because compliance would require destruction of far more wetlands than was estimated necessary in order to protect the environment.

Remedy Implementation

After an unsuccessful attempt to negotiate a Consent Decree, EPA issued a Unilateral Administrative Order (UAO) on April 19, 1994, to DuPont and Ciba-Geigy Corporation requiring them to implement the 1993 ROD. Pursuant to an agreement between the companies, DuPont has conducted almost all of the work.

In order to facilitate managing the remedial action, EPA divided the Site into seven operable units. However, the current division of the Site is slightly different than that outlined in the 1993 ROD. Below is a table summarizing the areas of the Site associated with each operable unit.

Table 2: Operable Unit Description

Operable Unit	Description
OU 1	Ballpark, waterline, ground water monitoring (monitoring for thorium migration at north landfill and plume migration at southern perimeter of Site), Ciba HASP (Health & Safety Plan) - <i>Completed 12/29/95</i>
OU 2	<i>No longer exists - during the RI/FS, the Site was split into two operable units and later recombined</i>
OU 3	North Wetlands - <i>Completed 6/30/98</i>
OU 4	North landfill, including north landfill vertical ground water barrier wall <i>Completed 9/6/01</i>
OU 5	South Wetlands - <i>Completed 12/30/98</i>
OU 6	South Landfill - <i>Completed 3/17/03</i>
OU 7	Christina River - <i>Completed 11/19/99</i>
OU 8	Plant Area paving, CibaSC vertical ground water barrier wall, ground water recovery & treatment - <i>Completed 11/2/01</i>

1. Operable Unit 1 - Ballpark, waterline, ground water monitoring, CibaSC HASP

a. Ballpark

On June 13, 1995, a 12-foot by 10-foot area at the ballpark was excavated to a depth of approximately 12 inches using a front-end loader. Approximately 4.5 cubic yards of material were removed and disposed of at the north landfill.

b. CibaSC HASP

Since the soils are contaminated, CibaSC prepared a health and safety plan (HASP) to ensure the protection of workers performing subsurface soil work at the CibaSC plant. The HASP includes a waste management plan.

c. Waterline

During the spring of 1994, DuPont approached the residents and business owners along Old Airport Road about tying their homes and businesses into a new public water supply line. The ROD required that all users, from immediately adjacent to the south wetlands area, west to Cress Collision Service be tied into the line. DuPont volunteered to extend the line to the end of Old Airport Road, but the portion beyond the Cress property was not part of the Superfund project. All of the well owners within the ROD portion of the line responded that they wanted to be tied into the water main. However, many of the well owners wanted to keep their wells for non-potable water uses. EPA determined that it was acceptable to continue to use the wells as long as all potable uses were completely disconnected

from the wells. Only three of eleven wells were abandoned. During December 1995, each home and business was tied into the main.

d. Ground Water Monitoring

DuPont developed a ground water monitoring plan that originally required sampling twice per year. The first sampling event took place in early 1996.

2. Operable Unit 3 - North Wetlands

Cleanup activities in the north wetlands included the excavation of sediments from the north wetlands (including the north drainageway) that were contaminated with heavy metals, on-site disposal of the sediments in a newly-constructed cell on the north landfill and restoration of the north wetlands.

The selected remedy for the north wetlands was modified during the remedial design in several ways that greatly enhanced the cleanup. As a result of DuPont's desire to construct the best possible wetland, EPA, DNREC and DuPont collaborated on design changes that brought about the improvements. The enhancements included a significant reduction of the site-specific sediment clean-up criteria for the north wetlands, excavating deeper, heavily contaminated sediments that were discovered in the remedial design and increasing the biodiversity of the wetland. The performance standards of the ROD had to be modified in order to accomplish these changes. The documents below contain the modifications.

8/18/95 Memo to "DuPont-Newport Post-Decision Document File" entitled "North/South Wetlands-Sediment Clean-up Criteria."

9/30/96 Memo to "DuPont-Newport Post-Decision Document File" entitled "North & South Wetlands ROD Modifications."

In total for the north wetlands, DuPont remediated 2.7 acres of wetlands and excavated 9,500 cubic yards of contaminated soil.

3. Operable Unit 4 - North Landfill

The north landfill cleanup activities included the capping of 7.6 acres of the north landfill and installing a ground water barrier wall approximately 1,730 feet in length along the sides of the landfill adjacent to the north wetlands and Christina River. The cap included a geosynthetic clay liner and a high density polyethylene membrane. The ground water barrier wall was constructed using sheet pile with grouted interlocks.

The following wastes were buried in the north landfill prior to capping: soil excavated from the ballpark area, Lithopone waste piles from an area adjacent to the north wetlands, sediments excavated from the north wetlands and north drainageway, soil and debris from the "concrete jungle" area at the west end of the landfill and soil from the Holly Run excavation project.

4. Operable Unit 5 - South Wetlands

In the south wetlands, DuPont remediated 6.5 acres (wetlands and pond combined) by removing 37,000 cubic yards of contaminated sediments and rebuilding the wetlands. DuPont also created 1.7 additional acres of wetlands by removing 20,000 cubic yards of contaminated soil from a berm. All 57,000 cubic yards were disposed in the south landfill. The cleanup included the restoration of the wetlands.

The remedy for the south wetlands was modified during remedial design in several ways that greatly enhanced the cleanup. As a result of DuPont's desire to construct the best possible wetland, EPA, DNREC and DuPont collaborated on design changes that brought about the improvements. The enhancements included a significant reduction of the site-specific sediment clean-up criteria for the south wetlands, excavating deeper, heavily contaminated sediments that were discovered in the remedial design, increasing the biodiversity of the wetland and removal of the berm mentioned above. The performance standards of the ROD had to be modified in order to accomplish these changes. The documents below contain the modifications.

8/18/95 Memo to "DuPont-Newport Post-Decision Document File" entitled "North/South Wetlands-Sediment Clean-up Criteria."

9/30/96 Memo to "DuPont-Newport Post-Decision Document File" entitled "North & South Wetlands ROD Modifications."

10/3/96 Memo to "DuPont-Newport Post-Decision Document File" entitled "South Wetlands."

5. Operable Unit 6 - South Landfill

In May 2001, EPA issued an Explanation of Significant Differences (ESD) that modified the south landfill cleanup plan.³ The new remedy included a barrier system to physically separate the waste material from the environment. The barrier system consisted of a slurry wall coupled with a permeable reactive barrier (PRB) wall to either filter contaminated ground water or to keep it from entering the wetlands and river. From December 2001 to August 2002, DuPont constructed the remedy at the south landfill. The slurry wall was placed parallel to the Christina River along the south side of the 6 foot-diameter New Castle County sewer main that runs through the landfill. The PRB wall, which filters the ground water, surrounded the remainder of the landfill.

The permeable reactive barrier (18-inches wide) is a mixture of treatment agents and clean sand in the weight ratio of 100:20:5:5 (mortar sand: gypsum: iron: magnesite). The iron immobilizes soluble zinc via surface adsorption reactions. The gypsum and magnesite immobilize soluble barium and manganese as barium sulfate and manganese carbonate, respectively. Based on field studies at the south

³ Note that this was the second ESD that EPA issued for the south landfill. The first was issued on August 19, 1995, and changed the landfill treatment technology from in-situ soil stabilization to irrigation with sodium sulfate and sodium sulfite to immobilize the metals in the landfill. However, tests conducted after the ESD showed that aluminum could become mobile in the ground water as a result of the treatment and that the anticipated cost savings was not going to materialize. As a result, EPA issued the second ESD.

landfill, the 18-inch thick wall is very conservatively estimated to have a wall life greater than 260 years.

In addition, the south landfill was capped using a geosynthetic clay liner and a high density polyethylene membrane. The membrane cap extended down the riverbank to the low mean tide line. The riverbank was then covered with armor stone. Sediment samples were collected in the Christina River along the south landfill to serve as a baseline for future monitoring to ensure that heavy metals from the south landfill do not contaminate the river sediments.

Monitoring wells were installed inside and just outside the landfill and inside the permeable reactive barrier to confirm that the PRB is working properly and to provide an early warning against breakthrough (see attached Figure 10 from the May 2001 ESD).

6. Operable Unit 7 - Christina River

Clean-up activities for the Christina River included the dredging of 2.9 acres⁴ of the river that were contaminated with heavy metals, on-site disposal of the sediments in the south landfill and restoration of the dredged areas.⁵ Sheet piling was used to prevent the migration of contaminated sediments during the wet dredging operation.

The remedy for the Christina River was modified during remedial design in several ways that greatly enhanced the cleanup. Once the contaminated areas of the river were delineated, it became apparent that there were areas of "marginal" contamination that were relatively small. DuPont proposed lowering the clean-up criteria and dredging these "marginal" areas thus eliminating the need for the extensive long-term monitoring program that was part of the ROD. As a result EPA changed the site-specific sediment clean-up criteria for the Christina River (see Table 4 below).

⁴ Note that there were three areas of dredging, one along the banks of the north landfill and the CibaSC plant, one upstream and one downstream of the facility. The total volume of sediments removed was approximately 11,000 cubic yards.

⁵ The restoration included backfilling all of the dredged areas and replanting the intertidal zones at the up-and downgradient areas.

Table 3: Site-specific Sediment Clean-up Criteria for the Christina River

Contaminant	Original Site-specific Clean-up Criteria ⁶	Revised Site-specific Clean-up Criteria ⁷	Effective Site-specific Clean-up Criteria ⁸	Approx. Average Sediment Concentration after Cleanup
Zinc	5,600 ppm	3,000 ppm	1,500 ppm	570 ppm
Lead	1,200 ppm	700 ppm	120 ppm	46 ppm
Cadmium	60 ppm	20 ppm	6 ppm	1.7 ppm

These changes were documented in a 8/5/96 Memo to "File" entitled "Christina River Remedy Modifications, E. I. DuPont, Newport Superfund Site."

7. Operable Unit 8 - CibaSC Plant Area and Ground Water Barrier Wall, Recovery and Treatment System

Clean-up activities for OU 8 included installing a jet-grouted vertical ground water barrier wall approximately 612 feet in length at the CibaSC plant and a ground water collection trench approximately 460 feet in length behind the wall. Recovery wells extract the ground water and pump it to the modified former DuPont Holly Run water treatment plant where the ground water is treated, using pH adjustment and filtering, to lower the zinc level. The water is then pumped to the Wilmington, Delaware treatment plant, a publicly-owned treatment works (POTW), for final treatment. The cleanup also included paving approximately 2.4 acres of unpaved area within the contaminated areas of the CibaSC plant and the former DuPont Holly Run chemical plant.

Operations & Maintenance (O&M)

Operations and Maintenance (O&M) activities have been and/or are being conducted at a number of areas at the Site including the north and south wetlands, the Christina River and the north and south landfills, as well as perimeter ground water monitoring, operation of the ground water recovery and treatment plant, paving repair in the plant areas and monitoring of ground water in the north landfill area for thorium. The O&M activities for each of these areas is described in O&M manuals that have been reviewed and approved by EPA.

⁶ These are "normalized to grain size values". See the ROD for further details.

⁷ The revised and effective sediment criteria are absolute values.

⁸ Although there currently are areas of the river with contaminant levels above the "effective criteria," the revised Site-specific clean-up criteria would have to be further lowered below the "effective criteria" before further dredging would be contemplated in the river (i.e., areas of the river that contain contamination between the revised criteria and the effective criteria are only hot spots which are too small to warrant dredging).

For the north and south wetlands and the Christina River, the O&M includes two inspections each year to monitor success of the plantings, evaluate the density and diversity of plants, observe wildlife usage, look for erosion and measure the percent coverage of invasive species (predominantly *Phragmites*, purple loosestrife and mile-a-minute weed). Experienced wetlands scientists familiar with local flora and fauna perform all field activities. Just about the only maintenance activity that has taken place is work to control *Phragmites* and purple loosestrife. DuPont has used the herbicide Roundup to treat *Phragmites* in limited areas of both the north and south wetlands and has introduced *Galerucella* beetles to help control the purple loosestrife. DuPont is required to keep the invasive species to below 15% coverage in the restored areas of each wetland and the Christina River.

Ground water is being monitored, generally along the southern or downgradient edge of the Site, to determine whether or not the plume of contamination is growing. Most of the ground water plume is underneath areas that still contain waste (the north and south landfills and the CibaSC plant), although some contamination has migrated beyond these areas. In the ROD, EPA determined that it was not appropriate to clean up the ground water contamination outside of these areas for several reasons. Since so much waste remains at the Site, trying to clean up the ground water would have resulted in more contamination entering the ground water. Also, EPA was concerned that attempts to clean up the ground water would adversely affect the water supply to the south wetlands by removing the ground water underneath the wetlands. Since there was no evidence of plume migration, EPA determined that monitoring and the connection of some residences and businesses along Old Airport Road to the public water supply would protect human health and the environment. Eight wells are sampled as part of the on-going perimeter ground water monitoring.

The caps of the north and south landfills undergo mowing (only part of each landfill is mowed each year to maximize the habitat value of the grasses on the landfills). One area that has needed repair, and will likely in the future as well, is the south landfill cap along the sides of South James Street. While the shoulder of the road is roughly the width of the travel lane, vehicles occasionally drive off the pavement and leave ruts in the soil. If left unaddressed, one of these could eventually expose the geomembrane liner.

Ground water monitoring also takes place at the south landfill to monitor the performance of the PRB. The PRB is designed to remove dissolved barium, manganese and zinc.⁹ EPA's initial review of nearly two years of quarterly monitoring shows that except for manganese, the PRB is performing as designed.¹⁰ DuPont is conducting additional assessments to determine how to meet the manganese standard.

⁹ Note that there are treatment standards for the PRB that also include cadmium, copper, lead and nickel, but these contaminants were already meeting the standard without treatment.

¹⁰ The South Landfill Status Report that described the performance to date of the PRB was submitted by DuPont to EPA in January 2005 during the five-year review. As a result, a detailed review of the report was not completed before the issuance of the five-year review.

The paving in the plant areas undergoes annual inspection and repair. Parts of the CibaSC plant are heavily traveled and maintenance of the asphalt will be an on-going activity. In December 2004, DuPont completed replacing/repairing approximately one-half acre of asphalt pavement.

Along the north bank of the Christina River, the ground water recovery system is composed of recovery wells (mainly in the north landfill), a collection trench in the CibaSC plant and wells to monitor the performance of the collection system in preventing migration of contamination to the north wetlands and the Christina River. Each of the collection components has had problems. Originally, the north landfill wells were not pumping the amount of ground water anticipated. Some of this has been due to the cap preventing infiltration and to the low permeability of the soils near the wells, but the wells have also had plugging problems and the pumps have broken down. DuPont has worked redeveloping the wells and replacing pumps and will continue to monitor these problems. The collection trench never worked according to design and had to be replaced in the spring of 2004. It appears that fines from the jet-grouted barrier wall that is between the trench and the river migrated to the trench and significantly reduced the permeability of the stone. The original stone was removed and new stone and an underground drain pipe were installed. As a result the amount of ground water recovered from the system overall has increased from 3,000 gallons per day to 30,000 gallons per day.

The recovered ground water is then treated. Ground water contaminants (principally zinc) are removed via precipitation and filtration. Precipitation is carried out through the addition of 50% caustic and then settling zinc hydroxide. Ferric chloride can be added to improve precipitant formation. Filtration is used to remove additional precipitant. Accumulated solids are periodically removed for disposal at DuPont's Deepwater, New Jersey facility.

The ground water treatment plant must lower the zinc levels to below 14 ppm in order for the water to be discharged to the sewer line for further treatment at the Wilmington treatment plant. The plant has easily met this level. The one part of the plant that has had some problems is the filtration step, the last step in the treatment process. Originally, the plant used Tyvek filter media, but the Tyvek became clogged rather quickly. Teflon filtration media is being used at the moment and lasts much longer. However, it does not filter the water as well as the Tyvek and thus does not remove as much zinc. DuPont will continue to carefully monitor the treatment plant effluent to ensure it is meeting the POTW's requirements.

The ground water in the vicinity of the north landfill undergoes monitoring in order to detect any release of the thorium that is buried in the landfill. The north landfill was once an Atomic Energy Commission-licensed disposal site for thorium which DuPont used in research and development activities at the Site. Thorium oxide, the form most if not all of the thorium was in, is one of the most insoluble compounds known and the likelihood of a release is very, very small. Two wells are monitored for thorium-232 and radium-238 every six months under this program. DuPont has requested that the sampling frequency be changed to every other year based on the results to date. EPA is evaluating this proposed change.

Data has been collected from a number of these O&M activities and is discussed in the "Data Review" section below.

V. Progress Since the Last Five-Year Review

This is the second five-year review for the DuPont-Newport Superfund Site. The first Five-Year Review was completed on March 31, 2000. The first Five-Year Review concluded that, at the time of its issuance, the remedy was not protective of human health and the environment (cleanup was on-going at that time). However, it noted that there were no people with on-going exposures to contaminants at levels that posed adverse health threats and that the worst environmental threats (sediment contamination in the north and south wetlands and the Christina River) had been remediated. It also stated that "by implementing the rest of the remedy-selected in the 1993 ROD (as modified), which includes the North and South Landfill caps, the South Landfill treatment, recovery of ground water from underneath the North Landfill and the Ciba-Geigy plant, and the enhancement of the sheet pile wall at the Ciba-Geigy plant, EPA is taking steps to make this remedy protective."

Since that time, the north landfill, the plant area, the south landfill and the ground water recovery and treatment projects have been completed, thus bringing the site to the "Construction Completion" milestone in 2002 (note that the topic of "protectiveness" is discussed below). Monitoring activities have also been taking place in the restored areas of the wetlands and the river as well as for the ground water.

VI. Five-Year Review Process

Administrative Components

This five-year review began in May 2004. The DuPont-Newport Site five-year review was conducted by Randy Sturgeon, EPA's Remedial Project Manager (RPM) for the Site, with support from Lindsay Hall, DNREC's project officer for the Site, Trish Taylor, EPA's Community Involvement Coordinator for the Site, Bruce Pluta, head of EPA Region 3's Biological Technical Assistance Group, Chris Guy, U.S. Fish and Wildlife Service, Peter Knight, the National Oceanic and Atmospheric Administration, and DuPont, the primary potentially responsible party (PRP) for the Site. EPA, DNREC and DuPont conducted a Site inspection September 14, 2004.

The five-year review included the following administrative components: community involvement, document review, data compilation and review, a site inspection and report development and review.

Community Involvement

Activities to involve the community in the five-year review were initiated by publishing an ad in the *Wilmington News Journal* on November 18, 2004 informing residents in the local area that EPA was conducting a five-year review at the Site and that it would be completed and available in March 2005. Historically, EPA has worked with the Mayor of the Town of Newport to keep the local community informed of Site activities. Therefore, Trish Taylor, EPA's Community Involvement Coordinator for the Site, interviewed Mayor Donald Mulrine on December 8, 2004. Overall, Mayor Mulrine was very positive about the clean-up activities of EPA and DuPont. In regard to potential community concerns, the Mayor did say that residents may be wondering how the permeable reactive barrier wall at the south landfill is performing (i.e., is it treating the ground water as designed?) as well as wondering what the Site will look like in 10 years. These issues can be discussed in future fact sheets that may be mailed to

community members. The Mayor did express concern that the "habitat piles" created just south of the south landfill from trees cut down in order to cap the landfill may be providing mosquito breeding areas. EPA will look into this issue in the spring and summer of 2005.

The Mayor also expressed interest in the future use of the north and south landfills which are currently open space generally owned by DuPont (the State of Delaware owns a small portion of the south landfill). He stated that he would like to see the land donated as open space to the Town to be used for community activities. The Mayor thought the south landfill area could be used for a community center and/or for recreational activities especially with the addition of bird watching towers, a fishing pier, walking/jogging trails, picnic areas, etc. The Mayor requested recommendations from EPA regarding potential future uses as well as information about EPA's Brownfields Program. EPA will schedule a meeting to discuss these issues in detail. In general, the north landfill would not be available to be used for community open space due to its proximity to the CibaSC plant, limited access (the only access is by going through the CibaSC plant) and the fact that it has thorium waste buried in it. The south landfill could be used for some outdoor activities, but significant issues, such as how to protect the ground water monitoring wells and CibaSC's discharge piping, who would be responsible for upkeep of the landfill and adjacent wetlands, health and liability issues if someone were to dig into the landfill and the current owner's desires, would have to be addressed. The ROD does require the landfill to remain as open space for both its value as habitat as well as to enhance the habitat value of the adjacent wetlands. The ROD also discussed, in response to public comment, keeping open the "unofficial" boat launch that had formed on the south landfill near the James Street bridge. However, with the changes to the south landfill remedy whereby waste in this area was left in place, this requirement was deleted in the first ESD issued in 1995. Incidentally, since the Town of Newport recently opened a boat ramp just downstream of the south landfill at a location originally cleared by DuPont to launch the dredging equipment, there is not a need to have a ramp at the south landfill.

On January 6, 2005, Randy Sturgeon conducted a phone interview with Dr. Colin Mackay, Vice President of CibaSC's Coating Effects Segment. The purpose of the interview was to inform CibaSC, as a PRP, about the five-year review and to ask CibaSC, as a stakeholder, if it had any issues in regard to the Site (while CibaSC is a PRP, DuPont has performed the vast majority of the work at the Site). From a stakeholder perspective, Dr. Mackay reported that CibaSC has worked harmoniously with DuPont. Also discussed was the topic of vapor intrusion and how EPA has recently become more aware of potential health risks from indoor air in buildings that are located over ground water contaminated with volatile organic compounds. In a situation such as an operating plant, EPA has yet to determine whether it has to review this issue in-depth or rely on Occupational Safety and Health Administration (OSHA) requirements to ensure worker protection. Dr. Mackay suggested that a meeting to discuss these issues would be appropriate.

Following issuance of this Second Five-Year Review report, the report will be made available to the public in the information repositories located at the Kirkwood Highway Library, 6000 Kirkwood Highway, Wilmington, Delaware, and at the EPA Region 3 office, 1650 Arch Street, Philadelphia, Pennsylvania, and on the internet at www.epa.gov/5yr.

Document Review

This five-year review consisted of a review of relevant documents including the ROD, the UAO, O&M records and monitoring data. The specific documents are listed in Appendix A. In reviewing the

documents, several issues came to light that did not fit within the discussion elsewhere in this five-year review and are discussed below.

The ground water remedy in the ROD includes invoking the "greater risk to human health and the environment" ARAR waiver for the Columbia aquifer underneath the south wetlands because EPA was concerned that pumping water from this aquifer would adversely impact the water supply to the south wetlands. During the remedial design, new information was discovered that shows that ground water perhaps could be removed from the Columbia aquifer underneath the south wetlands and not adversely impact the water supply of the wetlands. First, it was discovered that a continuous clay layer (called the marsh deposit) exists underneath the wetlands that naturally limits ground water migration from the Columbia to the south wetlands. Second, the south wetlands has become a tidal wetlands since the issuance of the ROD. A tide-gate on the east side of Highway 141 has fallen into disrepair allowing tidal flux of surface water in the south wetlands. The State of Delaware does not have plans to repair the tide gate. Since no one can drill drinking water wells in this area (it is part of a state ground water management zone and is underneath land owned almost exclusively by DuPont) and as long as the ground water plume does not grow, EPA has determined that there is not a need to revisit this aspect of the ground water remedy.

The remedy for the south wetlands included a "greater risk to human health and environment" ARAR waiver of Delaware's State Water Quality Standards. The ROD states that this waiver is only acceptable if the levels of metals contamination in the surface water of the south wetlands remain below the acute standards. If the levels were above the acute standard, the ROD required that the sediments must be removed to such a level, irrespective of the clean-up criteria outlined in the ROD, as to reduce the surface water contamination levels below the acute standards. A new round of samples should be collected to ensure that the surface water levels remain below the acute standards.¹¹

Section XI of the UAO has quality assurance and quality control (QA/QC) requirements to ensure that sample collection and analysis activities are of adequate quality. DuPont submitted its plans to comply with these requirements not long after the issuance of the UAO (with some revisions since then). EPA should re-evaluate DuPont's process to ensure that the samples collected on an on-going basis, such as the ground water monitoring samples, are being collected and analyzed in accordance with the requirements of the UAO.

The modifications to the Christina River sediment clean-up criteria also included requirements that sediment sampling take place in the north drainageway and the Christina River along the north landfill and the CibaSC plant to help monitor the performance of the ground water barrier wall. The sampling was initially to occur yearly for five years. This sampling has not begun and should at this time so the data is available for the next five-year review.

¹¹ The likelihood of residual contamination causing acute surface water quality standards exceedances is remote, even if one were to use the revised 2002 levels discussed under Question B of the Technical Assessment section below. There were no exceedances found during the remedial design that affected the size of the cleanup and now, the amount of the contamination present that could contribute contamination to the surface water has been drastically reduced. Note that now that the south wetlands is tidal, SWQS exceedances may occur due to elevated levels in the Christina River rather than due to sediment contamination. In this case, no further sediment removal would be required. This situation is similar to that described in the ROD for the north wetlands.

Data Review

A significant amount of data has been generated as part of the on-going operations and maintenance (O&M) activities at the Site including the north and south wetlands, the Christina River, the north and south landfills, perimeter ground water monitoring, operation of the ground water recovery and treatment plant and monitoring of ground water in the north landfill area for thorium.

North Wetlands

The north wetlands is in its eighth year post restoration (1997 to 2005). Prior to cleanup and restoration, the riverbank berm along the north wetlands was eroding away and the wetland was virtually a monoculture with one predominant plant species. The riverbank was stabilized to ensure long-term stability of the wetland. This stabilization has proven effective during numerous major storm events.

The water control structure has successfully created a tidal open water habitat that maintains a continuous pool of water within the wetland (prior to restoration, there was no permanent open water habitat in the wetland). The twice daily tidal flushing has facilitated the recruitment of regional benthic, fish and vegetative species to the wetland.

Data from fish surveys conducted in 1999, 2001 and 2002 have shown that the north wetland supports a diverse fish community comprised of freshwater and estuarine species. In 2002, approximately 900 fish were netted. Banded killifish, mummichog, mosquitofish, pumpkinseed sunfish and spottail shiners were the predominant species. Most were either juveniles or young-of-the-year. Overall, four species from traditional estuarine communities and seven species from traditional freshwater communities were collected. The increased complexity of this habitat type within the marsh provides niches for fish from all life stages (mature, mature spawning, juvenile, young-of-the-year and larval fish). Currently, fisheries survey results suggest that the north wetland is functioning as a fish community nursery area.

Revegetation of the wetland after the contaminated sediments were removed has been a tremendous success. Between the tidal and non-tidal portions of the north wetlands, a total of 88 different plants were observed in 2002. This included 10 different species that were originally planted as part of the restoration and 78 that have been naturally recruited. Thirty species of narrow-leaved herbaceous plants, 44 species of broad-leaved herbaceous plants, two species of vines and four species of shrubs were observed. In the tidal portions, the percent plant cover has increased from 52% in 1998 to over 98% in 2002. In 2004, abundant wild rice (*Zizania aquatica*) was found along the tidal channel. Wild rice tidal emergent marsh is considered a rare plant community by DNREC. Trees and shrubs continue to mature adding structural complexity and habitat to the wetland.

In regard to the bird community, ten different species were observed in the 2002 annual inspection. This included five new species, although not all previously observed species were observed in 2002. Over time, both migratory and resident bird species that fill various trophic levels have been observed including piscivores (e.g., great egrets and osprey), invertivores (e.g., American robin and swallows) and granivores (e.g., red-winged blackbirds and sparrows).

Benthic macroinvertebrate sampling in 2002 showed that 25 taxa were present across a total of five sampling stations. Aquatic earthworms, sludge worms, biting midges, fingernail clams and midges were present in every sample. The aquatic earthworms and midges were the dominant taxa. Crustaceans, bivalve and gastropod molluscs and aquatic stages of insects were also found.

The north wetlands is also monitored for invasive species, mainly *Phragmites*, purple loosestrife and mile-a-minute weed. Originally, the success metric was to have no more than 3% cover for three consecutive years. After comparison to other nearby marsh(es), EPA and DuPont changed the success metric to no more than 15% cover in perpetuity. In 2002, the total percent invasive species cover was approximately 2.5%. DuPont has treated for invasive species at various times to keep *Phragmites* and purple loosestrife from becoming too established. The *Phragmites* tends to establish itself in localized stands while the purple loosestrife is scattered throughout the wetlands. *Phragmites* was treated with the herbicide Roundup. Over the course of 2004, areas of *Phragmites* that had been treated in October 2003 and cleared in March 2004 were re-colonized with wetland plant species that provide greater value to wildlife. DuPont released approximately 2,500 purple loosestrife-eating beetles in 2002 which it obtained from the Delaware Department of Agriculture. Inspections in 2003 failed to reveal an established beetle community.

One area in which the monitoring reports could be improved is in comparing and reporting the data. Data such as the vegetation density and diversity data and the benthic data should be compared to data collected from the reference station and the data collected during the RI/FS

South Wetlands

The south wetlands is in its seventh year post restoration (1998 to 2005). Prior to cleanup and restoration, the south wetlands was dominated by a dense, nearly monotypic stand of *Phragmites*. During the RI/FS, the south wetlands was considered a non-tidal wetland. During the design stage, it was discovered to have tidal exchange due to a tide gate that is in permanent disrepair. There is approximately an 18" tidal exchange in the south wetlands (the river has an approximately 6' tidal swing but water must travel through several wetlands and a number of culverts to reach the south wetlands thus dampening the tidal exchange).

Revegetation of the wetland after the contaminated sediments were removed has been a tremendous success. Vegetation has become increasingly more diverse structurally with added strata, cover types and greater vegetation/water interspersions. During the 1999 annual inspection, 21 species of plants were identified, of which only 10 were originally planted. In 2002, 34 species of narrow-leaved herbaceous plants, 40 species of broad-leaved herbaceous plants, one species of vine, two species of shrubs and one tree species were observed. In 2003, 71 plant species were identified. The percent plant cover has increased from just over 70% in 1998 to nearly 90% in 2002.

Fish surveys conducted in 2000, 2002 and 2003 have indicated that the south wetlands supports a healthy diverse fish community comprised primarily of freshwater species with occasional use by estuarine species. The increased diversity of aquatic habitat types currently accessible to fish communities has provided niches for numerous species from all life stages (mature, mature spawning, juvenile, young-of-the-year and larval fish). In 2002, 475 fish were netted, representing 13 species.

Banded killifish, Bluegill and pumpkinseed sunfish were the predominant species.¹² The piscivorous species white crappie, white bass and largemouth bass were also present. Overall, three species from traditional estuarine communities and 10 species from traditional freshwater communities were collected.

In regard to the bird community, 19 different species were observed in the 2002 annual inspection. Colonial nesting birds such as the great-blue heron and great egret were observed foraging on fish and frogs in the open water areas, which were also being used by waterfowl and geese. Both migratory and resident bird species that fill various trophic levels have been observed including piscivores (e.g., great egrets), invertivores (e.g., American robin and swallows) and granivores (e.g., red-winged blackbirds and sparrows).

Benthic macroinvertebrate sampling in 2002 showed that 34 taxa were present across a total of five sampling stations. Aquatic earthworms, sludge worms, biting midges, small squaregills and midges were present in every sample. The aquatic earthworms and midges were the dominant taxa. Crustaceans, bivalve and gastropod molluscs and aquatic stages of insects were also found.

The south wetlands is also monitored for invasive species, mainly *Phragmites*, purple loosestrife and mile-a-minute weed. Originally, the success metric was to have approximately no more than 3% cover for three consecutive years. After comparison to other nearby marsh(es), EPA and DuPont changed the success metric to no more than 15% cover in perpetuity. In 2002, the total percent invasive species cover was less than 4%. A *Phragmites* control program implemented by DuPont has been successful in minimizing its presence. In 2002, DuPont initiated a program to control purple loosestrife. In 2004, approximately 9,700 beetles, obtained from the New Jersey Beneficial Insects Laboratory, were released at the Site. This on-going program aims at establishing a self-sustaining beetle population. A detailed methodology for evaluating the impact on the purple loosestrife was developed and implemented. Data collected in 2004 will serve as a baseline for data for future years.

The 2002 annual inspection also included a wetland delineation which showed that the area has nearly one extra acre of wetlands compared to before the cleanup. This area is where a berm of contaminated soil/sediment was removed.

One area in which the monitoring reports could be improved is in comparing and reporting the data. Data such as the vegetation density and diversity data and the benthic data should be compared to data collected from the reference station and the data collected during the RI/FS.

Christina River

The cleanup and restoration within the Christina River was successfully completed for three areas. Removal of sediment from these areas began in 1998. By September 1999, cleanup activities were completed and the areas were restored and planted with vegetation. The restoration areas were frequently monitored to ensure the stability of the backfill and growth and health of the vegetative cover. In 2003, the downstream restoration area was disturbed when DNREC cut a 10-foot wide channel through one of the areas as part of an adjacent marsh restoration project. The channel does not appear to

¹² Note that 2002 data evaluation did not explain the tremendous drop in the number of banded killifish, golden shiners and mummichog observed compared to the 2000 data.

be causing any sediment erosion based on observations during the five-year review inspection. However, contaminated sediments may have been exposed when the trench was constructed. This area of the river was dredged to a depth of two feet and backfilled as part of the remedial action. Some of the design samples showed contamination existed in the 18"-24" range. Contamination may have existed below that depth and now be on the surface as a result of the channel. This area should be sampled.

Each area has remained stable even through numerous hurricane-related storms that occurred over the past five years. Vegetative cover and species richness have also greatly increased. Only three species were planted originally. By the end of the fourth year, 57 plant species were found within the restoration areas. In 2004, 17 species of narrow-leaved herbaceous plants, 29 species of broad-leaved herbaceous plants, four species of vines, eight species of shrubs and three species of trees were observed. This increase in the number of plant species is the result of natural re-colonization from the watershed. The percent plant cover increased from just over 70% in 1998 to nearly 90% in 2002. Plants are even growing in the area that was dredged along the north landfill and where rip-rap was placed in the intertidal zone.¹³ Purple loosestrife and mile-a-minute weed were found in several of the areas. The purple loosestrife is generally removed during the inspections.

In September 2004, benthic macroinvertebrate samples were collected from the three areas of the river which were cleaned up. Horsehair worms, segmented aquatic worms, aquatic crustaceans, aquatic insects and molluscs were present. However, the benthic community is dominated by pollution tolerant species that can be found in naturally stressed freshwater systems. One of the lines of evidence used to determine that the river needed cleanup was the abundance of pollution tolerant species. Since these areas have been dredged and backfilled with clean sediments, the prevalence of pollution tolerant species would not be attributable to site-related contaminant toxicity (there is still zinc in the surface water from other sources). Due to the recent submission of this data, it is still undergoing review by EPA.

One area in which the monitoring reports could be improved is in comparing and reporting the data. Data such as the vegetation density and diversity data and the benthic data should be compared to data collected from the reference station and the data collected during the RI/FS.

Ground Water Recovery System

The objective of the ground water recovery system at the north landfill and in CibaSC's plant is to keep contaminated ground water from the fill zone and from a small area of the Columbia aquifer from entering the Christina River. Review of potentiometric maps generated from water level measurements collected in November and December 2004 show that for the most part this objective is being accomplished. However, there are several areas of the fill zone where further evaluation is needed because of seepages over the sheet pile. These areas are near the northern end of the sheet pile adjacent to the north wetlands and in the central portion of the landfill along the Christina River. In addition, there may need to be another monitoring well installed near the border of the CibaSC plant and the landfill to provide better coverage of data. DuPont claims that the slight amount of leakage is not causing a threat to the Christina River based on the small amount of the seepage coupled with the overall improvement of the zinc levels in the river due to this and other projects on the watershed. This

¹³ Rip-rap was used to ensure that the river does not erode into the landfill and carry contamination into the river. Some of the rip-rap was mixed with soil to facilitate colonization by plants.

issue will require further evaluation. One area of this evaluation should be the gravity drain pipe that transfers the treated water through the north landfill to a pump station where it is pumped into the sewer line. This pipe has some cracks in it and may be leaking water back into the landfill.

Each of the collection components has had problems. Originally, the north landfill wells were not pumping the amount of ground water anticipated. Some of this has been due to the cap preventing infiltration, but the wells have also had plugging problems and the pumps have broken down. DuPont has worked redeveloping the wells and replacing pumps and will continue to evaluate this issue. The collection trench never worked according to design and had to be replaced in the spring of 2004. It appears that fines from the jet-grouted barrier wall that is between the trench and the river migrated to the trench and significantly reduced the permeability of the stone. The original stone was removed and new stone and an underground drain pipe were installed. As a result the amount of ground water recovered from the system overall has increased from 3,000 gallons per day to 30,000 gallons per day.

Ground Water Pretreatment

The ground water pretreatment plant treats the recovered ground water. The major process at the plant is the removal of zinc to below 14 ppm in order for the water to be discharged to the sewer line for further treatment at the Wilmington treatment plant. The plant has easily met this level. The discharge to the Wilmington treatment plant is monitored for compliance with Wastewater Discharge Permit WDP 00-103 issued by New Castle County. Rarely has the level exceeded 14 ppm zinc, with the problem generally associated with the filter process. Through November 30, 2004, 16 million gallons of contaminated ground water has been treated and discharged to the New Castle County sewer.

Perimeter Ground Water Monitoring

The long-term monitoring of the Columbia and Potomac aquifer was initiated in 1995. Some wells have been sampled eleven times. The current schedule calls for sampling every other year with the next sampling event scheduled for November 2005. The samples are analyzed for arsenic, barium, cadmium, cobalt, copper, lead, manganese, nickel, zinc, vinyl chloride, trichloroethene and tetrachloroethene. Once every six years, levels of mercury, vanadium and chromium are also measured.

Generally, there has been little change in the contaminant concentrations over the past decade. However, there are a few wells that have shown some increases. Two Columbia aquifer wells along Old Airport Road (the most downgradient edge of the monitoring network) show definite increases in manganese levels (nearly an order of magnitude) and perhaps slight increases in zinc (from non-detect levels to measurable levels). The manganese levels have gone from levels that are below EPA Region 3's Risk Based Criteria used for screening purposes of 730 ppb to approximately two to four times above it. Even at the current levels, the zinc is approximately three orders of magnitude below the screening criteria. At this time, EPA is unsure if these changes indicate that ground water contamination is migrating or if this is related to natural levels of manganese in ground water. This area of Delaware has naturally high levels of manganese that can be highly variable. However, the current placement of wells (mostly just around the edge) makes it hard to determine the cause of the increase.

In regard to tetrachloroethene (PCE) and trichloroethene (TCE), the one remaining "interior" Columbia well has shown decreases over the past decade. The well is closest to the source. While the levels have gone up and down, the levels in 2001 and 2003 were approximately one-half of the levels in

1997. In 2003, the TCE was at the MCL and PCE was approximately five times over the MCL. In the perimeter well nearest to the plant area, PCE was never detected until 2003, but the level was estimated to be 1 parts per billion (ppb). The TCE level has moved up and down since 1997, ranging from non-detect (at a detection limit of 1 ppb) to 6 ppb (which occurred in 1999 and 2003). Note that vinyl chloride has never been detected (at a detection limit of 2 ppb) during the monitoring period.

Based on this review, consideration should be given to some modifications in the monitoring well network to properly assess the cause of the increase in manganese and to evaluate whether or not there is some unacceptable contaminant migration going on within the Site, particularly between the south landfill and the southern perimeter of the Site.¹⁴ One Potomac well in this area was abandoned during construction of the south landfill.

Thorium Ground Water Monitoring

Two wells in the north landfill are monitored for gross alpha radiation, gross beta radiation, radium-228 and thorium-232. At one time, there were one or two other wells that were monitored, but this was stopped due to problems with the wells. Based on a review of the placement of the two current wells and the lack of accurate information as to where in the north landfill the thorium waste was buried, EPA and DuPont should reassess the necessity of adding another monitoring well to cover the complete breadth of the landfill.

Except for one period of time for the gross alpha and gross beta levels in one of the wells, the levels of all four measurements have remained fairly constant and within background levels. During three sampling events, the gross alpha and beta levels in one well were elevated above the levels generally found. From May 2001 to November 2002, the gross alpha levels were above the MCL of 15 picocuries per liter (the highest level was 39) in three of four sampling events. During this time, DuPont attributed the rise to changes in ground water caused by the capping of the north landfill. EPA expressed concern that the uncertainty of the data (it is reported with - and - bounds that can be greater than the reported result) may not allow any conclusions to be drawn as to trends. DuPont provided the uncertainty information which shows that the levels were higher than usual. Results for both the gross alpha and gross beta have since returned to their original levels.

Christina River Biphenyl Monitoring

To monitor the performance of the sheet pile wall installed under a removal order to prevent oil seeps along the Christina River, biphenyl monitoring began in November 1995. As part of the implementation of the ROD, a jet-grout ground water barrier wall was constructed behind the sheet pile. Biphenyl monitoring has continued to monitor the success of the ground water barrier wall. Approximately 75 samples have been analyzed for biphenyl with only ten detecting any biphenyl with those results generally being 5 ppb or less. The last time biphenyl was detected was in January 2000. The jet-grout wall was completed in January 2001.

¹⁴ As part of this review, nearby residents and businesses should be surveyed to see how much water is being used from wells for non-potable purposes.

Site Inspection

EPA and DNREC conducted a Site inspection on September 14, 2004, for this Five-Year Review. Those present at the inspection included: Randy Sturgeon, EPA's Remedial Project Manager for the Site; Lindsay Hall of DNREC and Al Boettler, John Wolfe and Lee-Anne Simmler of DuPont. The purpose of the inspection was to assess the condition of the clean-up actions.

In general, the Site was in great condition. The restored areas of the north and south wetlands and the Christina River looked great. A deer, an egret, turtle eggs and fish were found. Even the rip-rap placed along the banks of the Christina River along the north wetlands is hardly noticeable due to the vegetation that has grown through it.

As would be expected on a site of this size and complexity, several items were found that need addressing as part of the on-going O&M activities at the Site. At the south landfill, the edge of the geomembrane liner of the landfill cap shows above the ground at a number of places where pipes or foundations go through the cap. These need to be covered to protect the liner. Several holes from burrowing animals were found. Further assessment is necessary to determine if the liner has been breached. A small tree was found at the base of the pipe bridge over the Christina River that needs to be removed so the roots do not damage the liner. A tire rut that needs to be filled was found along South James Street where it runs across the landfill.

In CibaSC's plant several areas of asphalt were in disrepair and in need of repaving (completed in December 2004). The flow meter at recovery well EW-106 needs to be insulated to prevent damage from freezing. A concrete cap over the top of a retaining wall along the Christina River at the building closest to the James Street bridge is in disrepair. As the concrete continues to crumble, the possibility of erosion into the river grows. Previous sampling of the soil underneath did not show contamination, but access was limited.

A small fire water holding pond for DuPont's now dismantled Holly Run plant was also inspected. During the RI/FS, no contamination requiring cleanup was found in this area. However, DuPont found a small amount of paint pigment shortly before the Site inspection. As part of the sale of the adjacent Koppers Superfund Site to Beazer East, the pond required closing since it straddled the property line. Blue pigment was found in a test pit. DuPont has since collected soil samples and the area is being addressed by excavation and off-site disposal.

Wet areas of soil were found just behind the sheet pile wall at the north landfill adjacent to the north wetlands. Concern was expressed to DuPont that this could be from ground water that is not being collected by the recovery system. There have been problems with the pumps, the soil is much less permeable than expected and the wells do not extract as much ground water as anticipated. These puddles had been seen before, but while DuPont was actively working on the recovery system, it was not worth evaluating the puddles. In November 2004, DuPont installed four piezometers to monitor the water table directly behind the sheet pile along the north landfill. Preliminary data shows that some ground water from the landfill may be forming a seep in this area.

One area that was not inspected was the condition of the plants around the south wetlands property that are intended to restrict access by humans but allow access by wildlife. The condition of these plants requires evaluation.

VII. Technical Assessment

Question A: Is the remedy functioning as intended by the decision documents?

Overall, the remedy is functioning as intended by the decision documents. The cleanup is providing protection to Delaware's natural resources and wildlife habitat. Over 35 acres of wetlands and wildlife habitat have been restored as part of the Site's overall cleanup. The cleanup has also allowed an important local employer (Ciba Specialty Chemicals) to continue operations safely on the Site. Due to the cooperative relationship of EPA, DNREC and DuPont, the cleanup is more comprehensive than what was originally required in the 1993 ROD, was \$13 million below estimated costs and was completed one year ahead of schedule.

In the north and south wetlands, contaminated sediments that either killed or stressed sediment benthos have been successfully cleaned up and restored. The restored wetlands have greater biodiversity than before the clean up thus increasing the habitat value of the wetlands. Areas of the Christina River have also been cleaned up and restored to provide viable habitat. The wetlands are being used by a variety of birds, fish and terrestrial wildlife. The Site has been through numerous flood events (including some from hurricane rains) without any erosion issues. The number of types of plants in these areas is vastly greater than what was originally planted due to natural re-colonization.

The capping of the north and south landfills and the paving of areas of the CibaSC and DuPont Holly Run properties have successfully limited infiltration of rain water to areas of highly contaminated soil. The permeable reactive barrier wall at the south landfill and ground water barrier wall along the north landfill and the CibaSC plant are, to a great extent, preventing contaminated ground water from impacting adjacent wetlands and the Christina River. The two exceptions are the high manganese levels at the south landfill and the two small areas of potential seeps at the north landfill. Both of these exceptions may or may not be causing adverse impacts to the environment and require further assessment.

The south landfill cap is also keeping any trespassers from coming into contact with contaminated soil. In one area of the plant (a small picnic area for plant workers) that was not paved, the surface soil was replaced to protect landscape workers from lead exposure)

The ballpark cleanup has ensured a safe place for neighborhood kids to play. The public water supply line that was installed along Old Airport Road has ensured that nearby residents and businesses have a safe supply of drinking water. As an added benefit, fire hydrants were also installed which helped recently in fighting a fire in a salvage yard.

There is some potential evidence that contamination may be migrating slightly in the Columbia aquifer. This issue also requires further evaluation, especially since one of the most significant pieces of the evidence (levels of manganese) may be related to natural sources.

DuPont has and will continue to undertake a number of O&M activities. These include the on-going efforts to control invasive species in the wetlands, operation of the ground water pretreatment plant, equipment repairs and upgrades on the ground water recovery system and maintenance of the pavement in the plant areas. These activities are contributing to the effectiveness of the remedy.

DuPont also undertakes a number of monitoring activities to ensure the effectiveness of the remedy. These include ground water monitoring every one to two years, monitoring of ground water conditions in and around the PRB to determine its effectiveness, an annual pavement inspection, monitoring of the pretreatment plant to ensure compliance with its County permit, and several inspections of the restored wetlands and river areas each year. Other than perhaps several additional ground water monitoring wells,¹⁵ these monitoring activities provide the information necessary to assess the effectiveness of the remedy. Based on the tremendous amount of data collected to date regarding the restored wetlands and river areas and the success of the restoration, some of the information such as plant surveys can be collected on a less frequent basis.

There are a number of institutional controls (ICs) that were in the ROD that are required to protect human health and the environment. In 2004, EPA reviewed the ICs and determined that there were no other ICs required other than the ones in the ROD. The ICs in the ROD include: 1) establishment of a ground water management zone by the State of Delaware to prevent drinking water wells from being installed at or near the Site, 2) prevention of wells being installed in the waste management areas for industrial purposes since they would draw-contamination down, 3) preparation and implementation of a health and safety plan to be used when subsurface soil must be disturbed in the plant areas, 4) the Site can not be used for residential purposes because of waste that remains at the Site, 5) notices placed on the property deeds to inform others of past disposal practices and the fact that releases and threats of releases of hazardous substances have affected the respective parcels, 6) owners of the north landfill and the plant areas (currently DuPont and CibaSC) must obtain EPA approval to transfer these properties because of the thorium waste at the Site, 7) access to the south landfill and wetlands shall be limited to the maximum extent practicable through the use of plants and fencing (the plants allow wildlife passage), 8) the landfills must remain vegetated to provide wildlife habitat and 9) development of a HASP to protect utility and highway workers who may be required to perform subsurface work in the south landfill.

Most of the ICs in the ROD have been implemented. DuPont and CibaSC have placed notices on their deeds, although this was approximately ten years ago and EPA should verify that the notices are still in place (including the addition of the May 2001 ESD). DNREC has established a ground water management zone around the Site and has an effective well licensing program that can control installation locations. CibaSC and DuPont have health and safety plans to be used for subsurface work in the plant areas. These plans are in use. Since the requirement for EPA approval for property transfers is unusual for a Superfund site, EPA recently reminded DuPont and CibaSC of the requirement. The north and south landfills are currently vegetated with plans to remain so. There has been some desire on the part of the Town of Newport to use the south landfill. Previous thoughts included use as a parking area for city equipment. Last fall, the Mayor expressed interest in using the south landfill as open space for community activities. While the appropriate fencing is in place at the south landfill, EPA did not inspect the rest of the perimeter of the south wetlands to see if the appropriate combination of plants and fencing is in place to limit access. This issue requires followup. A document entitled "Institutional

¹⁵ The additional wells that may be necessary include an extra well for monitoring potential thorium releases and "interior" wells to augment the perimeter wells and help monitor the effectiveness of the containment systems in the waste management area.

Control Plan, Newport South Landfill, Newport Superfund Site" has been prepared by DuPont to help utility and highway workers conduct work safely at the south landfill. The document describes the hazards associated with the contaminants at the landfill and some general precautions to take. Workers can use this to develop project specific HASPs. The document was recently approved by EPA and will be sent to the appropriate parties shortly (the document has a contact list).

Most of the ICs in the ROD must be implemented by DuPont and CibaSC as Site owners. Since each company has been ordered to implement the ROD, if the ICs do not remain in place, DuPont and CibaSC would be in violation of the UAO. One part of the Site that is not owned by DuPont or CibaSC is a small portion of the south landfill that is owned by DelDOT. To EPA's knowledge, a notice has not been placed on the deed(s) for this property. EPA should work with DelDOT to make sure the required notice is placed on the deed(s).

Question B: Are the exposure assumptions, toxicity data, cleanup levels and remedial action objectives (RAOs) used at the time of the remedy selection still valid?

The remedial action objectives (RAOs) in the ROD are still valid and have been met for the areas where cleanup has been conducted other than perhaps RAO #5 (prevent degradation to the environment by discharge of contaminated ground water to the Christina River and the wetlands). Substantial progress has been made to meet RAO #5, but work remains to prevent bypass of the ground water barrier wall on the north side of the river and to monitor the effectiveness of the PRB. Note that DuPont claims that RAO #5 is being met because the small bypass of zinc-contaminated ground water is not harming the Christina River and the manganese coming from the south landfill is not harming the south wetlands. These issues require further evaluation.

While DuPont's Holly Run plant has been shut down and mostly dismantled, this change does not affect the remedy. Only a portion of the Holly Run property is part of the Site (defined as where contamination has come to be located).¹⁶

Changes in Standards and To Be Considered

The ARARs in the ROD have been reviewed. Most have remained the same or, if changed, have no current bearing on the cleanup. In 2002, EPA issued revised National Recommended Water Quality Criteria (EPA-822-R-02-047). Federal ambient water quality criteria and State Water Quality Standards were listed as ARARs for surface water. Below is a comparison of the SWQSS listed in the ROD (from Table 7 of the ROD) and the 2002 National Recommended Water Quality Criteria.¹⁷

¹⁶ The ROD discussed that if the operations of the manufacturing plants were to materially change than EPA would assess any proposed change in operation at the Site and consider whether or not to take further response actions.

¹⁷ DNREC revised its SWQSS in July 2004 and for the chemicals listed above, the SWQSS match the federal WQC.

Table 4: Comparison of 1993 and Current Water Quality Criteria

Metal	1993 DNREC SWQSs		2002 National Recommended WQC	
	Chronic (ppb)	Acute (ppb)	CCC* (ppb)	CMC** (ppb)
Cadmium	1.1	3.9	0.25	2.0
Chromium (VI)	11	16	11	16
Copper	12	18	9	13
Lead	3.2	82	2.5	65
Mercury	0.012	0.77	2.4	1.4
Nickel	160	1,400	52	470
Zinc	110	120	120	120
Aluminum	87	750	n/a	n/a
Iron	1,000	n/a	n/a	n/a

* Criterion Continuous Concentration

** Criterion Maximum Concentration

Note: The criteria for cadmium, chromium, copper, lead, nickel, zinc are hardness dependent with the level listed being for a hardness of 100 milligrams per liter as calcium carbonate. Hardness levels in the wetlands during the remedial investigation ranged from 104 to 183 milligrams per liter.

Many of the levels have been reduced (note that SWQSs often track the federal WQC). The main ways these reductions could affect the remedy is by lowering the level at which the "greater risk to human health and the environment" ARAR waiver for the south wetlands would no longer be warranted. These new levels will be used to help evaluate the results of the surface water sampling being recommended as part of this review for the south wetlands.

These changes could also affect the performance standards of the permeable reactive barrier wall at the south landfill. The May 2001 ESD states that:

The 1995 ESD stated that "most of these concentrations represent the lower of either the acute ambient water quality criteria or a level generally considered acceptable to drink. The acute ambient water quality criteria is consider protective because of the waiver, already contained in the ROD, of chronic levels and the fact that because of the ground water recovery well operation, any leakage through the barrier wall will be into the containment system. The above concentrations must be met at each of the extraction wells and monitoring locations." While this rational (sic) is no longer directly applicable because, instead of extraction wells removing this water and sending it to a treatment plant, the water is migrating directly to the wetlands, these criteria are still protective of the environment since, due to the low amount of water migrating from the landfill, the overall amount of metals that will migrate from the landfill to the wetlands is so low that the metals do not pose a threat to the wetland sediments or surface water.

The treatment standards are listed in Table 5 below.

Table 5: South Landfill Permeable Reactive Barrier Wall Treatment Standards

Metal	May 2001 ESD PRB Treatment Standards (ppb)	2002 National Recommended WQC CMC (ppb)	October 2004 EPA Risk-Based Drinking Water Level (ppb)
Barium	7,800	n/a	2,600
Cadmium	4	2.0	18
Copper	18	13	1,500
Lead	15	65	15
Manganese	1,000	n/a	730
Nickel	730	470	730
Zinc	120	120	11,000

As can be seen in the above table, if the rationale from the May 2001 ESD were applied today, the treatment standards for barium, cadmium, copper, manganese and nickel would all be reduced (see the bolded values in Table 5 above). In reviewing the first two years of monitoring data for the PRB, changing the standards for these five contaminants would have likely had little bearing on the performance of the PRB. The highest barium level found inside the PRB was 2,550 ppb, but that well only averaged 947 ppb over seven sampling events in approximately two years. Often the average was less than 200 ppb in the eleven wells.

For cadmium, copper and nickel, there were no detections in the wall during this monitoring period, with the detection limits being below the more stringent standard. During the treatability studies conducted as part of the design, almost all of the samples of untreated ground water from the landfill had no traces of these contaminants. However, the cadmium detection limit (almost always 4 ppb) was higher than the more stringent standard.

As discussed earlier, the PRB is not meeting the manganese standard and would fail by a wider margin with the more stringent standard. As also mentioned earlier, EPA only recently received the PRB monitoring data and has not completed its review. As part of the complete review, EPA will evaluate whether or not the treatment standards in the May 2001 ESD must be changed in order to ensure protection of human health and the environment over the long-term.

Changes in Exposure Pathways, Toxicity and Other Contaminant Characteristics

Most of the cleanup at the Site was driven by risks to environmental receptors, mainly aquatic life. Approximately \$3 million of the original \$48 million cost estimate was to address environmental risks. Based on the fact the final sediment clean-up criteria were significantly lower than those originally called for in the ROD based on the RI/FS data, resulting in an even lower average concentration of the remaining sediments, EPA continues to believe that the criteria are protective of the environment. Also, since deeper sediments were removed (the original ROD only called for excavation of the top foot of the wetland sediments), the cleanup protects against such processes as bioturbation and natural disasters that could uncover contaminated sediments resulting in a risk.

The exposure assumptions used to develop the Human Health Risk Assessment included both current and potential future exposure scenarios. The scenarios that were evaluated and the associated exposure assumptions are summarized in Tables 9 and 10 of the ROD. These assumptions are considered to be conservative and reasonable in evaluating risk. While the risk assessment results would likely change some if it were conducted today (based on potentially-revised methodologies and toxicity information), the result would have no bearing on the cleanup or this five-year review. The cleanup mainly relied on breaking exposure pathways to protect human health rather than removing waste above a cleanup criteria. One exception was the ballpark that had a clean-up criteria of 500 ppm lead which EPA still considers protective.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

Yes.

Over the past several years, EPA has gained a greater understanding that ground water contamination by volatile organic compounds (VOCs) may give rise to the possibility of vapor intrusion into structures above a VOC-contaminated ground water plume. This is influenced by a variety of factors, including the concentration and characteristics of VOCs in ground water, the depth of the contaminated plume, the characteristics of the structures above the plume (basements, etc.), the time of year and other circumstances. Exposures may also vary based upon setting (i.e., residential vs. industrial) and by the type(s) of activities going on under these scenarios.

At this Site, there are VOCs in the ground water (for example VOCs were found in ground water seeps entering the Christina River at the CibaSC plant) that could potentially cause a vapor intrusion issue at the CibaSC plant. EPA contacted Dr. Colin Mackay at the CibaSC facility to begin discussing this issue, which requires further evaluation.

During the remedial action, the RPM became aware of other metals contamination in the Christina River watershed that may be site-related. Metals contamination very similar to that at the DuPont-Newport Site was found at the adjacent Koppers Superfund Site in and along Hershey Run. Most of this is planned to be remediated as part of the Koppers cleanup, with the remaining contamination being in subsurface sediments. DeIDOT also found contamination very similar to that at the DuPont-Newport Site in subsurface sediments at the Newport Marsh as part of an investigation of a potential wetlands mitigation site. In both areas, some of the contamination levels were above the sediment clean-up criteria for the Site. DuPont is currently reviewing the data in preparation for EPA and DuPont discussions about whether or not the contamination is site-related and if so, what, if any, steps must be taken to mitigate any potential risks.

There is no other information that calls into question the protectiveness of the remedy.

Technical Assessment Summary

According to the data reviewed and the site inspection, the vast majority of the remedy is functioning as intended by the ROD and May 2001 ESD. The wetland and river restoration areas are providing clean habitat for a much more diverse ecology than prior to the cleanup. The landfill caps and increased paved area are significantly limiting the on-going migration of contamination to the ground

water. The ground water barrier wall and the permeable reactive barrier wall are preventing a significant amount of contamination from entering the wetlands and the river. Several areas of the Site (especially the ground water at the perimeter of the south wetlands, several areas of potential seeps at the north landfill barrier wall and the treatment of manganese with the permeable reactive barrier wall) require further evaluation to ensure the effectiveness of the remedy. The RAOs in the 1993 ROD remain valid. Several of the surface water quality criteria have been reduced which should be taken into account when reviewing the performance data of the reactive barrier wall and any future sampling of the surface water at the Site. The sediment cleanup criteria remain valid. The only new exposure pathway that requires evaluation is the potential for vapor intrusion of ground water contamination into buildings at the CibaSC plant. Additionally, EPA and DuPont must continue to evaluate recent contaminated sediment data obtained by DelDOT and the Koppers Superfund Site Team in order to see if it is related to the DuPont-Newport Site.

VIII. Issues

Table 6: Issues

Issue	Currently Affects Protectiveness (Y/N)	Affects Future Protectiveness (Y/N)
Ground water appears to be seeping over the sheet pile wall in several areas of the north landfill	N	Y
Possible vapor intrusion into structures at the CibaSC plant above the contaminated ground water plume	N	Y
Are the QA/QC procedures for environmental samples up-to-date?	N	Y
The deed(s) for the DelDOT-owned portion of the south landfill may not have a notice regarding the presence of contamination attached	N	Y
Are the ROD and UAO still attached to the deeds for the DuPont and CibaSC properties? Has the May 2001 ESD been added to the DuPont south landfill deed?	N	Y
Do the metals levels in the south wetland surface water remain below the acute SWQSSs?	N	Y
Are the plants around the south wetlands to restrict access in good condition?	N	Y
There currently is one "interior" ground water monitoring well for heavy metals in the Columbia aquifer and none in the Potomac to help ensure that there is no continued migration of contamination to the Columbia and Potomac aquifers	N	Y

Issue	Currently Affects Protectiveness (Y/N)	Affects Future Protectiveness (Y/N)
Other potentially site-related contamination has been found in the Christina River watershed	N	Y
The PRB is not meeting the manganese treatment standard	N	Y
Should the PRB treatment standards be reduced for barium, cadmium, copper, manganese and nickel because of changes in SWQSS or risk-based criteria?	N	Y
Do the two wells being monitored for thorium provide adequate coverage to detect a release?	N	Y
Are the increases of manganese at the perimeter of the Site related to contamination?	N	Y
There are signs of animals burrowing into the cover soil of the south landfill	N	Y
Are residents and businesses along Old Airport Road still only using well water for non-potable purposes?	N	Y
Could erosion of soil from underneath CibaSC building near James Street release contaminants to the river?	N	Y
Was contamination exposed when DNREC cut a channel through a portion of the downgradient area of the river that was dredged?	N	Y

IX. Recommendations and Follow-up Actions

Table 7: Recommendations and Follow-up Actions

Issue	Recommendations/ Follow-Up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness? (Y/N)	
					Current	Future
Ground water appears to be seeping over the sheet pile wall in several areas of the north landfill	Continue monitoring elevation of ground water table; possible water, soil and/or sediment sampling; evaluate the need for more recovery wells	DuPont	EPA/ DNREC	5/30/05	N	Y

Issue	Recommendations/ Follow-Up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness? (Y/N)	
					Current	Future
Possible vapor intrusion into structures at the CibaSC plant above the contaminated ground water plume	Evaluate vapor intrusion potential and take appropriate steps, if any, to mitigate	Ciba/ DuPont	EPA	9/30/05	N	Y
Are the QA/QC procedures for environmental samples up-to-date?	Review existing QA/QC documentation and compare to the UAO requirements	DuPont	EPA	9/30/05	N	Y
The deed(s) for the DeIDOT-owned portion of the south landfill may not have a notice regarding the presence of contamination attached	Ensure that DeIDOT attaches a notice regarding the presence of the contamination to the deed(s) for the portion of the south landfill that it owns	DeIDOT	EPA	9/30/05	N	Y
Are the ROD and UAO still attached to the deeds for the DuPont and CibaSC properties? Has the May 2001 ESD been added to the DuPont south landfill deed?	Inspect the deeds	EPA	EPA	7/30/05	N	Y
Do the metals levels in the south wetland surface water remain below the acute SWQSSs?	Collect surface water samples in the south wetlands	DuPont	EPA/ DNREC	11/30/05	N	Y
Are the plants around the south wetlands to restrict access in good condition?	Inspect the plants	DuPont	EPA	6/30/05	N	Y
There currently is one "interior" ground water monitoring well for heavy metals in the Columbia aquifer and none in the Potomac to help ensure that there is no continued migration of contamination to the Columbia and Potomac aquifers	Consider modification of the ground water monitoring program to include more "interior" wells	DuPont	EPA	12/31/05	N	Y

Issue	Recommendations/ Follow-Up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness? (Y/N)	
					Current	Future
Other potentially site-related contamination found on the Christina River watershed	Continue on-going evaluation	DuPont	EPA/ DNREC	8/15/05	N	Y
The PRB is not meeting the manganese treatment standard	Complete a detailed review of the South Landfill Status Report regarding the performance of the PRB	EPA/ DuPont	EPA/ DNREC	7/31/05	N	Y
Should the PRB treatment standards be reduced for barium, cadmium, copper, manganese and nickel because of changes in SWQs or risk-based criteria?	Evaluate the necessity of reducing the standards	EPA/ DuPont	EPA/ DNREC	9/30/05	N	Y
Do the two wells being monitored for thorium provide adequate coverage to detect a release?	Review adequacy of well coverage; install a new well if necessary	DuPont	EPA	12/31/05	N	Y
Are the increases of manganese at the perimeter of the Site related to contamination?	Further evaluate the ground water data and the adequacy of the monitoring network	DuPont	EPA/ DNREC	8/30/05	N	Y
There are signs of animals burrowing into the cover soil of south landfill	Eliminate the burrows and increase inspections	DuPont	EPA/ DNREC	8/30/05	N	Y
Are residents and businesses along Old Airport Road still only using well water for non-potable purposes?	Survey well owners	EPA/ DuPont	EPA/ DNREC	7/30/05	N	Y
Could erosion of soil from underneath CibaSC building near James Street release contaminants to the river?	Continue monitoring status of concrete and consider further soil sampling	DuPont/ CibaSC	EPA/ DNREC	9/30/05	N	Y
Was contamination exposed when DNREC cut a channel through a portion of the downgradient area of the river that was dredged?	Sample the area	DuPont	EPA	9/30/05	N	Y

X. Protectiveness Statement

The remedy for OU 1 (includes the ballpark, the waterline, ground water monitoring and CibaSC's Health & Safety Plan) currently protects human health and the environment because the adjacent ballpark was cleaned up and nearby residents and businesses are on public water because of the water line that was installed as part of the remedy. Institutional controls are in place to prevent the installation of drinking water wells near the Site or production wells at the plant area. Subsurface soil work at CibaSC's plant is conducted using procedures to protect workers from contaminated soil. However, in order for the OU 1 remedy to be protective in the long-term, further evaluation of potential plume migration at the southern perimeter of the Site and evaluation of the ground water monitoring network for thorium must be conducted.

The remedy for OU 3 (the north wetlands) is protective of human health and the environment because the contaminated sediments have been removed and the wetlands have been successfully restored. On-going maintenance activities, mainly control of invasive plant species, will continue to ensure protectiveness.

The remedy for OU 4 (the north landfill and ground water barrier wall) currently protects human health and the environment because the combination of the cap and the ground water barrier wall are preventing (except as discussed under OU 8 below) the migration of contaminated ground water to the north wetlands and Christina River. The cap also successfully-covered contamination that was present in a wetland that had formed on the landfill. Institutional controls (ICs) are in place to ensure that the owners of the landfill are capable of performing on-going O&M and a monument has been placed at the entrance of the landfill warning of the presence of thorium in the landfill. However, in order for the OU 4 remedy to be protective in the long-term, further evaluation and/or upgrades of the ground water recovery system in the north landfill (see OU 8 discussion below) must be undertaken to address several areas of potential ground water seeps at the landfill.

The remedy for OU 5 (the south wetlands) currently protects human health and the environment because the contaminated sediments have been removed and the wetlands have been successfully restored. On-going maintenance activities, mainly control of invasive plant species, will continue to ensure protectiveness. However, in order for the OU 5 remedy to be protective in the long-term, surface water sampling must be conducted in the wetlands to ensure that levels of contamination in the surface water remain below acute state water quality standards.

The remedy for OU 6 (the south landfill) currently protects human health and the environment because the landfill has been capped and impacts to the adjacent wetlands and river have been significantly reduced by a combination of a slurry wall, a permeable reactive barrier wall and the cap construction along the river bank. However, in order for the OU 6 remedy to be protective in the long-term, further evaluation of the effectiveness of the permeable reactive barrier wall in controlling the migration of manganese to the south wetlands must take place. In addition, EPA must ensure that the ICs for the DuPont-owned portion of the landfill remain in place and that a notice regarding contamination is placed on the deed(s) for the Delaware Department of Transportation-owned portion of the Site.

The remedy for OU 7 (the Christina River) currently protects human health and the environment because the three areas of the river that were found to have levels of contamination that warranted clean

up have been dredged and restored. Approximately three miles of the river were sampled (both upstream and downstream from the landfills because of the tidal nature of the river) resulting in the delineation of these three areas (one along the north landfill, one upstream and one downstream). However, in order for the OU 7 remedy to be protective in the long-term, a determination must be made as to whether the sediment contamination found in the deeper sediments at the adjacent Koppers Superfund Site and a nearby potential wetlands mitigation site is from the DuPont-Newport Superfund Site and, if so, if it poses a risk to human health or the environment. Also, the area where DNREC cut a channel through the downgradient dredged area must be sampled to ensure that there is not contamination in the upper several feet of sediments.

The remedy for OU 8 (includes the plant paving, the vertical ground water barrier wall at CibaSC and the complete ground water recovery and treatment system) currently protects human health and the environment because the combination of the increase in paved area and paving integrity, the ground water barrier wall and the ground water recovery and treatment system are greatly restricting the flow of contaminated ground water to the river. The treatment plant is successfully reducing the level of contaminants in the ground water before it is discharged to a local treatment plant. ICs are in place to ensure that the CibaSC facility owners are capable of performing on-going O&M. However, in order for the OU 8 remedy to be protective in the long-term, further evaluation of the ground water recovery system at the north landfill is necessary. The north landfill has several areas of potential seeps (based on comparing the water table elevation to the elevation of the top of the sheet pile wall) that may be allowing small amounts of contaminated ground water to enter the Christina River. This is likely caused by lower-than-expected recovery rates from several pumping wells.

In summary, the remedial actions implemented at this Site are protective of human health and the environment in the short-term. However, as described above, a number of issues require further evaluation and possible action in order for the Site to be protective in the long-term.

XI. Next Five-Year Review

The next five-year review will be completed no later than March 2010, five years from the date of this review.

Appendix A - List of Documents Reviewed

Unilateral Administrative Order (EPA Docket No. III-94-21-DC); issued by EPA to DuPont and Ciba-Geigy requiring them to implement the ROD. Dated April 19, 1994.

Record of Decision (ROD) for the DuPont-Newport Superfund Site. Dated August 26, 1993.

Five-Year Review Report, E. I. DuPont, Newport Superfund Site; Newport, Delaware. U.S. Environmental Protection Agency. March 31, 2000.

Superfund Preliminary Close Out Report; E. I. du Pont de Nemours & Co., Inc. (Newport Pigment Plant Landfill) (a.k.a. DuPont-Newport Site); Newport, New Castle County, Delaware. September 19, 2002.

National Recommended Water Quality Criteria: 2002. U.S. Environmental Protection Agency (EPA-822-R-02-047). November 2002.

State of Delaware Surface Water Quality Standards, as Amended. July 11, 2004.
www.dnrec.state.de.us/DNREC2000/Divisions/Water/WaterQuality/WQStandards.pdf

Institutional Control Plan, Newport South Landfill, Newport Superfund Site. Corporate Remediation Group, DuPont and URS Diamond. Revised March 2004.

South Landfill Status Report, February 2003 through August 2004, Newport Superfund Site, Newport, Delaware. Corporate Remediation Group, DuPont and URS Diamond. January 25, 2005.

2002 Annual Inspection Report, North Wetlands, Newport Superfund Site; Newport, Delaware. Corporate Remediation Group, DuPont and URS Diamond. December 20, 2002.

2004 Annual Inspection Report, North Wetlands, Newport Superfund Site; Newport, Delaware. Corporate Remediation Group, DuPont and URS Diamond. December 1, 2004.

2002 Annual Inspection Report, Christina River; Newport Superfund Site, Newport, Delaware. Corporate Remediation Group, DuPont and URS Diamond. December 20, 2002.

2004 Annual Inspection Report, Christina River; Newport Superfund Site, Newport, Delaware. Corporate Remediation Group, DuPont and URS Diamond. December 1, 2004.

Email from Albert J. Boettler, DuPont, to Randy Sturgeon, EPA, dated January 15, 2005, entitled "Fw: Benthic Community Analysis". The email contained attachments summarizing benthic macroinvertebrate data for the Christina River that was collected in September 2004.

Email from Albert J. Boettler, DuPont, to Randy Sturgeon, EPA, dated December 15, 2004, entitled "Fw: 5-year review". The email contained attachments summarizing information regarding the operation of the ground water pretreatment plant.

Email from Albert J. Boettler, DuPont, to Randy Sturgeon, EPA, dated January 9, 2005, entitled "Fw: 5-year review summary". The email contained attachments summarizing the overall scope of the monitoring activities at the Site.

Email: Albert Boettler, DuPont, to Randy Sturgeon, EPA, dated January 26, 2005; entitled "Fw: Newport GW capture summary for EPA," Parts 1 and 2. Describes the performance of the ground water recovery system in preventing contaminated ground water from the fill zone and the Columbia aquifer from entering the Christina River.

Email from Albert J. Boettler, DuPont, to Randy Sturgeon, EPA, dated December 14, 2004, entitled "Re: Re: 5-year review summaries". The email contained attachments summarizing O&M data for the Christina River and the wetlands.

Long-term Groundwater Monitoring Report, November 2003; Newport Superfund Site, Newport, Delaware. Corporate Remediation Group, DuPont and URS Diamond. March 2004.

Long-term Groundwater Monitoring Report, May 2004; Newport Superfund Site, Newport, Delaware. Corporate Remediation Group, DuPont and URS Diamond. October 2004.

Letter with attachments from Albert Boettler, DuPont to Randy Sturgeon, EPA. entitled "Response to February 20, 2004 Comments, Newport Superfund Site, Newport, Delaware". Dated April 14, 2004. This document addressed EPA comments regarding a variety of issues at the Site.

Letter from Albert Boettler, DuPont, to James D. Houston, New Castle County, entitled "Periodic Self-Monitoring Report (July-December 2003), Wastewater Discharge Permit WDP-00-103, Newport Landfill Site, Newport Superfund Site, Newport, Delaware.

Letter from Albert Boettler, DuPont to Randy Sturgeon, EPA, entitled "Pipe Inspection, Groundwater Extraction System, Newport Superfund Site, Newport, Delaware. Dated November 20, 2001.

Letter from P. Brandt Butler, DuPont to Randy Sturgeon, EPA, entitled "Alternate Christina River Remediation Proposal, Newport Superfund Site, Newport, Delaware. Dated June 17, 1996.

Superfund Remedial Action Completion Report, Operable Unit I, E. I. DuPont, Newport Site, Newport, Delaware. U.S. Environmental Protection Agency. Dated December 29, 1995.

Superfund Remedial Action Completion Report, Operable Unit 3, E. I. DuPont, Newport Site, Newport, Delaware. U.S. Environmental Protection Agency. Dated June 30, 1998.

Superfund Remedial Action Completion Report, Operable Unit 4 (North Landfill), E. I. DuPont, Newport Site, Newport, Delaware. U.S. Environmental Protection Agency. Dated September 10, 2001.

Superfund Remedial Action Completion Report, Operable Unit 5, E. I. DuPont, Newport Site, Newport, Delaware. U.S. Environmental Protection Agency. Dated December 30, 1998.

Superfund Remedial Action Completion Report, Operable Unit 6 (South Landfill) , E. I. DuPont, Newport Site, Newport, Delaware. U.S. Environmental Protection Agency. Dated March 17,2003.

Superfund Remedial Action Completion Report, Operable Unit 7 (Christina River), E. I. DuPont, Newport Site, Newport, Delaware. U.S. Environmental Protection Agency. Dated February 18,2000.

Superfund Remedial Action Completion Report, E. I. DuPont, Newport Site: Operable Unit 8 (Plant Area Paving, Ciba Vertical Ground Water Barrier Wall, Ground Water Recovery & Treatment), Newport, Delaware. U.S. Environmental Protection Agency. Dated November 2, 2001.

Phase III Remedial Investigation Data Sufficiency Report, Volume II, (in particular the section on ballpark soils). Woodward-Clyde Consultants. Dated May 17, 1991.

South Landfill Explanation of Significant Differences, E. I. DuPont, Newport Superfund Site, New Castle County, Delaware. U.S. Environmental Protection Agency. Dated May 18, 2001.

EPA Region 3 Risk-Based Concentration Table, October 2004 Update.
<http://www.epa.gov/reg3hwmd/risk/human/rbc/rbc1004.pdf>

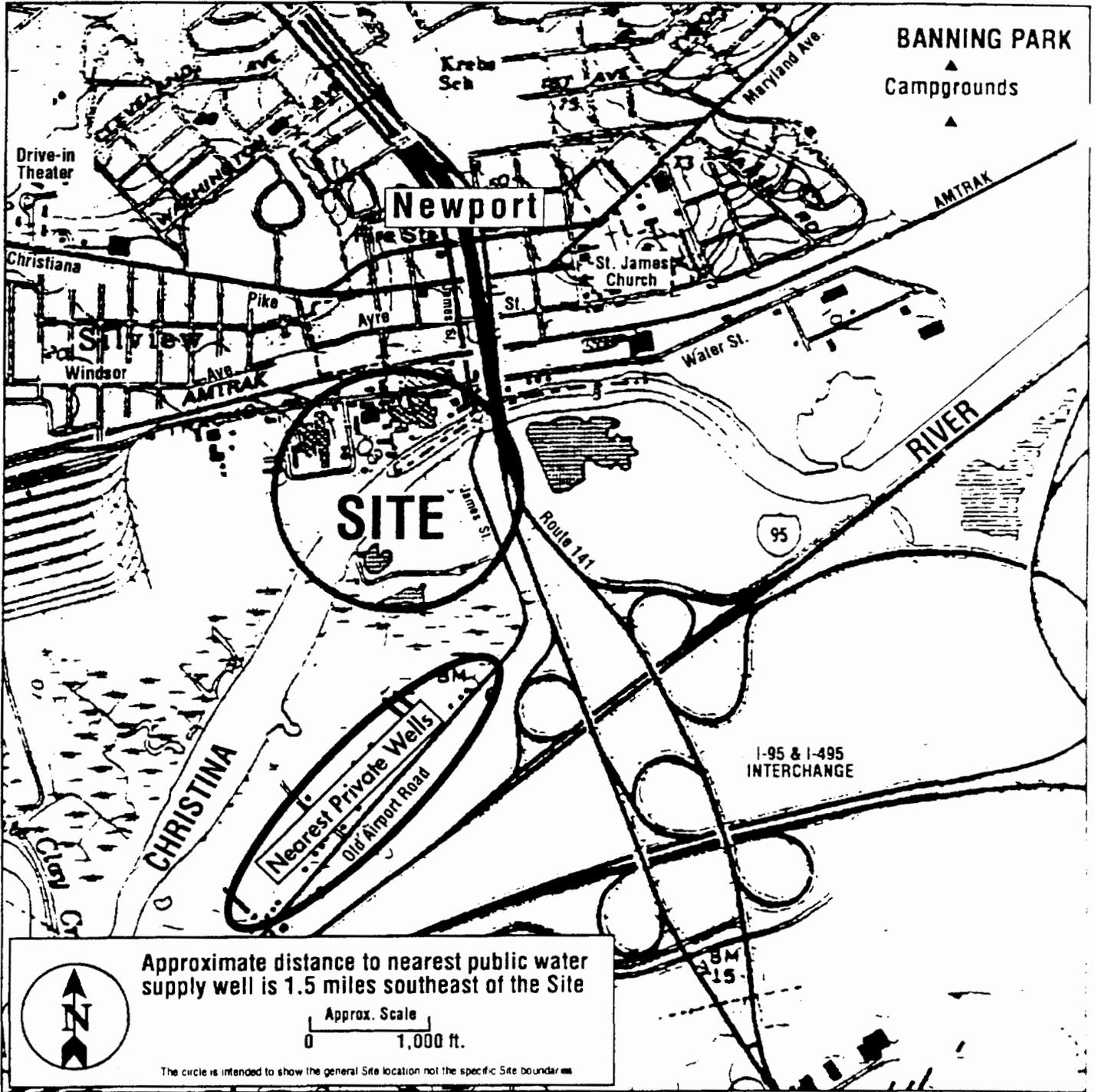
Feasibility Assessment and Proposal, Permeable Reactive Barrier Remedy, Newport Superfund Site, Newport, Delaware. Corporate Remediation Group, DuPont and URS Diamond. January 2001.

Memo from Randy Sturgeon, EPA, to "DuPont-Newport Post-Decision Document File" entitled "North & South Wetlands ROD Modifications." Dated September 30, 1996.

Memo from Randy Sturgeon, EPA, to "File" entitled "Christina River Remedy Modifications, E. I. DuPont, Newport Superfund Site." Dated August 5, 1996.

30 Percent Design Plan, Christina River Remediation. DuPont Environmental Remediation Services. Dated April 11, 1997.

FIGURE 1
Site Location Map
E.I. Du Pont, Newport Superfund Site

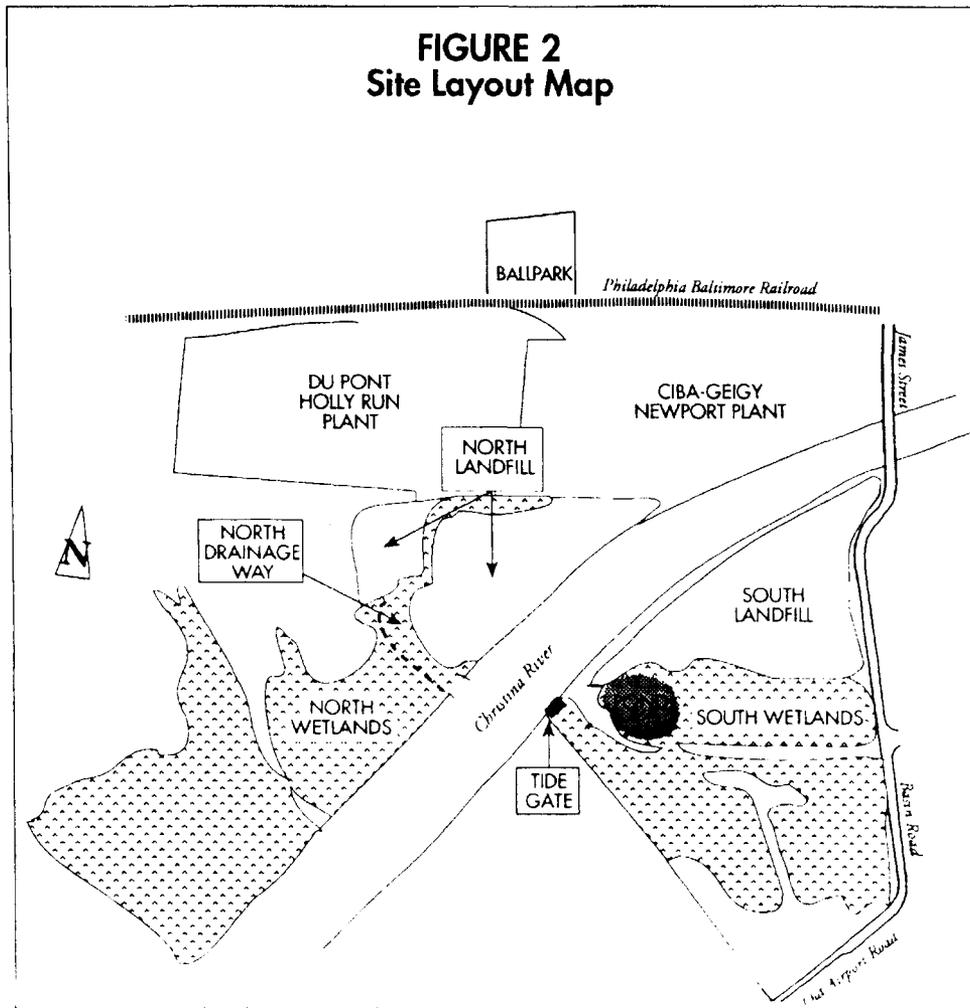


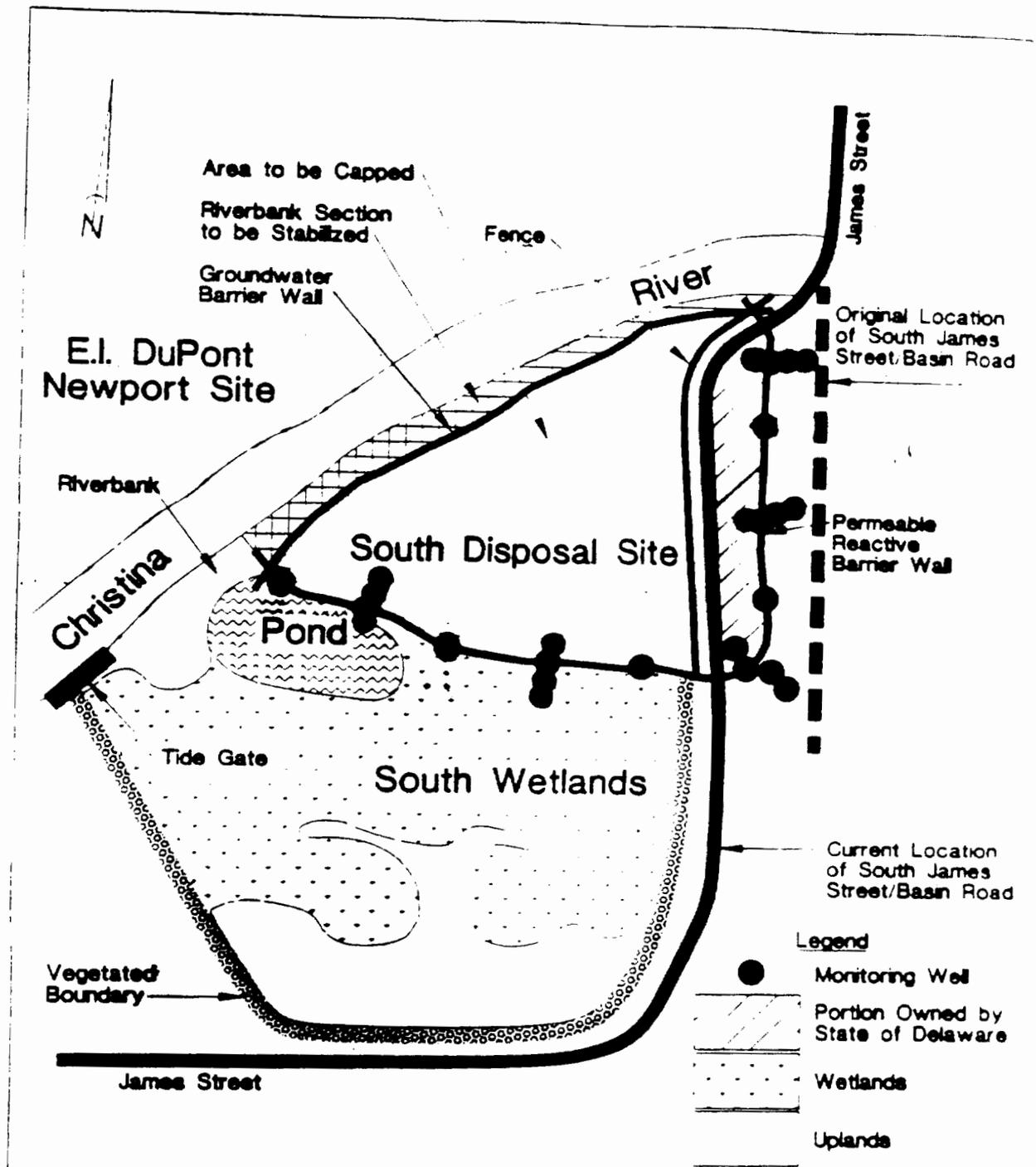
Approximate distance to nearest public water supply well is 1.5 miles southeast of the Site

Approx. Scale
 0 1,000 ft.

The circle is intended to show the general Site location not the specific Site boundaries

FIGURE 2
Site Layout Map





PERMEABLE REACTIVE BARRIER REMEDY

Figure 10